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Canadian Surgery Forum

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

Calgary, Alta.

Sept. 13–16, 2012

Forum canadien de chirurgie

Résumés des communications présentées aux congrès annuels de

l'Association canadienne des médecins et chirurgiens bariatriques

l'Association canadienne des chirurgiens généraux

l'Association canadienne des chirurgiens thoraciques

la *Canadian Hepato-Pancreato-Biliary Association*

la Société canadienne d'oncologie chirurgicale

la Société canadienne des chirurgiens du côlon et du rectum

Calgary (Alta)

du 13 au 16 sept., 2012

Abstracts • Résumés

Canadian Association of Bariatric Physicians and Surgeons

Association canadienne des médecins et chirurgiens bariatriques

1

Is laparoscopic sleeve gastrectomy a reasonable stand-alone procedure for super morbidly obese patients? ***R. Fayez, M. Roy, S. Villeneuve, A. AlMuntashery, S. Demyttenaere, N. Christou, O. Court.*** **From the Department of Surgery, McGill University, Montréal, Que.**

Laparoscopic Roux-en-Y gastric bypass (LRYGB) is a well established standard of care in the treatment of obesity and its associated comorbidities. Laparoscopic sleeve gastrectomy (LSG) is currently gaining popularity as a primary weight loss procedure, with limited evidence to justify this trend. We have tested a hypothesis that LSG is a reasonable stand-alone procedure in a super morbidly obese patient population.

A retrospective comparative analysis of prospectively collected data was conducted from September 2005 to December 2010. A total of 184 LRYGBs and 102 LSGs in super morbidly obese patients were performed. Primary end points included weight loss, resolution of comorbidities and complication rates each evaluated at 3, 6, 12, 24 and 36 months. Secondary end points were patient satisfaction and dietary habits postoperatively.

The 2 groups of patients are comparable in terms of age and preoperative BMI (Table). Weight losses are shown in the graph, and by 36 months they become equivalent. No statistically significant differences were observed in the overall improvement of preoperative comorbidities or the overall complication rates.

In a super morbidly obese patient population, LSG achieved comparable improvement in comorbidities and operative safety when compared with LRYGB. Weight loss rates are slower at the short-term but become equivalent at the midterm follow-up. However, longer follow-up times are needed to evaluate the maintenance of weight loss.

Table , abstract 1.

	Characteristic; mean (SD) [range]			Improvement of comorbidities, %		Complication, %		
Procedure, no.	Age, yr	Preop weight, lb	Preop BMI	DM	HTN	MWI	Leak	Internal hernia
LRYGB, *n* = 184	44.6 (11.3) [22–71]	383 (55.8) [234–530]	61.2 (5.8) [55–84.8]	100	90.3	2.6	1.2	1.7
LSG, *n* = 102	47.2 (11.3) [21–73]	390 (64) [263–570]	64 (9.6) [50.1–96]	100	84	4.4	2.65	0

DM = diabetes mellitus; HTN = hypertension; LRYGB = laparoscopic Roux-en-Y gastric bypass; LSG = laparoscopic sleeve gastrectomy; MWI = minor wound infection; Preop = preoperative; SD = standard deviation.

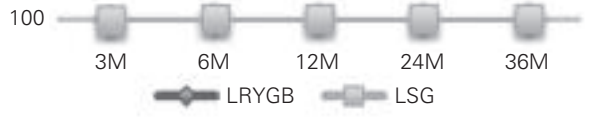

Fig., abstract 1. Percent excess weight loss.

2

Postoperative monitoring requirements of patients with obstructive sleep apnea undergoing bariatric surgery. ***A. AlMuntashery, R. Fayez, S. Demyttenaere, N. Christou, O. Court.*** **From the Department of Surgery, McGill University, Montréal, Que.**

Obstructive sleep apnea (OSA) is a frequent comorbidity in patients undergoing bariatric surgery. It has been implicated as a significant independent risk factor for postoperative complications. Despite the formulation of practice guidelines based on this assertion, little evidence exists to support this association in any patient population. The aim of this study was to assess the postoperative incidence of significant hypoxemic episodes in patients undergoing bariatric surgery with a diagnosis of OSA or at high risk for OSA.

A retrospective review of 561 weight loss procedures performed at our centre between January 2006 and December 2011 was conducted. Patients with an established preoperative diagnosis of OSA by polysomnography or at a high risk of having OSA according to the STOP-BANG criteria were included in the analysis. Patients were divided into 2 groups: those OSA patients using continuous positive airway pressure (CPAP) preoperatively and those patients at high risk of having OSA or with diagnosed OSA but not using CPAP. Patient demographics, length of postoperative stay in a monitored setting (postanesthesia care unit or intensive care unit), incidence of hypoxemic events, length of hospital stay, complications and comorbidities were analyzed.

A total of 188 patients were included in the analysis. Patient demographics were similar between the 2 groups. No difference was observed in the mean length of stay in a monitored setting (7.9 v. 8.3 h), length of hospital stay (3.4 v. 3 d), opioid use and complication rates. Hypoxemic episodes were observed in 5 patients (5.2%) from the first group and 9 patients (9.8%) from the second group. All were easily reversed with oxygen administration. Half of all hypoxemic episodes occurred after the first 24 hours postoperatively.

Our results show no difference in the incidence of postoperative

hypoxemic episodes in CPAP-compliant OSA patients when compared with CPAP noncompliant patients and patients at high risk of OSA. Prolonged postanesthesia monitoring or admission to the intensive care unit does not appear to be indicated.

3

Role of relaparoscopy in the diagnosis and treatment of bariatric complications in the early postoperative period. ***G. Bodie, E. Bonrath, J. Hagen, A. Okrainec, P. Sullivan, T. Grantcharov.*** **From the University of Toronto, Ont.**

Bariatric patients are difficult to assess clinically for signs of postoperative complication. Diagnostic laparoscopy (DL) is used to investigate patients suspicious for complications such as anastomotic leak (AL) and intra-abdominal hemorrhage (IH). Most bariatric surgeons use DL in the presence of sustained tachycardia; however, the rate of this procedure and its clinical value have not been sufficiently investigated.

A retrospective review of patients undergoing bariatric surgery from January 2010 to December 2011 was performed. Data from 4 collaborative bariatric centres of excellence were included in this analysis. From among all elective bariatric procedures, cases that required early reoperation were selected for further evaluation.

A total of 1001 elective bariatric procedures were identified. Of these, 952 (95%) were primary bariatric procedures, including 866 (91%) Roux-en-Y gastric bypasses and 86 (9%) sleeve gastrectomies. The remaining 48 cases represented revisional procedures. Of these, 11 patients (1.1%) returned to the operating room within 72 hours for DL: 64% were primary cases (n = 7) and 36% revisional cases (n = 4). Intraoperative findings included AL (45%, n = 5), IH (27%, n = 3), no pathology identified (18%, n = 2) and small bowel obstruction (9%, n = 1). Of the 9 patients with complications, all were tachycardic (heart rate > 100 beats/min), and 4 of the 5 patients with AL were febrile (t > 37.5). There were no reported adverse events directly related to the use of DL.

Diagnostic laparoscopy is a useful and safe option for both the diagnosis and treatment of suspected complications after bariatric surgery. The majority of patients returning to operating room had significant findings, and all were treated laparoscopically. Persistent postoperative tachycardia or fever were highly predictive of positive findings during DL. An emphasis on early decision-making and expeditious return to the operating room for laparoscopy should be the standard for bariatric patients on clinical suspicion of a postoperative complication.

4

Changes of active and total ghrelin, GLP-1 and PYY following restrictive bariatric surgery and their impact on satiety: comparison of sleeve gastrectomy and adjustable gastric banding. ***A. Almamar, A. Sharma, S. Karmali, D.W. Birch.*** **From the University of Alberta, Edmonton, Alta.**

Laparoscopic adjustable gastric banding (LAGB) is one of the most performed restrictive bariatric procedures. On the other hand, laparoscopic sleeve gastrectomy (LSG) is a relatively new procedure that has been proposed as a potential definitive treatment for morbid obesity. The mechanism of action of LSG remains unclear but may include increased restriction of meal portion size, alterations in gastric emptying or increased satiety related to alterations in serum ghrelin (endogenous orexigenic hormone) or other active endogenous satiety hormones. Initial reports have suggested that LSG produces dramatic reductions in hunger and augmented satiety. However, the data on the effect of this procedure on satiety hormones and their influence on satiety and hunger are still limited.

This cross-sectional study involved 30 female patients. The patients were divided into 3 groups of 10 each, including post-LSG, post-LAGB and obese controls. To ensure that only clinically stable patients with successful operations were enrolled, surgical patients were 12 or more months postsurgery (period of weight stabilization). All groups were matched by age (within 5 yr) and BMI (within 2 kg/m^2). Blood was collected after an overnight fast, before and after a standardized meal, and analyzed for active and total ghrelin, PYY3–36, active GLP-1, leptin and insulin. Satiety was assessed by visual analogue scale (VAS), which was performed after each blood sampling.

There were no significant differences between mean BMI at the time of collecting hormones (38.7 ± 5.4, 38.4 ± 5 and 38.5 ± 4.8 for the LSG, LAGB and nonsurgical groups, respectively, p = 0.99). The weight loss defined as percent excess weight loss (% EWL) was 39.9 ± 18.7 for LSG versus 20.8 ± 21.45 for LAGB group (p = 0.0683). Average follow-up time for the LSG group was 16.7 months versus 25.2 months for the LAGB group. Both active and total ghrelin areas under the curve ($AUC_{0–120}$) were suppressed significantly in the LSG group compared with the LAGB group (p < 0.0001). Furthermore, $AUC_{0–120}$ of GLP-1 and of PYY were significantly elevated for the LSG group compared with the LAGB group (p < 0.0001). These hormonal changes translated to a significant decrease in hunger and increase in fullness as determined by VAS $AUC_{0–120}$ (p < 0.05).

The changes in active ghrelin, GLP-1 and PYY 3–36 after LSG appear to be related to the better satiety effect. Difference in active ghrelin levels between these operations may be the key to understanding the superiority of LSG over LAGB in sustaining weight loss.

5

Prioritization and willingness to pay for bariatric surgery: the patient perspective. ***R.S. Gill, S.R. Majumdar, X. Wang, R. Tuepah, S.W. Klarenbach, D.W. Birch, S. Karmali, A.M. Sharma, R.J. Padwal.*** **From the Departments of Surgery and of Medicine, the Centre for the Advancement of Minimally Invasive Surgery (CAMIS), the University of Alberta, the Royal Alexandra Hospital, Edmonton, Alta.**

Access to publicly funded bariatric surgery is limited, potential candidates face lengthy waits, and no universally accepted prioritization criteria exist. We examined patients' perspectives regarding prioritization for surgery.

Consecutively recruited patients approved for and awaiting bariatric surgery completed a self-administered survey. After reviewing 9 scenarios describing hypothetical cases of patients wait-listed for surgery, respondents were asked to rank these hypothetical patients relative to themselves in the surgery queue. Scenarios examined variations in age, clinical severity, functional impairment, social dependence and socioeconomic prominence. Willingness to pay for faster access was assessed along a 5-point ordinal scale and analyzed using multivariable logistic regression.

The 99 respondents had a mean age of 44.7 (SD 9.9) years, most (76%) were female, and they had a mean BMI of 47.3 (SD 7.6) kg/m^2. Mean duration in the queue was 34.4 (SD 9.4) months. Respondents assigned similar mean scores (relative to themselves) to hypothetical patients with characteristics identical to themselves ($p = 0.22$) and higher mean scores (indicating greater urgency) to those exhibiting greater clinical severity ($p < 0.001$) and functional impairment ($p = 0.003$). Lower mean scores were assigned to patients at the extremes of age ($p \leq 0.006$), on social assistance ($p < 0.001$) and of high socioeconomic prominence ($p < 0.001$). Of respondents, 85% disagreed that payment to expedite access should be available, and 67% disagreed with paying for faster access for themselves. Compared with those making less than $50 000/year, respondents making $50 000–79 999/year (adjusted OR 0.11, 95% CI 0.03–0.46) and $80 000/year or more (adjusted OR 0.16, 95% CI 0.04–0.65) were less likely to disagree with paying for faster access for themselves.

Most wait-listed patients consider greater clinical severity and functional impairments related to obesity to be important prioritization indicators for bariatric surgery and disagreed with others paying for faster access. These findings may help inform future efforts to develop acceptable prioritization strategies for publicly funded bariatric surgery.

6

Ventral hernia at the time of laparoscopic gastric bypass surgery: Should it be repaired? ***I. Raîche, C. Smith, F. Haggar, H. Moloo, E.C. Poulin, G. Martel, J.-D. Yelle, J. Mamazza.***
From The Ottawa Hospital, Ottawa, Ont.

Conflict exists regarding the optimal treatment of patients with ventral hernias undergoing gastric bypass. The objective of this study was to conduct a systematic review of the current evidence to determine the most appropriate management of patients found to have a ventral hernia at the time of laparoscopic gastric bypass (LGB).

MEDLINE, EMBASE and Cochrane databases were searched from January 1995 to September 2010. The search strategy included the MeSH terms ventral hernia, abdominal hernia, laparoscopy, minimally invasive surgery, bariatric surgery, Roux-en-Y and gastric bypass. Outcomes of interest included small bowel obstruction, hernia recurrence and mesh infection.

In all, 583 articles were identified, and 83 potentially relevant articles were reviewed (4 systematic reviews, 3 randomized controlled trials, 59 observational studies, 17 narrative reviews). Excluding reviews, case reports and studies in which fewer than 50% of patients underwent a laparoscopic approach left 3 retrospective studies with a total of 123 patients. The incidence of ventral hernias found at LGP was 8%. Three management strategies were reported: deferred treatment, primary repair or repair with biological or synthetic mesh. Up to 35.7% of patients in whom the treatment was deferred presented with small bowel obstruction within 150 days. Recurrence after primary repair varied from 22% to 100%. No recurrence was found in the group using biologic mesh after a follow-up of 13 months. In the group using synthetic mesh, the recurrence varied from 0% to 9%, with a mean follow-up of 14 months. No mesh infection was reported.

There is a paucity of high-level evidence to guide the management of ventral hernias at the time of LGB. The available information suggests that mesh repair of the hernia may be a safe and appropriate treatment option.

7

Linear stapled gastrojejunostomy with transverse hand-sewn enterotomy closure significantly reduces strictures for laparoscopic Roux-en-Y bypass. ***C.L. Mueller, T.D. Jackson, T. Penner, K. Pitzul, D.R. Urbach, A. Okrainec.***
From the University of Toronto, Ont.

Gastrojejunostomy stricture is the most common complication after laparoscopic Roux-en-Y gastric bypass (LRYGB) for morbid obesity and results in considerable morbidity and resource utilization. Substantial debate persists regarding the optimal construction of this anastamosis. One commonly applied technique is a linear stapled anastamosis and hand-sewn longitudinal (stomach-to-stomach, small bowel–to–small bowel) enterotomy closure, with an average stricture rate of 7% in large series.

Our aim was to compare the gastrojejunostomy stricture rate of longitudinal versus transverse enterotomy closure using the cumulative summation (CUSUM) technique.

Charts of all consecutive patients with at least 60 days of postoperative follow-up after LRYGB at our tertiary care institution from November 2009 to December 2011 were retrospectively reviewed. The CUSUM method was used to analyze the stricture rate following a change in technique from longitudinal to transverse enterotomy closure.

A total of 197 patients were included (97 longitudinal closures, median age 44 [21–67] yr, median BMI 47 [35–80], 85.8% female). Gastrojejunostomy strictures occurred in 16.5% of longitudinal and 0% of transverse patients ($p < 0.0001$). The CUSUM analysis demonstrated a significant improvement in stricture rate after the change in technique was applied. The longitudinal group had a significantly higher rate of surgery-related readmissions (14.4% v. 3.0%, $p = 0.048$), with 43% of those readmissions related to gastrojejunostomy strictures. There were no other significant outcome differences between groups (Figure).

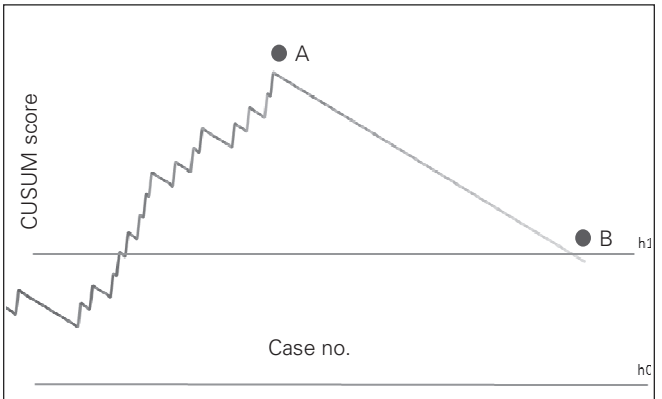

Fig., abstract 7. Cumulative sum analysis of gastrojejunostomy stricture rates. h0 = acceptable stricture rate set at 5%; h1 = unacceptable stricture rate set at 10%; A = change in technique from longitudinal to transverse closure; B = end of data series showing return to acceptable overall stricture rates.

Linear stapled anastamosis with a transverse enterotomy closure significantly reduces gastrojejunostomy stricture for LRYGB, drastically reducing procedural morbidity.

8

Laparoscopic biliopancreatic diversion with duodenal switch as second stage for super super morbidly obese patients. Do all patients benefit? ***A. AlMuntashery, S. Villeneuve, M. Roy, R. Fayez, S. Demyttenaere, N. Christou, O. Court.*** **From the Department of Surgery, McGill University, Montréal, Que.**

In this study we analyze our experience with staged biliopancreatic diversion with duodenal switch (BPD-DS) to determine if all patients will achieve the expected weight loss with the addition of a second stage malabsorptive procedure to the laparoscopic sleeve gastrectomy (LSG).

In all, 47 super super morbidly obese patients received a staged BPD-DS at our centre between July 2006 and September 2010. Completion of BPD-DS was performed once the weight loss from the LSG had stabilized. Patients were separated based on expected minimal weight loss for LSG (40%–60%); group 1 (n = 21) with a percent excess weight loss (% EWL) less than 40% and group 2 (n = 26) with % EWL of 40% or greater. Weight loss, BMI, overall % EWL and % EWL after completion of BPD-DS were compared at 3, 6, 12, 24 and 36 months.

Age, sex, preoperative weight, preoperative BMI and the time between the 2 stages were comparable in both groups (Table). Statistical significance was observed between the 2 groups when comparing the overall % EWL at 3, 6, 12, 24 and 36 months (Figure).

In our small cohort of patients, the addition of a malabsorptive second stage did not produce similar increases in estimated weight loss for all the patients. Those who achieved 40% or greater % EWL after LSG showed the greatest potential for further weight loss by completing the staged procedure. Given the small number of patients, further studies are needed.

Table , abstract 8.

	ESL; mean (SD)		
Variable	< 40%	≥ 40%	*p* value
No. cases	21	26	
Age, yr	45 (11)	49 (9.4)	0.16
% female	57	50	
Weight at first stage, kg	190 (34.5)	176 (26.8)	0.12
BMI at first stage, kg/m^2	67.6 (13)	62.7 (8.5)	0.13
Time between 2 stages	440 (170)	432 (249)	0.9

EWL = excess weight loss; SD = standard deviation.

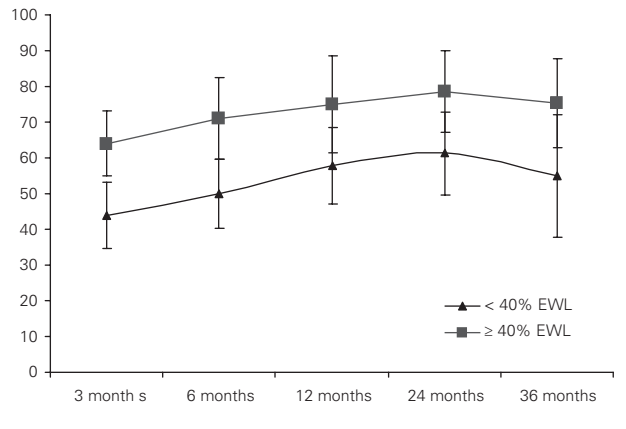

Fig., abstract 8. Overall percent excess weight loss.

9

Sleeve gastrectomy in the super super morbidly obese (BMI > 60 kg/m^2): a Canadian experience. ***R. Fayez, M. Roy, S. Villeneuve, A. AlMuntashery, S. Demyttenaere, N. Christou, O. Court.*** **From the Department of Surgery, McGill University, Montréal, Que.**

We report the outcomes of laparoscopic sleeve gastrectomy (LSG) performed by a single surgeon in a Canadian centre and discuss using the surgical technique in the super super morbidly obese.

Between September 2005 and January 2012, all LSGs performed at our centre were reviewed, and a total of 76 super super morbidly obese patients were identified. Retrospective analysis of patient demographics, percentage of excess weight loss, complications and resolution of comorbidities was conducted. In addition, patients' postoperative satisfaction rates and dietary habits were prospectively surveyed.

The mean body mass index was 69.2 (range 60.1–98.4) kg/m^2. Mean excess weight loss after 3 and 6 months, and 1, 2 and 3 years was 25.7%, 37.2%, 45.9%, 59.1% and 63.5%, respectively. Complications were seen in 7 patients (9.2%). A total of 33 patients underwent a second-stage duodenal switch procedure at 1 year (n = 7), 2 years (n = 20) and 3 years (n = 6) after the weight loss had reached a plateau.

In this highly selective group of super super morbidly obese patients, LSG has produced effective and reliable weight loss with few perioperative complications. A second-stage procedure can be added at a later date if further weight loss needs to be achieved.

10

Laparoscopic gastric bypass for the treatment of refractory idiopathic gastroparesis: a report of 2 cases. ***A. AlMuntashery, R. Fayez, S. Demyttenaere, O. Court, N. Christou.*** **From the Department of Surgery, McGill University, Montréal, Que.**

We describe our successful utilization of laparoscopic Roux-en-Y gastric bypass (LRYGB) for the treatment of severe refractory idiopathic gastroparesis in 2 patients.

Two patients with refractory idiopathic gastroparesis underwent laparoscopic gastric bypass between December 2010 and September 2011. Surgery was considered for both patients owing to long-standing symptoms despite multiple unsuccessful treatment attempts with different therapeutic modalities, including gastric pacing and gastrostomy tube insertion. Severity of symptoms was assessed using the Gastroparesis Cardinal Symptom Index and the Patient Assessment of Upper Gastrointestinal Symptom Severity Index at baseline and at 3, 6 and 12 months after surgery. Follow-up upper gastrointestinal study was done to assess gastric emptying of the pouch.

There were no perioperative complications. Upper gastrointestinal contrast studies showed good gastric emptying in both patients. One patient demonstrated marked improvement in both symptom score indexes at 3 and 6 months, whereas the other patient did not show much improvement at 3, 6 or 12 month follow-up (Table).

Table, abstract 10. Severity of symptoms, mean scores

Test; patient	Baseline	3 mo. follow-up	6 mo. follow-up	12 mo. follow-up
GCSI				
Patient 1	4.6	3.5	3.5	4.1
Patient 2	3.6	1.77	1.1	—
PAGI-SYM				
Patient 1	4.4	3.15	3.15	3.8
Patient 2	3.65	1.36	0.96	—

GCSI = Gastroparesis Cardinal Symptom Index; PAGI-SYM = Patient Assessment of Upper Gastrointestinal Symptom Severity Index

Gastroparesis is a difficult condition to treat. This small study of 2 patients who underwent RYGB for treatment of severe refractory idiopathic gastroparesis revealed symptomatic improvement in 1 of the 2 patients. Laparoscopic RYGB might be an option to treat severe refractory idiopathic gastroparesis in carefully selected patients. Further investigations and long-term follow-up are needed.

11

Duodeno-ileal switch as a primary bariatric and metabolic surgical option for the severely obese patient with comorbidities: review of a single-institution case series of duodeno-ileal intestinal bypass. ***F. Moustarah, L. Biertho, F.-S. Hould, S. Lebel, O. Lescelleur, S. Marceau, P. Marceau, S. Biron.*** **From the Department of Surgery, Institut universitaire de cardiologie et de pneumologie de Québec, Université Laval, Québec, Que.**

The effects of a stand-alone duodeno-ileal switch (DIS) component of a duodenal switch (DS) operation are described in a series of severely obese patients.

Our clinical database was surveyed to identify patients who had a duodenal switch without gastrectomy. Results are reported as mean ± standard devation. The *t* test was used to compare continuous variables.

Between January 2001 and April 2011, 51 consecutive patients with obesity-related comorbidities (21 women, 30 men) and a mean age of 58 (range 35–70) years at the time of surgery had a stand-alone DIS. Initial weight and BMI were 144.5 ± 25.3 kg and 52.6 ± 8.7 kg/m^2, respectively. There was 1 perioperative (< 30 d) mortality. Sleeve gastrectomy was then performed in 6 patients, completing the standard DS procedure at a mean of 19.5 ± 9.5 months after the index surgery. In the 42 patients who had our standard length DIS only (250 cm alimentary tract, 100 cm common channel), nadir weight and BMI data were available for 38 and were 104.3 ± 23.1 kg and 37.0 ± 8.0 kg/m^2, respectively; the corresponding drop of 15.3 ± 6.5 kg/m^2 in BMI from baseline was significant ($p < 0.001$). Follow-up for the DIS only group ranged from 8 months to 11 years, and this cohort's weight-related measures over time were as follows: at 3, 5 and 8 years, the percent of excess weight lost was 49.2% ± 20.4% ($n = 32$); 44.3% ± 18.6% ($n = 22$) and 39.7% ± 15.8% ($n = 4$), respectively. On last follow-up, improvement in diabetes was observed in 87% of the 31 DIS only patients who had diabetes at the time of surgery; remission was seen in 55% (17 of 31).

In patients for whom clinical indications may warrant foregoing a gastrectomy (super morbid obesity, advanced age, multiple comorbidities and/or technical intraoperative challenges), DIS only is a reasonable primary surgical option. In this unique series, a significant weight loss response and antidiabetic effect was observed and sustained over several years of follow-up.

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Management of large paraesophageal hernias in morbidly obese patients with laparoscopic sleeve gastrectomy: a case series. ***M. Khokhotva, T. Grantcharov.*** **From the Queen's University, Kingston, Ont., and the University of Toronto, Toronto, Ont.**

While laparoscopic hiatus hernia (HH) management has become the standard of care, some uncertainty remains about the optimal surgical procedure to address type III or IV HHs in morbidly obese patients. The main concern after laparoscopic repair is the high rate of symptomatic recurrence in this patient group. Laparoscopic sleeve gastrectomy (LSG) has been described to address both obesity and HH symptoms with minimal morbidity and long-term complications. We present a series of 7 patients treated with laparoscopic HH repair and LSG.

A retrospective chart review was performed at a single institution. Between November 2008 and July 2011, 7 consecutive patients were identified: 5 were referred for management of symptomatic HH and 2 for management of morbid obesity; 6 patients had a type III HH and 1 patient had a type IV HH. Mean preoperative BMI was 43.4 kg/m^2. Intraoperatively, the hiatus was dissected circumferentially and hernia contents reduced into the abdomen without sac excision or cruroplasty. Laparoscopic sleeve gastrectomy was then completed with linear cutting staplers using a 36 Fr bougie for gastric sleeve calibration. All procedures were completed laparoscopically without intraoperative complications. The mean duration of follow-up was 14 (range 3–32) months and included clinical assessments, routine upper endoscopy and imaging when indicated. Mean excess weight loss was 34%. Study participants completed validated symptom severity and quality of life questionnaires. Analysis included descriptive statistics. Two patients developed symptomatic recurrence of HH and inadequate weight loss; they were considered for revisional bariatric surgery. Three patients developed incisional hernias. The remaining patients reported satisfactory symptoms and weight loss.

Current results support selective use of LSG at the time of paraesophageal hernia repair in obese patients to address both issues. Further research with larger patient groups and longer follow-up would be of additional value.

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Early results of the Ontario bariatric surgical program: using the bariatric registry. ***M. Anvari, A. Sharma, S. Yusuf.*** **From the McMaster University, Hamilton, Ont., and the University of Alberta, Edmonton, Alta.**

The Ontario bariatric program was established in 2009 with 2 sites initially and has since expanded to 12 sites, including 5 bariatric surgical centres of excellence and 4 regional assessment and treatment centres. In 2010, the bariatric registry was established to manage patient flow and collect standardized information and outcomes on patients receiving bariatric treatment in Ontario.

Since January 2010, 14 443 patients have been referred for bariatric treatment using the web-based referral portal, and 2680 patients have consented to participate in the bariatric registry. Data for 1819 patients (mean age 45 yr, 81.7% female) have been collected across participating sites: 6 month and 1 year follow-up data were available for 292 and 115 patients, respectively. The mean preoperative BMI was 49.7 kg/m^2. At the 6 month and 1 year follow-up after surgery, the mean BMI was 36.2 (percent excess weight loss [% EWL] 56.8%) and 32.1 (% EWL 72.6%), respectively. The intraoperative complication rate was 2.2%, with 16 (2.5%) revision/repairs and only 1 (0.16%) death, occurring more than 30 days postsurgery. Improvement or resolution of the majority of comorbidities was observed at 6 months and 1 year, including diabetes, which improved from 33.9% of participants at baseline to 9.1% at 1 year.

The Ontario model of collaboration between the centres of excellence with a standardized approach and establishment of a common referral system, and the monitoring of outcomes using a registry, has been associated with excellent early outcomes and rapid development of necessary support services. The Ontario model may be a good model for other provincial programs.

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Improving access to bariatric surgical care: Is universal health care the answer? ***J. Kwong, A. Okrainec, K.B. Pitzul, D.R. Urbach, T. Jackson.*** **From the University of Toronto, University Health Network, Toronto, Ont.**

Canada's health care system provides universal health coverage and access to bariatric surgery based on medical need. Significant disparities have been identified between those eligible for bariatric surgery and those receiving it in the United States based on sex, socioeconomic status, insurance status, geography, age and ethnicity.

The objective of the present study was to determine if apparent disparities in bariatric surgical care exist or are remedied within a universal healthcare system.

Inpatient bariatric surgical cases performed in Ontario from April 2007 to March 2010 were captured using the Canadian Institute for Health Information's Discharge Abstract Database. Diagnostic codes were used to define cases (ICD-10-CA, E66). Statistics Canada data were used to define demographic characteristics of the obese population. Patient characteristics included age, sex and mean household income in the postal region of residence. No information on race, ethnicity or surgical care in private clinics was available.

In all, 1797 patients were identified; 1483 (82.5%) were female. Income as estimated by flexible spending accounts demonstrated 70.5% of patients reside in regions with an average income that falls in the $20 000–$39 999 range (aggregate data). Significant geographic variability including 423 rural and urban postal codes was identified in those receiving surgery.

Within Canada's universal health care system, disparities in access to bariatric surgery based on socioeconomic status and geography appear less often than described in the United States. Sex remains a significant determining factor. Further comparative analysis with patient-level data is needed to assess the importance of universal health coverage in achieving health equity in bariatric surgical care delivery.

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Early and liberal postoperative exploration can reduce morbidity and mortality in patients undergoing bariatric surgery. ***S. Elkassem, D. Lindsay, P. Sullivan, L. Smith.*** **From the University of Toronto, Toronto, Ont.**

Bariatric surgery for morbid obesity can be safely performed at centres of high volume and experience. Identifying patients with significant or even potentially life-threatening complications remains a challenge. A strategy of close clinical follow-up and early postoperative exploration has been used at our centre. The purpose of this study was to evaluate the effectiveness of this strategy.

A retrospective review of 145 patients undergoing laparoscopic gastric Roux-en-Y bypass and sleeve gastrectomy was performed. Patients taken to the operating room for suspicion of complication were identified and evaluated.

In total, 14 patients (9.6%) were taken back for postoperative exploration. The most common indication was persistent tachycardia (> 100 beats/min). Of the 14 patients, 13 (92.8%) had significant findings, including bleed (6 patients), leak (5 patients) and obstruction (3 patients); 1 patient had no findings. The sensitivity and specificity of tachycardia over 100 beats/minute was 100% and 77%, respectively, compared with 57% and 99%, respectively, for tachycardia over 120 beats/minute. All patients with postoperative bleeds were taken back within the first 2 postoperative days (PODs; 4 patients on POD1 and 2 on POD2). Patients with leaks were identified on POD2 (2 patients), POD5 (2 patients) and POD10 (1 patient). Patients with obstruction were taken back at POD2 (1 patient) and POD3 (2 patients). There were no mortalities. The median length of hospital stay for these patients was 8 days (compared with 3 days for the uncomplicated cohort).

Nearly 10% of patients undergoing bariatric surgery were taken back to the operating room postoperatively. Whereas tachycardia greater than 100 beats/minute is highly sensitive, it is only 77% specific for a true complication. Clinical judgment and close monitoring are needed. A liberal policy of early postoperative exploration can reduce morbidity and mortality in these complicated patients.

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Withdrawn

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Identification and assessment of technical errors in laparoscopic Roux-en-Y gastric bypass. ***E. Bonrath, B. Zevin, N. Dedy, T.P. Grantcharov.*** **From the St. Michael's Hospital, Toronto, Ont.**

Error analysis has been suggested as an additional surrogate measure for the evaluation of skill in surgical education. The goal of this study was to identify and assess technical errors in laparoscopic Roux-en-Y gastric bypass (LRYGB) using a novel generic tool for the assessment of technical errors.

Video analysis of LRYGB was conducted. Two independent raters assessed errors using a tool consisting of 9 error groups (access, retractors, energy devices, grasping/dissection, cutting, clipping, suturing, suction and others). Error groups were subdivided in error-execution modes such as inadequate force, orientation or visualization. Time of error execution and resulting

"events" (bleeding, injury, etc.) were recorded. The operative steps jejunojejunostomy (JJ), gastrojejunostomy and pouch formation were also evaluated using the Objective Structured Assessment of Technical Skills (OSATS) score. Statistical evaluation included interobserver reliability (Cronbach α) and construct validity (Mann–Whitney *U* test).

We analyzed 16 procedures totaling 106 784 seconds of recordings. The median total error score was 28.5 (range 17.5–49.5), with a median event rate of 2.5 (range 1–5) per procedure. The Cronbach α for error frequency was 0.914, and 0.842 for event frequency. During the JJ, there was a significant correlation between error frequency and OSATS score (Spearman rho = –0.733, $p = 0.01$). The median error frequency during the JJ executed by "expert" surgeons (OSATS score ≥ 28, $n = 9$) was 5 (range 2–10); that by median "nonexpert" surgeons (OSATS < 28, $n = 7$) was 9.5 errors (range 5–11, $p = 0.012$).

This method of error analysis allows for objective and reliable assessment of operative performance. It could serve as an additional measure for skills evaluation and as a source for constructive feedback and deliberate practice curricula, especially for complex laparoscopic procedures.

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A valid and reliable tool for assessment of surgical skill in laparoscopic Roux-en-Y gastric bypass. ***B. Zevin, E.M. Bonrath, R. Aggarwal, T. Grantcharov.*** **From the University of Toronto, Toronto, Ont., the Division of General Surgery, St. Michael's Hospital, Toronto, Ont., and the Department of Surgery and Cancer, Imperial College London, London, United Kingdom**

Laparoscopic Roux-en-Y gastric bypass (LRYGB) is an advanced procedure without an objective tool to assess operative skill. The objective of this study was to develop and validate such a tool.

A Hierarchical Task Analysis (HTA) of 10 LRYGB procedures was conducted to deconstruct LRYGB into its component tasks. An online Delphi survey was administered to a panel of experts to identify tasks for inclusion in the final assessment tool. Tasks were rated (1 to 5), and responses were returned to the panel until consensus (Cronbach α ≥ 0.80) was achieved. Tasks that 80% of experts rated as 4 or higher were included in the tool. Inter-rater and test–retest reliability (Cronbach α), construct validity (expert v. novice scores, Mann–Whitney *U* test) and convergent validity (Spearman correlation with Objective Structured Assessment of Technical Skills [OSATS] scores) were confirmed by independent assessment of 19 LRYGB videos by 2 trained raters.

In the end, 214 discrete steps were identified in the HTA. Twelve experts completed the first round (α = 0.65), and 17 experts completed second round (α = 0.85) of the survey. Excellent inter-rater (α = 0.90) and test–retest (α = 0.98) reliability for the tool were demonstrated. Experts scored significantly higher than novices on jejunojejunostomy (29.7 ± 4.2 v. 25.6 ± 2.4, $p = 0.016$) and gastrojejunostomy (31.0 ± 2.2 v. 26.9 ± 3.7, $p = 0.033$) components of the operation. There was moderate correlation with OSATS scores for jejunojejunostomy (Spearman rho = 0.54, $p = 0.025$), gastric pouch creation (Spearman rho = 0.50, $p = 0.041$) and gastrojejunostomy (Spearman rho = 0.58, $p = 0.014$) component scores.

A reliable and valid tool for objective assessment of surgical skill in LRYGB has been developed. Implementation of this tool is expected to enhance trainees' understanding of the constellation of skills necessary to perform a successful LRYGB and to focus trainees on specific aspects of the operation that require further training.

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Psychiatric predictors of presurgery drop-out following suitability assessment for bariatric surgery. ***S. Sockalingam, S. Cassin, S. Crawford, K. Pitzul, A. Khan, R. Hawa, T. Jackson, A. Okrainec.*** **From the University Health Network, Ryerson University, the University of Toronto, and the Toronto Westem Hospital, Toronto, Ont.**

Bariatric surgery is recognized as a treatment for severe obesity; however, little is known about factors influencing patient drop-out presurgery.

This study explored the relationship between psychiatric factors and patient drop-out during the prebariatric surgery assessment for suitability.

A total of 367 consecutive bariatric surgery patients at the Toronto Western Hospital Bariatric Surgery Program underwent a structured psychiatric interview and were classified as presurgery "dropouts" if they attended at least 1 presurgery assessment appointment but did not receive surgery, and surgery completers. The χ^2 test and independent *t* tests were used to compare the dropout group and the surgery group on categorical variables and continuous variables, respectively.

During the presurgery assessment phase, 47.4% ($n = 172$) patients dropped out of the program without any documented reason. In comparison to the surgery completers, the presurgery dropout group had significantly higher rates of past anxiety disorders (17.4% v. 9.4%, $p = 0.03$), past substance use disorders (8.7% v. 3.7%, $p = 0.03$) or past Axis I psychiatric disorders (58.1% v. 46.6%, $p = 0.035$). For individual psychiatric disorders, the dropout group exhibited a significantly higher rate of either past (5% v. 1%, $p = 0.029$) or current posttraumatic stress disorder (2% v. 0%, $p = 0.049$), current generalized anxiety disorder (4% v. 0%, $p = 0.005$) and past substance dependence disorder (7% v. 1%, $p = 0.005$).

History of an anxiety or substance use disorder may play a role in patient drop-out during the bariatric surgery process. Additional psychosocial support, such as cognitive behavioural therapy or motivational interviewing, may help reduce patient drop-out during the presurgery phase.

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Predictors of outcomes following Roux-en-Y gastric bypass surgery at The Ottawa Hospital. ***C. Smith, B. Brar, J. Mamazza, I. Raîche, J.-D. Yelle, F. Haggar, H. Moloo.*** **From the Department of Surgery, University of Ottawa, Ottawa, Ont.**

The purpose of this study was to review The Ottawa Hospital data on laparoscopic Roux-en-Y gastric bypass surgery to identify predictors of outcomes.

Patients undergoing surgery from November 2007 to July 2011 were prospectively analyzed. The primary outcome measure was the incidence of complications. Other factors including length of stay, operative time, age, BMI, comorbidities, etc., were also explored.

Data on 377 patients were analyzed, with a complication rate of 18.7%. The mean duration of follow-up was 7.2 months. Using multiple logistic regression, univariate analysis identified BMI (odds ratio [OR] 1.058, 95% CI 1.019–1.098) and history of hypertension (OR 2.086, 95% CI 1.231–3.536) as being significantly associated with the incidence of complications, whereas multivariate analysis showed that BMI alone (OR 1.043, 95% CI 1.000–1.088) was significant. Separate logistic models were used to analyze each complication type. This identified hypertension (OR 2.027, 95% CI 1.034–3.973) as being significantly linked to the incidence of wound infection. The number of visits with the behaviourist preoperatively (OR 2.375, 95% CI 1.289–4.375) was associated with a higher number of complications greater than 90 days, whereas type 2 diabetes correlated with a longer length of stay (OR 1.983, 95% CI 1.216–3.233). Linear regression analysis showed that increased BMI was negatively associated with excess weight loss (OR –1.429, 95% CI –2.19 to –0.66).

In our experience, BMI, hypertension and number of visits to the behaviourist preoperatively were associated with a higher risk of complications postlaparoscopic Roux-en-Y gastric bypass. History of diabetes was predictive of increased length of stay, whereas increased BMI was associated with decreased excess weight loss. These factors may be important when counselling patients who are considering bariatric surgery.

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Prophylactic management of cholelithiasis in bariatric patients: Is routine cholecystectomy warranted? ***C. Smith, B. Brar, F. Haggar, R. Dent, J. Mamazza, I. Raîche, H. Moloo.*** **From the Department of Surgery, University of Ottawa, Ottawa, Ont.**

The role of prophylactic cholecystectomy and the usefulness of preoperative ultrasound in patients undergoing bariatric surgery is unclear. The objective of this study was to identify risk factors for the development of symptomatic gallstones requiring cholecystectomy in patients participating in a weight loss program.

We conducted a prospective study of 176 consecutive patients who were enrolled in an intensive weight loss program. Logistic regression was used to model the risk of cholecystectomy after enrolment into the program. Risk factors associated with cholelithiasis including sex, age, BMI, percent weight loss, fatty liver, etc., were explored.

Data from 166 patients who had transabdominal ultrasound at week 1 of the program were analyzed; 34 patients had previous cholecystectomy. Gallbladder disease, as indicated by the presence of gallstones on ultrasound, was found in 16.3% (n = 27) of patients. Of these, 25.9% (n = 7) developed delayed symptoms related to biliary disease and underwent cholecystectomy. In contrast, of the 105 patients who had a negative ultrasound, 8.6% (n = 9) underwent cholecystectomy. Median time to surgery was 6.2 years. Logistic regression analysis revealed that patients with gallstones were significantly more likely to undergo cholecystectomy compared with those with no gallstones at the start of the program (OR 4.6, 95% CI 1.6–12.4). Having gallstones discovered after starting the program was highly associated with development of symptoms requiring cholecystectomy (OR 5.2, 95% CI 3.16–8.4).

The presence of gallstones during rapid weight loss is associated with an increased risk of developing symptoms requiring cholecystectomy. Routine preoperative ultrasound and concomitant cholecystectomy at the time of gastric bypass surgery may be indicated given this increased risk.

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Early outcomes of Roux-en-Y gastric bypass in a publicly funded obesity program. ***K.A. Whitlock, R.S. Gill, T. Ali, X. Shi, D.W. Birch, S. Karmali.*** **From the Faculty of Medicine and Dentistry and the Department of Surgery, University of Alberta, and the Centre for the Advancement of Minimally Invasive Surgery (CAMIS), Royal Alexandria Hospital, Edmonton, Alta.**

The majority of Canadians are overweight, and almost a quarter of the population is clinically obese. The use of bariatric surgery to reduce weight and improve comorbidities in North America is typically performed in privately funded centres with dedicated bariatric surgeons. There is limited literature assessing the outcomes of bariatric surgery in a publicly funded, multidisciplinary bariatric program. Our objective was to assess outcomes of Roux-en-Y gastric bypass (RYGB) in a publicly funded bariatric program through retrospective review of patient records.

From 2005 to 2011, 293 patients underwent laparoscopic RYGB at our institution: 79% were female; the average BMI at first visit to clinic was 55.3 kg/m^2; and approximately 25% were unemployed, on social assistance or on long-term disability. Patients spent a median of 13 months attending a multidisciplinary obesity clinic, modifying diet and lifestyle, before surgery. The hospital was a Canadian, publicly funded, level 2 trauma centre with 750 inpatient beds. The hospital had university teaching services, including an accredited minimally invasive surgery/bariatric program. All the operations were performed by 3 generalist surgeons, with the majority involving teaching. After surgery, 94.5% of the patients presented for postoperative follow-up. The median follow-up time was 12 months, and the average decrease in BMI was 19.2 kg/m^2. This was an average absolute weight loss of 56.1 kg or 35.5% of initial weight. The average excess weight loss was 63.4% after 12 months. Improvement or resolution of obesity-related comorbidities occurred in 65.9% of patients with type 2 diabetes and in 50% of patients with hypertension.

Despite this being an unconventional setting — a publicly funded bariatric program in a large Canadian teaching hospital — early outcomes following RYGB were appropriate in severely obese patients. Ongoing work will identify areas of improvement for enhanced efficiencies within this system.

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Similar incidence of gastrojejunal anastomotic stricture formation with hand-sewn and 21 mm circular stapler techniques during Roux-en-Y gastric bypass. ***R.S. Gill, K.A. Whitlock, X. Shi, K. Sarkhosh, D.W. Birch, S. Karmali.*** **From the Department of Surgery and the Faculty of Medicine and Dentistry, University of Alberta, and the Centre for the Advancement of Minimally Invasive Surgery (CAMIS), Royal Alexandria Hospital, Edmonton, Alta.**

Over 500 million individuals are classified as obese (BMI > 30 kg/m^2) worldwide. Roux-en-Y gastric bypass (RYGB) has been shown to be effective in producing marked weight loss in obese individuals. However, stricture formation at the gastro-

jejunostomy site remains the commonest postoperative complication in these patients. In this study, we analyze our experience and compare the incidence of stricture formation with hand-sewn and 21 mm circular stapler techniques to create the gastrojejunal anastomosis in RYGB.

A retrospective chart review (2005–2010) was completed for all RYGB patients with gastrojejunostomy creation with either hand-sewn or 21 mm circular stapler (OrVil) techniques at a teaching hospital with a comprehensive publicly funded obesity program.

We identified a total of 198 patients (hand-sewn RYGB, $n = 158$; 21 mm RYGB, $n = 40$). The mean preoperative BMI was 54 kg/m^2 and 47 kg/m^2 in the hand-sewn and 21 mm RYGB groups, respectively. The mean operative time was significantly greater in the hand-sewn group compared with the 21 mm group (164 ± 47 min v. 138 ± 29 min, $p < 0.001$). There were 14 (8.9%) gastrojejunal strictures identified in the hand-sewn RYGB group compared with 1 (2.5%) in the 21 mm RYGB group ($p = 0.3$). Sixteen (10%) anastomotic leaks were observed in the hand-sewn RYGB group compared with none in the 21 mm RYGB group ($p = 0.07$).

We observed low rates of gastrojejunal anastomotic stricture formation overall, with no significant difference between hand-sewn and 21 mm circular stapler techniques. However, gastrojejunal anastomoses creation with the 21 mm circular stapler may have a modest reduction in the incidence of anastomotic .

Canadian Association of General Surgeons
Association canadienne des chirurgiens généraux

24 (CAGS Basic Science Award)
Exogenous glucagon-like peptide-1 improves clinical, morphological and histological outcomes of intestinal adaptation in a distal-intestinal resection piglet model of short bowel syndrome. ***M. Suri, J.M. Turner, P.N. Nation, P. Wizzard, P.L. Brubaker, D.L. Gisalet, P.W. Wales.*** **From the University of Toronto, Toronto, Ont., the Stollery Children's Hospital, Edmonton, Alta., the University of Alberta, Edmonton, Alta., the Alberta Children's Hospital, Calgary, Alta., and the Hospital for Sick Children, Toronto, Ont.**

Glucagon-like peptide-2 (GLP-2) is an intestinotrophic hormone produced in the ileum and colon that has been shown to augment intestinal adaptation in the setting of short bowel syndrome (SBS). Endogenous GLP-2 production and adaptation are reduced in distal-intestinal resection animal models that lack the remnant ileum. Although exogenous administration of GLP-2 in midintestinal resection animal models of SBS (models in which the terminal ileum is preserved) has shown to augment intestinal adaptation, few studies have been performed in distal-intestinal resection models.

We hypothesize that exogenous GLP-2 treatment will improve clinical, morphological and histological outcomes of intestinal adaptation in a distal-intestinal resection neonatal piglet model of SBS.

In all, 12 neonatal piglets underwent a 75% distal small intestinal resection with a jejunocolic anastomosis. Parenteral nutrition commenced on day 1 and was weaned as enteral nutrition was advanced. On day 2, piglets were randomized to intravenous GLP-2 (11 nmol/kg/d) or an equivalent volume of saline. Piglets were maintained for 14 days. Comparisons were made between groups using the Student *t* test.

Piglets treated with GLP-2 had fewer days of diarrhea (8.0 ± 0.7 v. 12.3 ± 0.4 d), fewer days on parenteral nutrition (10.0 ± 0.6 v. 13.8 ± 0.2 d), increased bowel length (19% ± 4% v. –5% ± 2%), increased small bowel weight/piglet weight (14.7 ± 0.6 v. 11.0 ± 0.5 g/kg) and deeper jejunal crypts (235 ± 8 v. 183 ± 7 μm) compared with saline-treated animals ($p < 0.05$).

We have shown that GLP-2 therapy improves clinical, morphological and histological parameters of intestinal adaptation in a distal-intestinal resection neonatal piglet model of SBS. These results support the potential role of GLP-2 as a treatment for pediatric SBS.

25 (CAGS Clinical Research Award)
Development and validation of a comprehensive curriculum to teach an advanced minimally invasive procedure: a randomized controlled trial. ***V.N. Palter, T.P. Grantcharov.*** **From the Departments of Surgery, University of Toronto and St. Michael's Hospital, Toronto, Ont.**

Simulators have been shown to be viable systems for teaching technical skills outside the operating room (OR); however, integration of simulation training into comprehensive curricula remains a major challenge in modern surgical education. Currently, no curricula have been described or validated for advanced laparoscopic procedures. The objective of this study was to develop and validate a comprehensive ex vivo training curriculum for laparoscopic colorectal surgery.

This prospective, single-blinded randomized controlled trial allocated 25 surgical residents to receive either conventional residency training or a comprehensive training curriculum for laparoscopic colorectal surgery. The curriculum consisted of proficiency-based psychomotor training on a virtual reality simulator, cognitive training and participation in a cadaver laboratory. The primary outcome measure in this study was surgical performance in the OR. All participants performed a laparoscopic right colectomy, which was video-recorded and assessed using 2 previously validated assessment tools. Secondary outcome measures were knowledge relating to the execution of the procedure, assessed with a multiple-choice test, and technical performance on the simulator.

Curriculum-trained residents demonstrated superior performance in the OR compared with conventionally trained residents (global score 16.0 [14.5–18.0] v. 8.0 [6.0–14.5], $p = 0.030$; number of operative steps performed 16.0 [12.5–17.5] v. 8.0 (6.0–14.5), $p = 0.021$; procedure-specific score 71.1 [54.4–81.6] v. 51.1 [36.7–74.4], $p = 0.122$). Curriculum-trained residents scored higher on the multiple-choice test (10 [9–11] v. 7.5 [5.3–7.5], $p = 0.047$], and out-performed conventionally trained residents in 7 of 8 tasks on the simulator.

Participation in a comprehensive ex vivo training curriculum for laparoscopic colorectal surgery results in improved technical knowledge and improved performance in the operating room compared with conventional residency training.

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Negative-pressure wound therapy (iVAC) on closed, high-risk incisions following abdominal wall reconstruction. ***E. Wakeam, H. Tien, F. Spencer, F. Brenneman.*** **From the Sunnybrook Health Sciences Centre, University of Toronto, Toronto, Ont.**

Wound infection remains a major cause of morbidity and increased cost after general surgical operations, including abdominal wall reconstruction (AWR) for large ventral incisional hernias. Using primary negative pressure wound therapy (NPWT) on closed incisions before an infection has developed has been theorized to decrease the risk of wound infection, though little evidence exists concerning its use. The purpose of this study was to determine our experience of primary NPWT for high-risk abdominal incisions.

We retrospectively reviewed a prospectively collected database containing clinical and outcomes data for 99 consecutive AWR cases treated with biologic mesh from December 2009 to March 2012. Study patients were identified as being at high risk for

wound infection if any of the following were present: active infection at the time of operation, concomitant bowel resection or stoma creation, or explant of infected mesh. The study patients were divided into 2 groups: those in whom a postoperative NPWT was not used (no iVAC) and those in whom it was used (iVAC) at the discretion of the surgeon who considered this group of patients to be highest risk. Demographic, clinical, operative and outcomes data were analyzed.

In all, 53 patients were identified as being at high risk for wound infection and were included in the study. There were 35 patients in the no iVAC group and 18 in the iVAC group. Demographic data were similar in both groups. More patients in the iVAC group required a colon resection compared with the no iVAC group (33% v. 6%). Despite a predicted higher rate of wound infection in the iVAC group compared with the no iVAC group, there was no statistically significant difference in the rate of wound infection in the iVAC group compared with the no iVAC group (39% v. 43%, $p = 1.0$).

Although there has been recent interest in using NPWT on closed incisions (iVAC) to prevent wound infections, we found no significant difference between groups in terms of the rate of wound infection. We believe that a prospective randomized trial is warranted to determine if iVAC is useful and cost effective in general surgery patients at high risk for wound infection.

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The impact of seed granting on research in the University of British Columbia Department of Surgery. ***R.S.A. Khan, J. Kowal, S.M. Wiseman.*** **From the University of British Columbia and the St. Paul's Hospital, Vancouver, BC**

At the University of British Columbia (UBC), in the Department of Surgery, the Concept Award (CA) was given through a competition to departmental members from 2003 to 2008. Many new project ideas were abandoned owing to lack of funds once they were stopped. The purpose of the study was to evaluate the impact the CA had on individual and departmental research.

The CA recipients were identified from the database of Centre of Surgical Research at UBC. A questionnaire survey was sent by mail to enquire about the outcomes of proposals, further grants (amount in $CAD) if any received, their ability to complete the project, the development of new projects stemming from their initial projects, and the publication of their research in the peer-reviewed and non–peer reviewed journals.

There were 28 CA recipients identified; 19 (68%) replied to the survey. Thirteen (68%) completed the research for which they received the award. Ten (53%) carried on to do more projects stemming from the original concept. The range of seed award was between $5000 and $10 000. In total, these 19 responders received $142 000 in CA prize money. They received a total of $2 201 765 external grants ($2 133 015 in grants through a peer-reviewed process and $68 750 in industry funding). This is a 145% return on investment (net return is $2 059 765). There were 25 peer-reviewed, 4 non–peer reviewed and 17 abstract publications generated. There were 45 presentations out of these projects. These seed grants were used on supplies, research staff and statistician fee. There were 5 of each doctoral, master's, resident and medical students involved in these studies. Of the 19 survey responders, 2 would apply for these grants again if offered.

The CA had a positive impact on research and was productive in terms of generating new grants, publications and presentations for individuals and their departments. Therefore, the CA should be encouraged to promote research.

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Quality of surgical care is inadequate for elderly patients. ***V. Martelli, S.A. Fraser, I. Vedel, M. Deban, C. Holcroft, M. Monette, J. Monette, S. Bergman.*** **From McGill University, the Jewish General Hospital and the Lady Davis Institute for Medical Research, Montréal, Que.**

Quality indicators (QI) are meant to set the standard for medical care. Generally, if QIs are not met, care may be considered to be of inferior quality. The objectives of this study were, first, to assess the quality of surgical care delivered to elderly patients by measuring adherence to QIs, and second, to determine the association between patient characteristics and QI adherence.

This is a retrospective study of patients 65 years and older who underwent elective major abdominal general surgery between November 2009 and July 2010. Patient characteristics (age, sex, Charlson Comorbidity Index [CCI] and functional status) and complications were recorded. Adherence to 7 geriatric QIs (Table) was abstracted from medical records using a standardized abstraction tool. Individual QI pass rates were calculated (no. patients passed / no. patients eligible). In addition, for each patient, a quality score was calculated (no. QIs passed / no. QIs eligible). This outcome was dichotomized into high- and low-quality groups, depending on whether the quality score was above or below the median, respectively. The association between patient characteristics (independent variables) and high- or low-quality score (dependent variable) was determined using logistic regression.

Table, abstract 28. Individual quality indicator pass rates

Quality indicator	Pass rate, %	No. eligible (missing data)
Delirium screening	0.0	143 (9)
Level of care documentation	0.7	143 (1)
Cognitive assessment	5.1	143 (5)
Oral intake documentation	12.6	143 (3)
Pressure ulcers screening	35.0	143 (0)
Complete delirium work-up	50.0	32 (0)
Complete discharge planning	55.1	143 (5)

In all, 143 patients were studied. Their mean (SD) age was 75.7 (7.1) years, 47.6% were male, the median (IQR) CCI was 3 (2–8), 95.8% were independent and 30.1% of patients developed at least 1 complication, with a 30 day mortality of 2.8%. Individual QI pass rates are summarized in the Table. The median quality score was 20.0%. Patient characteristics were equivalent between the low- and high-quality groups.

When measured by adherence to a specific set of geriatric QIs, a novel, process-based approach, care delivered to elderly patients undergoing major surgery is generally poor, independent of baseline patient characteristics. More research is needed to better understand how QI adherence impacts this population.

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Recurrence of inguinal hernia in general and hernia specialty hospitals in Ontario, Canada. ***A. Malik, C. Bell,***

T. Stukel, D.R. Urbach. **From the Toronto General Hospital Research Institute and the Institute for Clinical Evaluative Sciences, Toronto, Ont.**

Special expertise in surgical procedures can improve surgical outcomes; however, it is unclear if inguinal hernia treatment at a high-volume specialty hospital can result in improved patient outcomes compared with high-volume general hospitals. We compared hernia recurrence rates in patients undergoing primary elective inguinal hernia repair at general hospitals with the Shouldice Hernia Hospital in Ontario, Canada.

We conducted an administrative data analysis of 234 284 people who underwent primary elective inguinal hernia repair in Ontario, Canada, from 1993 to 2007. Patients who had surgery at general hospitals were divided into quartiles according to the prior year's hospital volume. We estimated the risk of recurrent hernia repair according to hospital type and volume using Cox proportional hazards regression models to adjust for patient and health services variables that could affect hernia recurrence.

Almost 30% (64 966) of primary inguinal hernia repairs performed in Ontario during the study period were at the Shouldice Hospital. A total of 8563 surgical recurrences occurred by Mar. 31, 2010. The risk of recurrence in the lowest volume quartile was 5.7% (95% CI 5.5%–6.1%), as compared with 3.9% (95% CI 3.7%–4.2%) at high-volume general hospitals and 1.1% (95% CI 1.0%–1.1%) at the Shouldice Hospital. Compared with patients who had surgery at the lowest volume hospitals, hernia recurrence among those who underwent hernia repair at the Shouldice Hospital was substantially lower after adjustment for age, sex, comorbidity and household income (adjusted hazard ratio 0.18, CI 0.16–0.19, $p < 0.001$).

Patients who had elective primary inguinal hernia repair at the Shouldice Hospital had a substantially lower risk of recurrence than those who had surgery at general hospitals, including high-volume general hospitals.

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Oncostatin M receptor deficiency results in increased mortality in an intestinal ischemia reperfusion model in mice. *P.Y. Young, T.F. Mueller, V.A. Lucykx, C.M. Lukowski, C.A. Compston, T.A. Churchill, R.G. Khadaroo.* From the University of Alberta, Edmonton, Alta.

Sepsis is a major clinical problem throughout the world, contributing to inpatient morbidity and mortality, and posing a considerable cost to health care systems. Its associated and significant morbidity and mortality is related to the progression of injury from the initial local infection to multiple organ dysfunction. With sepsis, adaptive physiologic mechanisms cause early changes in the mesenteric circulation that can lead to acute intestinal ischemia/reperfusion (AIIR) injury. In turn, AIIR likely plays a significant role in the pathogenesis of distant organ injury in sepsis.

Oncostatin M (OSM) is a 28 kDa glycoprotein in the IL-6 family of cytokines. Activation of the oncostatin M receptor (OSMR) results primarily in activation of the JAK-STAT pathway. The primary biological functions of OSM/OSMR are in immunomodulation. Serum OSM levels have been shown to increase significantly in sepsis. The role of signalling in the OSM/OSMR axis in AIIR has not been previously investigated.

Using superior mesenteric artery (SMA) occlusion, we studied AIIR in an experimental animal model. Wild-type and OSMR knockout C57BL/6 mice underwent either sham laparotomy or 30 or 60 minutes of ischemia and 2 or 4 hours of reperfusion. Mortality was significantly higher in knockout animals undergoing AIIR. In the 30 minute ischemia with 4 hours of reperfusion group, the mortality rate was 0% in the wild-type group versus 57% in the knockout group. Wild-type groups showed a trend of increased local intestinal injury based on tissue myeloperoxidase activity. No differences were seen in markers of lung injury.

Further investigation into the role of OSM/OSMR signalling needs to be conducted in order to better establish its role in sepsis. Preliminary animal models suggest that the OSM/OSMR axis plays an important immunomodulatory role in AIIR, with increased mortality with deficiency of OSMR signalling.

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Laparoscopic repair of large paraesophageal hernias with anterior gastropexy: a multicentre trial. *C. Daigle, T. Grantcharov.* From the University of Toronto and St. Michael's Hospital, Toronto, Ont.

The optimal approach to repair of paraesophageal hernias (PEH) has remained a controversial topic since its inception. Recent data suggest that mesh repair leads to a recurrence rate similar to those reported using other approaches, while subjecting patients to the complications associated with its use. Routine fundoplication for acid reflux prevention during PEH repair has also been favoured despite significant dysphagia rates. This study includes multicentre retrospective data on laparoscopic PEH repairs using a modified Boerema gastropexy. Standard fundoplication was avoided unless clearly indicated, and mesh hiatoplasty was omitted

A total of 108 patients were followed after laparoscopic PEH repair at 3 institutions. Preoperative symptoms, perioperative outcomes and complications were evaluated. Both subjective and objective postoperative outcomes were assessed via follow-up questioning, endoscopy and upper gastrointestinal series. Primary outcomes included evidence of recurrence at endoscopy and need for acid reflux pharmacotherapy after repair.

After discharge, patients were followed for an average of 10.78 months. Reflux symptoms were absent in 72 patients (69.9%). Of the remaining patients, 9 (8.7%) had mild intermittent reflux without the need for proton pump inhibitors (PPi), 12 (11.7%) had moderate reflux necessitating PPi as needed and 10 (9.7%) had reflux requiring daily PPi. Our overall recurrence rate, assessed at postoperative endoscopy, was 17.5% ($n = 18$). Of these, 11 (10.7%) were small segmental recurrences and 7 (6.8%) were large recurrences.

The repair of large PEHs appears to have an inherent recurrence rate regardless of the operative approach. The present series demonstrates a similar recurrence rate to what has been reported for mesh PEH repair, while avoiding the catastrophic complications associated with its use. The findings also support a tailored approach to the incorporation of fundoplication. Postoperative acid reflux was absent in most of our patients, and PPi alone was sufficient for those who did experience reflux symptoms.

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Response to preoperative medical therapy predicts success of laparoscopic splenectomy for immune thrombocytopenic purpura. *G. McCreery, K. Vogt,*

L. Dubois, D. Gray. **From the London Health Sciences Centre, London, Ont.**

This retrospective cohort study evaluated laparoscopic splenectomy (LS) for treatment of immune thrombocytopenic purpura (ITP) to elucidate preoperative prognostic factors associated with recurrence of ITP.

All patients who underwent LS for ITP from 2000 to 2011 at London Health Sciences Centre (LHSC), Canada, were identified. Patient records were reviewed to identify demographics, preoperative response to medical treatment (steroids, intravenous immunoglobulin, azathioprine, etc.), operative details and recurrence of clinically significant ITP. Recurrence was defined as need for post-LS medical management for thrombocytopenia, or platelet counts less than 50×10^9/L. Multivariable logistic regression was used to identify factors associated with recurrence.

In all, 93 patients underwent LS for ITP. Their median follow-up was 8 months (IQR 1–26), mean age was 46 (range 6–88) years, 34% were male and 6 (7%) required conversion to an open procedure. There was one 30 day mortality, related to staphylococcal sepsis. Disease recurrence occurred in 22 patients (24%). Multivariate logistic regression adjusted for preoperative platelet count found the following to be associated with recurrence: failure to respond to preoperative steroids (OR 4.1, 95% CI 1.2–14.6) and requirement for additional pre-LS medical therapies (OR 3.9, 95% CI 1.7–9.2). The success rate among patients who had a good response to initial steroid treatment was 90%. A linear relationship was found between increasing number of preoperative medical therapies and failure of LS, where all patients requiring 4 pre-LS treatment regimens experienced recurrence.

Laparoscopic splenectomy is an effective treatment for many patients with ITP, with sustained clinical response observed in 76%. Poor response to preoperative steroids and increasing number of treatment regimens are associated with a higher likelihood of recurrence. Patients requiring 4 or more medical therapies may be considered inappropriate candidates for this procedure.

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Perioperative sepsis, but not hemorrhagic shock, promotes the development of cancer metastases in a murine model. ***R. Seth, A. Ananth, L.-H. Tai, T. Lam, T. Falls, C. Souza, J. Bell, R. Auer.*** **From the Centre for Innovative Cancer Research, The Ottawa Hospital Research Institute and the Division of General Surgery, Department of Surgery, The Ottawa Hospital, Ottawa, Ont.**

Surgery is thought to promote cancer metastases. Natural killer (NK) cells are important in clearing tumour cells. Although sepsis and blood loss are associated with poorer outcomes in cancer patients, mechanisms by which they increase tumour metastases are incompletely understood. We hypothesize that the combination of surgery and perioperative complications, involving sepsis and blood loss, may further enhance postoperative metastases. We sought to establish a murine model of surgical stress involving sepsis and blood loss to study their effects on postoperative cancer metastases.

Surgical stress was induced by partial hepatectomy (PH) or left nephrectomy (LN) preceded by intravenous challenge of CT26LacZ colon cancer cells in Balb/c or B16LacZ melanoma cells in C57Bl/6 mice to establish pulmonary metastases. Sepsis was induced by puncturing the cecum and expressing stool in the abdomen. Hemorrhagic shock was induced by removing 30% of total blood volume. Lung metastases were quantified at 3 days postintervention. The role of NK cells was studied using an in vitro cytotoxicity assay.

Surgical stress via PH or LN resulted in 2-fold increase in metastases compared with nonsurgery mice in both murine models. Surgically stressed NK cells showed impaired killing of tumour targets compared with NK cells from nonsurgery mice. The prometastatic effect of surgery was further augmented in mice with perioperative sepsis but not in mice with stage 3 hemorrhagic shock.

Surgical stress induced by 2 different means results in 2-fold increase in lung metastases in 2 murine models. Sepsis, but not hemorrhagic shock, results in further augmentation of metastases. Surgery impairs NK cell function. Studies aimed at exploring the role of NK cells in the context of perioperative sepsis and blood loss are being pursued. This will be important in the development of perioperative immunomodulation strategies aimed at attenuating metastatic disease in the setting of sepsis and blood loss.

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Measuring the impact of implementing an acute care surgery service on the management of acute biliary disease. ***D. Paskar, S. Crawford, N. Parry, K. Leslie.*** **From the University of Western Ontario and the Victoria Hospital, London Health Sciences Centre, London, Ont.**

Acute care surgery (ACS) is an increasingly common model for provision of emergency general surgery care. Evidence to date has largely supported ACS, particularly from patient care perspectives. This study's objective was to assess how implementing an ACS service would influence the management of patients presenting to the emergency department (ED) with symptoms of acute biliary disease

A hospital database search and subsequent review of electronic medical records was performed to identify patients presenting to the ED with acute biliary complaints (colic, choledocolithiasis, cholecystitis and gallstone pancreatitis) for the 6 months following ACS implementation, as well as the corresponding period in the previous year. Data were collected for demographics, diagnosis, time to admission, use of imaging, operative timing, complications and ambulatory visits. Descriptive statistics and tests of statistical significance were performed.

There were 137 patients in the pre-ACS group and 169 in the post-ACS group, with no differences in age, sex or diagnosis. Post-ACS patients experienced shorter time to cholecystectomy (49.2 v. 91.3 d, $p = 0.0002$). In the post-ACS phase, more surgeries occurred during daytime hours (88% v. 70%, $p = 0.0002$) and were increasingly performed on an inpatient basis (39% v. 26%, $p = 0.047$). Length of surgery was longer in the post-ACS period (64.5 v. 53.7 min, $p = 0.04$). There was no difference in the number of admissions, imaging tests and ED or outpatient visits. Length of stay was unchanged. There was a trend toward faster time to admission from the ED (7.7 v. 8.8 h, $p = 0.07$). There were no differences in rates of mortality, operative complication or open versus laparoscopic surgery.

The implementation of ACS has resulted in patients presenting to the ED with acute biliary disease receiving earlier definitive surgical care. Further initiatives are needed to reduce the use of health care resources by this patient population.

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Patient flow and efficiency in an acute care surgery service. ***M. Sudarshan, M. Alhabboubi, E. St-Louis, D. Deckelbaum, T. Razek, L.S. Feldman, K. Khwaja.*** **From McGill University, Montréal, Que.**

The increasing prevalence of acute care surgery (ACS) services strives to reduce the burden on the emergency department while providing comprehensive and timely surgical consultation. Our objective was to analyze patient flow and efficiency after implementation of this service at our large teaching hospital.

Prospective collection of data from the ACS service was performed over a 7 month period after its implementation (post-ACS). In addition, data were also collected retrospectively from all emergency general surgery admissions (pre-ACS) over a 1 year period. End points analyzed included time between emergency department consult and first contact by the general surgery team, time to generate a general surgery plan, time to admission, length of stay and time of discharge.

In all, 507 general surgery consultations were identified over a 7 month period for the ACS service, with 318 admissions; 527 patient admissions were obtained upon retrospective review from pre-ACS service. The average time from consult to first contact was 216 minutes for the pre-ACS group and 112 minutes for the post-ACS group ($p = 0.0001$). The average time from first contact to admission was 629 minutes for the pre-ACS group and 521 minutes for the post-ACS group ($p = 0.0009$). From time of contact to definitive plan, a mean time of 92 (SD 232) minutes was obtained for the post-ACS group. There was a trend toward decreased length of stay, with 9 days for the pre-ACS groups versus 5.5 days for the post-ACS group (median 4 v. 3 d, $p = 0.099$). No significant difference in average time of surgery and time of discharge was found.

An ACS service provides timely expert surgical consultation and decreases emergency department burden. Our study results indicate faster times to see emergency department consults and decreased time to admission.

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The relationship between treatment factors and postoperative complications after radical surgery for rectal cancer. ***D. Richardson, G. Porter, P. Johnson.*** **From Dalhousie University, Halifax, NS**

Rectal cancer care is provided in a variety of hospital settings by surgeons with differing training and experience. It is unclear to what extent these factors influence postoperative complication (POC) rates. The purpose of this study was to examine POC rates among hospitals providing rectal cancer care in a Canadian province and to determine if POCs are associated with surgeon training, surgeon procedure volume and/or hospital procedure volume.

Patients with a new diagnosis of rectal cancer from July 1, 2002, to June 30, 2006, in Nova Scotia, Canada, who underwent radical surgery with curative intent were included. Data were collected through a comprehensive, standardized review of hospital inpatient and outpatient medical records. A priori defined POCs occurring within 30 days of surgery or during the index admission were identified. Surgeon training was categorized according to completion of a surgical oncology or colorectal fellowship. Surgeon volume was categorized as high (6–15 cases/yr) and low (≤ 5 cases/yr). Hospital volume was categorized as high (42 cases/yr), medium (12–19 cases/yr) and low (3–11 cases/yr).

Over the study period, 472 patients underwent surgery by 51 surgeons in 10 hospitals. Overall, 9.4% of patients had cardiovascular/respiratory complications, 8% had renal/urinary tract complications, 0.6% developed *C. difficile* and 0.8% had stoma complications. The overall rate of abdominal/pelvic sepsis was 7.6%. Among patients who had a sphincter-preserving procedure, the rate of pelvic abscess/anastomotic leak was 11%. The overall perioperative mortality rate was 0.85%. On multivariate analysis controlling for patient age, comorbidities and tumour height, there was no association between surgeon training, surgeon volume or hospital volume and POC.

Most POCs following rectal cancer surgery are not related to the gastrointestinal tract. No significant surgeon or institution factors were associated with POC.

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Risk of ventral hernia after laparoscopic colon surgery. ***F. Haggar, R. Boushey, H. Moloo, I. Raiche, J. Mamazza.*** **From the Division of General Surgery, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.**

This study aims to determine the risk of a first-time incidence of ventral incisional hernia in patients who underwent laparoscopic-assisted bowel resection (LABR), and to compare their risk with that of patients who underwent open bowel procedures.

A cohort of patients undergoing either LABR ($n = 14\,435$) or open ($n = 1367$) procedures between January 1992 and July 2008 was selected from a whole population-based prospective hospital morbidity registry. Cox proportional hazards modelling was used to determine the median time to failure (development of incisional hernia).

The 5-year risk of developing an incisional hernia requiring surgery was 3.4% (95% CI 1.2%–6.5%) for LABR patients and 12.2% (95% CI 8.7%–23.2%) for open patients. The median time to failure was 48 months (95% CI 37–59 mo) and 36 months (95% CI 25–47 mo) for LABR and open groups, respectively ($p = 0.0057$). The incidence of a second surgical repair for a ventral hernia was significantly higher in the open group compared with LABR (7.7%, CI 3.2%–12.5% v. 3.8%, CI 2.3%–5.4%). Male patients and patients 65 years and older had a significantly higher 5-year incidence of incisional hernia ($p = 0.004$ and $p = 0.007$, respectively). In addition, a history of bilateral inguinal hernia repair was associated with incisional hernia ($p = 0.02$).

A significant number of patients undergoing colon surgery will eventually undergo hernia repair surgery. Laparoscopic access reduces the risk of incisional ventral hernia. This will reduce the need for readmission to the hospital and additional surgical procedures, providing a potential source of decreased morbidity and a means of cost savings.

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Urinary metabolomics as a tool for early detection of Barrett's and esophageal cancer. ***V.W. Davis, D.E. Schiller, D. Eurich, M.B. Sawyer.*** **From the University of Alberta, Edmonton, Alta.**

Esophageal adenocarcinoma (EAC) often presents at a late, incurable stage, and mortality has increased substantially owing to an

increase in the incidence of EAC arising from Barrett's esophagus (BE). When diagnosed early, however, the combination of surgery and adjuvant therapies is associated with high cure rates. The objective of the current study was to evaluate urinary metabolomics profiles of patients with precursor BE and EAC for early diagnosis, to define distinct BE and EAC tumour signatures.

Urine samples from patients with BE (n = 32), EAC (n = 44) and healthy controls (n = 42) were examined using ^{1}H-NMR spectroscopy. Targeted profiling of spectra using Chenomx software permitted quantification of 59 distinct metabolites. Unsupervised (principal component analysis) and supervised (partial least squares discriminant analysis) multivariate pattern recognition techniques were applied using SIMCA-P$^+$.

Clear distinctions between BE, EAC and healthy controls were noted ($p < 0.001$, $R^2 = 0.437$, $Q^2 = 0.507$). Model validity was confirmed with both cross-validation and response permutation. Receiver operating characteristic curve analysis revealed excellent predictive power, with an area under the curve of 0.924.

Urinary metabolomics identified discrete metabolic signatures which clearly distinguished both BE and EAC from controls. These preliminary results suggest that urinary metabolomics may have a potential future role in noninvasive screening in this condition.

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Construct validity of individual and summary performance metrics associated with a computer-based laparoscopic simulator. ***J. Rivard, A. Vergis, B. Unger, K. Hardy, C. Andrew, L. Gillman, J. Park.*** **From the University of Manitoba, Winnipeg, Man.**

Computer-based surgical simulators capture a multitude of metrics based on different aspects of performance, such as speed, accuracy and movement efficiency. However, without rigorous assessment, it may be unclear whether all, some or none of these metrics actually reflect technical skill, which can compromise educational efforts on these simulators. We assessed the construct validity of individual performance metrics on the LapVR (Immersion Medical) simulator and used these data to create task-specific summary metrics.

Medical students with no prior laparoscopic experience (novices, n = 12), junior surgical residents with some laparoscopic experience (intermediates, n = 12) and experienced surgeons (experts, n = 11) all completed 3 repetitions of 4 LapVR simulator tasks. The tasks included 3 basic skills (peg transfer, cutting, clipping) and 1 procedural skill (adhesiolysis).

We selected 36 individual metrics on the 4 tasks that assessed 6 different aspects of performance including speed, motion path-length, respect for tissue, accuracy, task-specific errors and successful task completion. In all, 4 of 7 individual metrics assessed for peg transfer, 6 of 10 metrics for cutting, 4 of 9 metrics for the clipping and 3 of 10 metrics for adhesiolysis discriminated between experience levels. Time and motion path-length were significant on all 4 tasks. We used the validated individual metrics to create summary equations for each task. We then applied these summary equations to the raw data and were able to successfully distinguish between the different experience levels.

Educators should maintain some skepticism when reviewing the plethora of metrics captured by computer-based simulators as some, but not all, are valid. We showed the construct validity of a limited number of individual metrics and developed summary metrics for the LapVR. These validated measures can be used to set standards on the LapVR, assess training and provide feedback to learners.

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Impact of a city-wide health system reorganization on emergency department visits in hospitals in surrounding communities. ***J. Agzarian, J. Prodger, W. Kelly, S. Kelly, D. Prodger.*** **From McMaster University and Hillfield Strathallan College, Hamilton, Ont., and the Joseph Brant Memorial Hospital, Burlington, Ont.**

In April 2011, a major reorganization of health care provision in an Ontario city was implemented, creating a dedicated pediatric (< 18 yr) emergency department.

The objective of our project was to find out if the creation of a pediatric only emergency department (ED) led to a change in the number and type of visits in the surrounding community hospitals' EDs. For the same 6-month time period (April to September) before (2010) and after (2011) this change, we obtained data from 2 surrounding community hospitals, looking at emergency department visits by age (adult v. pediatric) and postal code. Using Ministry of Health and Long-Term Care data, we also looked at the effect of these ED changes on total time spent in the ED.

Our findings showed that there was a decrease in pediatric ED visits in the 2 surrounding community hospitals after the establishment of a dedicated pediatric emergency department in the city, from 6608 visits to 6216. There was an increase in adult ED visits to both hospitals, from 27 962 visits to 29 202, leading to an increase in the total number of visits to each ED. Postal code data showed that the decrease in pediatric visits at 1 of the surrounding hospitals was owing to fewer children from rural postal codes being seen there (293 v. 219, $p = 0.01$). The decrease at the other hospital was owing to fewer visits from children from rural postal codes (1017 v. 819, $p < 0.01$), but also from the town itself (869 v. 719, $p < 0.01$). The major change seen with total time spent in the ED was a halving of the time at the city hospital once it became a pediatric only ED.

Our study showed that reorganization of health care within a city does impact the surrounding community hospitals, and their input should be sought when planning such reorganizations.

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Transcatheter aortic valve implantation for the nonoperative management of aortic stenosis: a cost-effectiveness analysis. ***J. Racz, E. Ewara, J. Martin, S. Sarma, M. Chu, C. Schlachta, G. Zaric.*** **From the University of Western Ontario Schulich School of Medicine and Dentistry, the University of Western Ontario, and the London Health Sciences Centre, London, Ont.**

Despite promising clinical results in elderly patients who are ineligible to undergo surgery, transcatheter aortic valve implantation (TAVI) is one of many health technologies competing for funding from a limited health care budget. The objective of this study was to assess the cost-effectiveness of TAVI compared with standard therapy, consisting mainly of balloon aortic valvuloplasty, in patients with severe aortic stenosis who are ineligible for conventional aortic valve replacement, from the perspective of the Ontario health care payer.

A microsimulation decision analytical model was developed to estimate the incremental costs and benefits associated with both interventions over a lifetime time horizon. Monthly adverse event and patient mortality rates were determined using data from the PARTNER randomized controlled trial (cohort B). Quality of life values were determined through literature review, expert opinion and data provided by the PARTNER investigators. The London Health Sciences Centre Case Costing Initiative and the Canadian Institute for Health Information were used to estimate costs. Extensive sensitivity analyses were performed to explore the impact of uncertainty surrounding model parameters on the resulting cost-effectiveness estimates. The primary outcome measure was the incremental cost-effectiveness ratio (ICER), with benefits expressed as quality-adjusted life years (QALYs). Costs were expressed in 2011 $CAD. Both costs and benefits were discounted at 5%.

The base case ICER was approximately $38 447 per QALY gained. The results of the sensitivity analyses yielded ICERs ranging from approximately $32 238/QALY to $43 887/QALY. The ICER estimates were most sensitive to changes in the cost of the Edwards SAPIEN device.

At cost-effectiveness thresholds normally used to define value for money in health care, TAVI represents a cost-effective treatment option for patients with severe aortic stenosis who are currently ineligible to undergo conventional aortic valve replacement in the province of Ontario.

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Breast cancer: racial differences in age of onset. A potential confounder in Canadian screening recommendations. ***J. Winocour, K. Al-Ali, K. Briggs, R. George.*** **From the St. Michael's Hospital, Toronto, Ont.**

Asian and sub-Sahara regions are witnessing increases in the incidence of breast cancer (BC). A number of areas (China, Japan, Taiwan, Korea, India) are reporting median ages at diagnosis that are 5–10 years younger than seen in western countries (*World J Surg* 2010;34:2308-24). Canadian screening guidelines have been based on Canadian National Breast Screening studies 1 and 2, which report 97% and 98.4% of their study populations as being born in North America or Europe. The Canadian Task Force guide (*CMAJ* 2011;183:1991-2001) analyzed 9 trials from North America and Northern Europe. These trials may not reflect the populations served in some modern Canadian urban centres. This study examines racial differences in the onset of BC in a Canadian urban setting.

Sequential cases encountered in the surgical clinics of an urban screening and diagnostic centre were examined July 2009 to December 2011. Race of origin was defined as Caucasian, east central/south Asian, sub-Sahara, Hispanic and South Pacific/Filipino. No aboriginal North American BC case was encountered. Mixed races were excluded from this analysis. Demographic and breast cancer risk factors (Gail score, use of hormone replacement therapy, age of menarche, age of first pregnancy) were all tabulated as well as tumour characteristics and stage. Data analysis was done with Stat Tools 1.1.

In all, 357 patients were of Caucasian background and 184 non-Caucasian (NC). Median age of diagnosis in the NC group was 53 years, 5 years younger than the Caucasian cohort (58 yr, $p = 0.017$). Diagnosis at 50 years or younger (age at screening implementation in Ontario) was 38.5% in the NC group versus 24% in the Caucasian group ($p = 0.0011$). The NC group was almost twice as likely to present under 45 years (20.1 v. 10.8%, $p = 0.005$). Multivariate analysis could not demonstrate significant differences in the use of hormone replacement therapy, Gail scores or other standard breast cancer risk factors. There were more estrogen receptor–negative tumours in the NC group, but this did not reach significance in this study.

The NC patients in this study were on average 5 years younger at presentation than Caucasian BC patients. A large portion of the NC population was 50 or under (38.5%). Practitioners need to be aware of a possible earlier age of onset of BC in NC groups. A larger study will be needed to assess the value of enhanced screening or awareness in these groups.

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Risk taking in surgery: in and out of the comfort zone. ***N.R. Zilbert, M.L. Murnaghan, A. Leung, G. Regehr, C.-A. Moulton.*** **From The Wilson Centre and the Department of Surgery, University of Toronto, Toronto, Ont., and the Centre for Health Education Scholarship, University of British Columbia, Vancouver, BC**

An element of risk is inherent in surgical practice. System-wide efforts have been made to reduce risk in surgery, but little is known about the role and perspective of the individual surgeon on risk and its influence on surgical practice.

We conducted 18 semistructured, 60-minute interviews with surgeons. Purposive and theoretical sampling strategies were selected for sex, clinical discipline, experience and reputation (e.g., conservative, aggressive). Using a constructivist grounded theory approach, we explored surgeons' perspectives on risk in their practice, with data collected and analyzed in an iterative design until saturation was reached.

All surgeons recognized risk in their practice and explicitly distinguished between preoperative risk-taking and intraoperative risk-taking. Surgeons' perception of risk is largely based on their "comfort zone," defined as when their perceived resources met the perceived demands of a situation, but is affected by several modulating factors. These included threat to reputation, influence of the patient, the surgeon's mood and tolerance for complications. Surgeons considered by their peers to have high risk tolerance often considered themselves to have low risk tolerance. Through explicit strategies of risk management. they made "risky" operations "safe."

Surgeons recognized risk in their practice and elaborated their mechanisms for risk perception, management and tolerance. A framework for understanding surgeons' approach to risk was developed for educational purposes, both for trainees and clinicians, to foster more critical self-reflection on risk-taking in surgery.

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A tumour board in the office: Track those cancer patients! ***C. Decker.*** **From the West Parry Sound Health Centre, Parry Sound, Ont.**

Depending on practice profiles, most general surgeons both in community and academic practice will see cancer patients or potential cancer patients. The diagnostic and management pathway

travelled by these patients in the Canadian health care system can be simple or very complicated. It may require multiple steps, often requiring considerable periods of time and travel. Patients do not always follow quick, linear pathways from the surgeon's office to their definitive treatment. In other words, our patients can and do sometimes "slip through the cracks" in their diagnostic and treatment journey.

We have created a tumour board or grid that tracks patients from their first office appointment to diagnostic testing, to definitive surgery and follow-up in the cancer centre. The purpose of the board is to prevent missed appointments and reports that cause delays. It ensures that all appropriate steps in the process are followed and tracks wait times.

Our community surgery office uses this tumour board. The board can be electronic (Microsoft Excel) or in paper form. We have initially chosen a simple paper form for quick visualization by the surgeons and staff.

From Oct. 1, 2011, to Apr. 1, 2012, patient data were entered in graphic form on the board. It is located in the office in a discrete location not viewable by the public. It is updated 3 times per week by the office staff. Patients were entered onto the board at the request of the surgeon.

Criterion for entry onto the board varied. They include clinical, endoscopic or radiologic findings initially presenting to the surgeon with a high suspicion of a serious cancer. This includes patients primarily with colorectal, breast, melanoma and thyroid tumours. Excluded were squamous and basal cell skin cancers. Patients were removed once they received a benign diagnosis or once the cancer clinic referral was completed. Tolerance for wait times in obvious or suspicious cases was set at 2 weeks.

Data collected in the grid included patient demographics (name, date of birth, sex); date of the first appointment with a surgeon; the diagnosis or possible diagnosis; the diagnostics received currently; the date of endoscopy (if applicable); date the imaging requirements were faxed and where (ultrasound, CT, MRI); date of the imaging study; date of the biopsy and type; date the pathology report was received; date the pathology report was reviewed; date of the operation; referral to cancer centre faxed; appointment with cancer care confirmed; off the list.

In 6 months, 25 patients in a single surgeon's practice met the criterion for entry onto the tumour board. This included 10 colorectal cancers, 10 breast cases, 2 thyroid cancers, 2 melanomas and 1 soft tissue tumour. In 4 cases (16%), intervention was undertaken to clarify delays or rebook a diagnostic test or surgery.

As patient advocates, we have a duty to ensure that all patients navigate quickly through the complexities of cancer care. Larger centres may have patient navigators, but these are not available necessarily in smaller centres. Tracking patients on an office tumour board aids in this duty.

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Increased patient BMI is not associated with advanced colon cancer stage or grade on presentation: a retrospective chart review. ***K. Neumann, S. Mahmud, J. Metcalfe, A. McKay, J. Park, D. Hochman.*** **From the University of Manitoba and Cancer Care Manitoba, Winnipeg, Man**

The purpose of this study was to investigate whether obesity (BMI > 30) is associated with advanced stage or grade at time of presentation in colon cancer.

The study was nested in a cohort of 800 colon cancer patients who received their diagnosis between 2004 and 2008 in Manitoba and who underwent surgical resection, with hospital charts from facilities within the Winnipeg Regional Health Authority. The stage and grade data were obtained from the Manitoba Cancer Registry. Height and weight information were acquired from preoperative assessments reported in the hospital charts. Complete data were retrieved on 691 of 800 patients.

With regard to tumour stage, the average BMI in the lower stage colon cancer group (stage I and II) was 28.1, with 102 of 365 patients being obese (28.0%). The advanced colon cancer group (stage III and IV) had an average BMI of 27.6, with 85 of 322 patients being obese (26.4%). Metastatic colon cancers (stage IV only) had the lowest average BMI (27.1), with only 18 of 81 patients being obese (22.2%). Differences among groups did not reach statistical significance. Tumour grade was compared, and patients with lower grade colon cancers (grade 1) had an average BMI of 27.6, with 14 of 45 patients being obese (31.1%). Patients with moderate grade (grade 2) cancers had an average BMI of 28.1, with 144 of 510 patients being obese (28.2%). The BMI in patients with higher grade cancers (grades 3 and 4) was 26.9, with only 29 of 132 patients being obese (22.0%). Only patients with higher grade cancers had a statistically significant lower average BMI (1.18, 95% CI 0.02–2.35, $p = 0.046$) than those with moderate grade cancers.

Unlike the known association of increased BMI with advanced adenomatous polyps, this study does not demonstrate a correlation between higher patient BMI and more advanced stage or grade of colon cancer on presentation. On the contrary, lower BMI appears to be more prevalent in the higher grade colon cancer groups, particularly with metastatic disease. Explaining these data is difficult and would require further study, but the results may represent the cumulative effects of multiple factors including disease biology, lag-time before diagnosis and patient behaviours relating to frequency of health visits.

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Consensus statements regarding the multidisciplinary care of limb amputation patients in disasters or humanitarian emergencies. Report of the 2011 Humanitarian Action Summit Surgical Working Group on amputations following disasters or conflict. ***J.E. Gosney Jr., F.M. Burkle Jr., A.D. Redmond, K. McQueen.*** **From the Handicap International, Takoma Park, Md., the Harvard Humanitarian Initiative, Harvard University, Boston, Mass., the Humanitarian and Conflict Response Institute, University of Manchester, Manchester, United Kingdom, and the Harvard Humanitarian Initiative, Harvard University, Cambridge, Mass.**

The World Health Organization (WHO) Global Burden of Disease project notes the significant physical disability and socioeconomic impact placed upon amputation patients, their families and society. Given the substantial number of amputations performed during recent humanitarian disasters such as the 2010 earthquake in Haiti, a subsidiary of the international Burden of Surgical Disease Working Group was formed to create guidelines for coordinating care of these patients in austere settings.

During the 2011 Humanitarian Action Summit, a working group of invited experts convened in the fields of surgery, anesthesia,

rehabilitation medicine, emergency medicine, mental health and family medicine. A formal review was conducted of current literature and guidelines. Consensus statements were developed for international organizations providing care to limb amputation patients during disasters or humanitarian emergencies.

Expanded planning is needed for a multidisciplinary surgical care team, inclusive of surgeons, anesthesiologists, rehabilitation specialists and mental health professionals. Surgical providers should approach amputation using an operative technique that optimizes limb length and prosthetic fitting. Appropriate anesthesia care involves both perioperative and long-term pain control. Rehabilitation specialists must be involved early in treatment, ideally before amputation, and should educate the surgical team in prosthetic considerations. Mental health specialists must be included to help the patient with community reintegration.

A key step in developing local health systems is the establishment of surgical outcomes monitoring. Such monitoring can optimize patient follow-up and foster professional accountability for the treatment of amputation patients in disaster settings and humanitarian emergencies.

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Learning the CanMEDS role of professional: a pilot project of supervised discussion groups addressing the hidden curriculum. ***H. Wissanji, E. Desrosiers, A. Gilbert.*** **From the Université de Laval, Québec, Que.**

The CanMEDS role of professional is strongly influenced by the hidden curriculum, a set of processes, pressures and constraints that fall outside the formal curriculum and are often unarticulated or unexplored (Cribb, 1999). Role modelling is a method used to teach professionalism but lacks uniformity. Our objective was to determine the feasibility and potential benefits of teaching the professional competencies via discussion groups supervised by a mentor. From Laval University, 7 general surgery residents in postgraduate year 1 and an attending surgeon participated in our project. Discussions were held on a monthly basis for 3 consecutive months, and topics were inspired by the local hidden curriculum. The respective discussion topics were the importance of professionalism during residency, discordance between patients and surgeons regarding the operating decision, and criticism of other health care providers. The mentor supervised the discussions, ensuring a thorough reflexive process from the participants. A questionnaire was filled before and after the project by the residents. The mentor and residents separately assessed their global appreciation in independent discussion groups. The residents evaluated this project as engaging and a learning method likely to improve their professional behaviour. They recommended that the discussion groups be carried out for the entire duration of their residency. The mentor evaluated the discussions as stimulating and having a positive impact on the residents. We concluded that a discussion group of residents, supervised by a mentor, is potentially effective to teach the role of professional in a more uniform manner. A comparative study is currently underway and will attempt to determine the optimal format of this teaching method.

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Assessing the changing scope of training in Canadian general surgery programs: expected versus actual experience. ***S.A. Chadi, K. Leslie, M.C. Ott.*** **From the University of Western Ontario, London, Ont.**

In the recent era of work-hour restrictions (WHR), there has been increased focus on the appropriate assessment of surgical residents to ensure competence has been attained by the culmination of residency. With the increased complexity and number of general surgical procedures, it is hypothesized that WHR may have a potentially restrictive effect on the operative caseloads of general surgical residents. Bell and colleagues (*Ann Surg* 2009;249:719-24) demonstrated a decrease in the number of procedures US graduating general surgical residents are able to perform independently. As such, the objective of this study was to assess the changing scope of general surgical training.

In phase one, a survey was circulated to the Canadian Association of General Surgery Postgraduate Committee members (program directors) to obtain a consensus opinion on which general surgical procedures (A) graduating residents are expected to be comfortable performing independently as well as (B) procedures residents should be knowledgeable in but not necessarily comfortable performing. Common confounders (years of experience, specialty) will be adjusted for. In phase 2, a survey will be circulated to graduating surgical residents at their annual review course to assess their perspectives on the aforementioned procedures. Residents will recategorize procedures as either A or B and subsequently rate each procedure according to their level of comfort (from 1 to 5). Procedure ratings will be standardized according to resident experiences in various subspecialties.

Using the aforementioned methodology, we hope to demonstrate any difference that may exist in the expected and actual procedures residents are comfortable performing independently. Such differences would assist in addressing the changing scope of general surgery training in the recent era of increasing WHR. We are currently at the stage of survey distribution and expect results to be available by May 2012.

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Predicting need for surgical management for massive gastrointestinal hemorrhage. ***M. Alhabboubi, M. Sudarshan, S. Jessula, A. Alburakan, D. Deckelbaum, T. Razek, S. Iqbal, K. Khwaja.*** **From the Montréal General Hospital, Montréal, Que.**

Gastrointestinal bleeding presents a substantial challenge to surgeons when nonsurgical therapies fail to achieve hemorrhage control. Our study seeks to identify risk factors that predict failure of nonsurgical management, and that could guide and accelerate surgical decision-making for this patient population.

A retrospective review of all intensive care unit admissions for gastrointestinal bleeding was conducted, identifying 422 admissions between January 2008 and December 2010. Data collection included demographics, hypotension during the bleeding episode, lowest hemoglobin level, comorbidities, number of blood products given and APACHE III score. Interventions performed were also collected. End points were need for surgery and survival. Multivariate analysis was conducted to identify significant predictors ($p < 0.05$).

The mean age of patients was 67 years and 65.8% of them were male. Upper gastrointestinal bleeds constituted 81.2% of cases. Overall in-hospital mortality was 21%. Endoscopy was the

first intervention 84.3% of the time. As first intervention, 3.8% and 1.8% had angiography or surgery, respectively. The remaining 8.5% did not require any intervention. Of the patients who had endoscopy as a first intervention, 8.8% required angiography with or without embolization and 4.7% eventually required surgery. Univariate analysis is shown in the Table.

Table, abstract 49.

Variable	No surgery	Surgery	*p* value
Length of hospital stay, mean d	13	31	0.0190
Length of ICU stay, mean d	2	12.5	< 0.0001
Ventilation, no. (%)	106 (37)	13 (76)	0.0016
Systolic blood pressure < 90 mmHg, no. (%)	82 (25.5)	10 (55.6)	0.0110
PRBC transfused after first intervention	2	3.5	0.0840
Platelets transfused after the first intervention	0 (0–105)	0 (0–50)	0.0428
Rebleed, no (%)	162 (50)	16 (89)	0.0012

ICU = intensive care unit; PBRC = packed red blood cells.

Multivariate analysis identified high APACHE III score, hemoglobin level lower than 80, low platelets and hypotension during the bleeding episode as independent risk factors for mortality. Furthermore, use of invasive ventilation, high serum lactate and high APACHE III score were found to be predictive of eventual surgery.

Severe gastrointestinal bleeding presents a significant management challenge. We have identified independent risk factors that correlate with increased probability of surgery. These results can help guide surgical decision-making for this high-risk patient population.

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International health care experience: using CanMEDS to evaluate learning outcomes following a surgical mission in Mampong, Ghana. ***E. Partridge, C. Aikins.*** **From the University of Toronto, Toronto, Ont., and Cooper Health University, Camden, NJ**

Surgical residents participating in volunteer international health electives may face challenges in identifying and evaluating learning objectives. Residents pursuing clinical exposure in a low-income country anticipate a challenging and rewarding educational experience, and a conceptual framework for self-assessment of learning objectives provides an invaluable tool to maximize this learning experience.

International Healthcare Volunteers (IHCV) is a nonprofit organization founded in 2001 by Dr. James Aikins, and has led missions to Ghana on an annual basis over the past decade. The mandate of IHCV includes the provision of free medical and surgical care, as well as screening programs for colon and cervical cancers. Over the past 10 years, IHCV has completed a total of 10 missions to Ghana, with more than 9500 patients assessed and over 500 surgical procedures performed. In 2011, IHCV led a 20 day mission to 4 rural regions of Ghana.

We describe the experiences of a Canadian general surgery resident participating in a 20 day mission to Mampong, Ghana. In addition to the clinical experiences documented, the Canadian Medical Education Directives for Specialists (CanMEDS) framework was used to define and evaluate learning objectives, challenges and insights gained over the course of the mission.

A total of 47 volunteers participated in the 2011 mission to Ghana, including 4 attending general surgeons, 5 attending OB-GYNs and 4 teams comprised of residents, medical students and volunteer participants. A total of 850 patients was seen in clinic, and 93 surgeries were performed, including the first laparoscopic cholecystectomy performed in Ghana. No postoperative complications were reported. Reflection on the CanMEDS framework yielded insights into the challenges of health care implementation in a setting with limited diagnostic testing and record-keeping, considerable financial restraints at both a patient and institutional level, and communication barriers including primary language as well as cultural beliefs. Challenges specific to the roles of medical expert, resource manager and communicator were identified, whereas positive experiences in the roles of collaborator, health advocate, scholar and professional were explored.

Resident education in volunteer international surgical experiences may be hindered by a lack of structured learning objectives and evaluations. The CanMEDS framework provides a useful construct for self-directed evaluation of resident learning objectives in international health, and may be used to identify areas of focus for improvement in the delivery of health care in this setting.

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The open abdomen: risk factors for mortality and rates of closure. ***M. Alhabboubi, M. Sudarshan, D. Deckelbaum, S. Iqbal, K. Khwaja, T. Razek.*** **From the Montréal General Hospital, Montréal, Que.**

The open abdomen technique is becoming more common in trauma and acute care surgery. These patients pose a great challenge for surgeons, as they require the intensive care unit and have high rates of complications. Our aim is to identify possible predictors of mortality and failure of closure.

A retrospective chart review of 45 patients with open abdomens was performed at a level 1 trauma centre (Montréal General Hospital) from January 2010 to September 2011. Additionally, data from 13 patients collected prospectively from

Table, abstract 51.

Variable	Abdomen; mean (range)*		*p* value
	Closed, *n* = 26	Open, *n* = 32	
APACHE II score	25 (11–39)	32 (17–52)	0.0024
Trauma patients, no. (%)	15 (57.7)	22 (68.8)	NS
Pulse rate	100 (67–120)	117 (53–160)	0.0243
Enteral feed 10 d from open abdomen, no. (%)	15 (57)	25 (83)	0.0426
INR	1.3 (0.9–3.0)	1.8 (0.9–6.7)	0.0008
Lactate	3.8 (0.9–12)	5.8 (0.9–19)	0.0190
pH	7.3 (7.1–7.5)	7.2 (7.0–7.5)	0.0049
PRBC	3 (0–25)	7 (0–59)	NS
Fresh frozen plasma	2 (0–18)	4 (0–39)	0.0438
Cryotherapy	0 (0–40)	0 (0–40)	NS
Crude mortality, no. (%)	2 (8)	18 (58)	< 0.0001

INR = international normalized ratio; NS = not significant; PBRC = packed red blood cells.
*Unless otherwise indicated.

September 2011 to March 2012 were included. Variables collected included demographics, vital signs and laboratory values on the day of surgery, APACHE II and Injury Severity Scores, daily fluid balance, nutritional support and blood product management. Outcomes measured were failure of closure of the abdomen and mortality within the same admission. Multivariate analysis was conducted to identify significant predictors ($p < 0.05$).

Ventilator days, hemoglobin level and fluid balance on the day of surgery were significant predictors of mortality. Moreover, APACHE II score, international normalized ratio level and number of packed red blood cells transfused during surgery were significant predictors of mortality during the first 24 hours after surgery. The Table illustrates important comparisons between patients with closed abdomens versus those remaining open.

Our study identifies predictors of mortality in patients with open abdomens. Important differences between abdomens that are closed versus left open are illustrated and need to be studied further.

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How surgeons think: an exploration of mental practice in surgical preparation. ***M. Olszewski, N. Roberts, C.-A.Moulton, M.L. Murnaghan, T. Cil.*** **From the University of Toronto, Toronto, Ont., and the Southern Illinois University School of Medicine, Springfield, Ill.**

Mental practice is the process of systematically imagining objects and movements. Studied and used extensively in sports psychology, mental rehearsal and visual imagery in surgery are still in their infancy. The purpose of this study was to explore the ways in which surgeons use mental practice.

Semistructured interviews were conducted with 14 surgeons (11 general surgeons, 2 plastic surgeons, 1 orthopedic surgeon; 3 women, 11 men) at 3 academic hospitals who were purposively sampled for different experience levels and specialties. Questions focused on the advantages and disadvantages of mental practice, structure of imaging sessions and purpose of imagery. Data collection and analysis occurred in an iterative manner. Data were coded and analyzed using constructivist grounded theory methodology. A reflexive approach was adopted throughout.

All 14 surgeons used mental practice techniques. This included visualizing procedures from start to finish, mentally practicing only pivotal steps in an operation, and imagining the surrounding physical and social environment. Visualization was used at different time points, including before surgery to plan appropriate steps or to highlight overlooked ones, during surgery to reorient or to troubleshoot and after surgery to reflect on, correct or improve performance. Mental practice was also used outside the operating room to teach new surgical procedures and to interpret radiologic images. Novice surgeons were found to rely more on mental practice for routine procedures, whereas experienced surgeons used mental practice for complicated or new operations. A common reason for using mental practice was to alleviate anxiety.

This exploratory study suggests that mental practice is an integral component of preparation for surgery. Although surgeons are not formally taught mental practice techniques, the approach might have great potential for learning surgical skills and for improving how experienced surgeons become excellent ones.

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The surgery wiki: a novel method for delivery of undergraduate surgical education. ***R. Chan, J. Marshall, K. Pederson, S. Erichsen, J. White.*** **From the University of Alberta, Edmonton, Alta.**

A "wiki" is defined as a webpage whose content can be edited by users in real time using a web browser. Wiki technology has been employed in a number of educational settings. This paper explores wiki use in undergraduate surgical education.

Since 2009, we have employed wiki websites to deliver educational material to approximately 300 medical students per year enrolled in the year 3 (general surgery) and year 4 (specialty surgery) clerkships at the University of Alberta. The wikis contained essential information such as learning objectives, assessment protocols, hospital information and schedules, preceptor contacts and links to educational resources. Students were also given course credit for contributing learning resources to the wikis. Wiki use was tracked using Google Analytics, and an analysis of usage data is presented.

A high level of usage was noted: the year 3 wiki received 8679 visits and 45 710 page views in 20 months, while the year 4 wiki received 6945 visits and 31 787 page views in 18 months. Together, the wikis received an average of 43 visits and 210 page views per day. Students contributed a total of 170 learning resources to the wikis as described in the Table.

Table, abstract 53.

Wiki usage	Year 3	Year 4	Total
Learning objectives (study guide on a topic)	20	28	48
Practice examinations	2	3	5
Online video	5	5	10
Podcast	2	2	4
Guide to working at a particular hospital	7	0	7
Tips for students	15	1	16
Guide to working with a particular surgeon	4	1	5
Surgery rotation reflective experience	50	19	69
Total	110	60	170

Wikis are an acceptable and effective way of providing surgical education materials to students. Wiki technology has the potential to increase student engagement and allow students to contribute to learning.

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Understanding surgical residents' postoperative practices before implementing an enhanced recovery after surgery (ERAS) guideline at the University of Toronto. ***A. Nadler, M.-A. Aarts, A. Okrainec, J.C. Victor, E. Pearsall, R.S. McLeod.*** **From the University of Toronto, Toronto, Ont.**

An enhanced recovery after surgery (ERAS) clinical practice guideline (CPG) was developed at our institution. Prior to implementation, general surgery residents were surveyed to determine their views regarding current practices and to assess their concordance with CPG recommendations.

The survey, which consisted of questions related to the postoperative management of patients having open (OC) and laparoscopic colectomy (LAC) and open rectal resection, was distributed

to all residents. The χ^2 and Fisher exact tests were used to test differences.

Of 77 residents surveyed, 58 (75%) responded. Overall, 32.8% residents agreed with a planned discharge by postoperative day 3 (POD3) following OC, 75.9% by POD3 following LAC and 36.8% by POD4 following rectal resection. A fluid diet would be ordered on POD0 and regular diet on POD1 by 50.0% and 25.9%, respectively, following OC, and 67.9% and 49.1%, respectively, following LAC. Significantly more senior versus junior residents would order fluids on POD0 following OC (71.4% v. 37.1%, $p = 0.013$) and LAC (58.3% v. 25%, $p = 0.017$). On POD0, 48.8% and 54.0% of residents expected patients to dangle at the side of the bed following OC and LAC, and on POD1, 67.9% expected patients to ambulate following OC compared with 89.3% following LAC. Urinary catheters would be removed on POD1 following OC by 81.3%, following LAC by 87%, and by POD3 following rectal resection by 89.3%. However, in patients with an epidural, approximately 50% of residents would wait until it was removed before catheter removal. Overall, 76.4% of residents agreed that an ERAS guideline should be adopted.

More residents were compliant with the CPG recommendations for patients who had LAC, with lower compliance following OC and rectal resection. Senior residents were more likely than junior residents to agree with CPG recommendations. Although most residents are in agreement with the implementation of an ERAS CPG, strategies aimed at increasing resident compliance with the recommendations are required.

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From laparoscopic transabdominal to posterior retroperitoneal adrenalectomy: a paradigm shift in operative approach. ***U. Hameed, T.D. Jackson, A. Okrainec, T.P. Penner, D.R. Urbach.*** **From the University of Toronto and the University Health Network, Toronto, Ont.**

Posterior retroperitoneoscopic adrenalectomy (RA) is an appealing alternative to the laparoscopic transperitoneal adrenalectomy (TA). However, it has yet to gain popularity in North America. Here we compare the 2 approaches by reviewing 1 surgeon's shift in practice from the transperitoneal to the retroperitoneal approach.

All laparoscopic adrenalectomies performed at a single centre by a single surgeon from 2003 to 2011 were reviewed. Demographic and postoperative variables were analyzed and compared. A total of 100 unilateral adrenalectomies and 14 bilateral adrenalectomies were performed during the study period. From 2003 to March 2010, 80 unilateral (56 left-sided) and 14 bilateral TAs were performed. After April 2010, 20 unilateral (11 left-sided) and 9 bilateral RAs were performed.

Length of stay, blood loss and operative time were all lower for the unilateral RA. There was a statistically significant decrease in length of stay (2.8 v. 4.9 d, $p = 0.01$) and operative time (60 min shorter, $p = 0.05$) for the RA group when undergoing bilateral adrenalectomy. There were 3 conversions to open for the TA group (2 for bleeding and 1 for adhesions) and 0 for the RA group. There was also a higher rate of inadvertent visceral injury with the TA approach (5% v. 0%). The rate of major perioperative complications was 14% for the TA group and 0% for the RA group.

Retroperitoneoscopic adrenalectomy is an excellent alternative to transperitoneal adrenalectomy for well selected patients and may result in a decreased length of stay, operative time, blood loss, rate of conversion and complications.

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A retrospective audit of outcomes in patients over the age of 80 undergoing acute care abdominal surgery. ***H. Brotherhood, A. Karimuddin, C. Hall, S. Bawan, S. Malik, A. Hayashi.*** **From the Department of Surgery and the Faculty of Medicine, University of British Columbia, Victoria, BC**

This retrospective study in 2 tertiary care hospitals aimed to evaluate postoperative mortality, morbidity and functional status in elderly patients (> 80 yr) undergoing emergent general surgery procedures. Records of all patients aged 80 years and over who were admitted from the emergency department and underwent urgent/emergent surgery ($n = 140$) were examined.

The aim was to ascertain which factors predict increased odds of mortality and/or major morbidity and to assess final functional status in elderly patients.

The patients' median age was 85 (range 80–101) years, and the male to female distribution was 40.3% to 59.3%, respectively. Regarding surgery, 44 patients (31.4%) underwent general abdominal surgery (appendectomy, cholecystectomy, hernia repair), 55 (39.3%) had surgery for ischemic gut and 41 (29.3%) required cancer surgery. Median length of stay was 18 (IQR 2–145) days. Admission to the intensive care unit was required for 3 patients; the longest stay was 1 day. A geriatrics referral was required for 37 patients (33.3%, 95% CI 24.7–42.9). In all, 18 patients (16.2% 95% CI 9.9–24.4) had a functional status decrease, needing a higher level of care at discharge. Perioperative mortality was 2.7% (95% CI 0.6–7.7); there were 17 deaths overall at 2 years (15.3%, 95% CO 9.2–23.4). Presence of multiple preoperative comorbidities was the only predictor of death/major complication, with an odds ratio for death/major morbidity of 8.1 (95% CI 2.5–25.8, $p < 0.0001$). Age, sex, ASA class, presence of gastrointestinal perforation, length of time in the operating room, type of surgery and surgical Apgar were not predictive of death/major morbidity in our cohort.

Acute care surgery in the elderly has an impact on mortality, morbidity and functional status but can be undertaken in patients over the age of 80 with acceptable outcomes. Preoperative comorbidities were the only factor that influenced death/major morbidity in our patients. Further study is underway to determine whether a surgical Apgar score can predict major complications or death in this population.

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Canadian general surgery residents' perspectives on work-hour regulations. ***A.S. Menezes, R.S. Gill, C. McAlister, N. Zhang, Emilie DesRosiers, A. Mills, M. Crozier, L. Lee, J. Maxwell, E. Partridge, S. Chad, S. Steigerwald, D. Mapiour, D. Roberts, C. MacPherson, L. Donahoe.*** **From the University of Ottawa, Ottawa, Ont., the University of Alberta, Edmonton, Alta., the University of Toronto, Toronto, Ont., McMaster University, Hamilton, Ont., the Université Laval, Québec, Qué., the Northern Ontario School of Medicine, Sudbury, Ont., the Memorial University of Newfoundland, St. John's, Nfld., McGill University, Montréal, Que., Queen's University, Kingston, Ont., the**

University of Western Ontario, London, Ont., the University of Manitoba, Winnipeg, Man., the University of Saskatchewan, Saskatoon, Sask., the University of Calgary, Calgary, Alta., the University of British Columbia, Vancouver, BC, and Dalhousie University, Halifax, NS

Work-hour regulations have been implemented in all residency programs in Canada since 2009. Work-hour restrictions have significant effects on surgical specialties; however, minimal evidence is available to ascertain the viewpoints of general surgery residents. The Canadian Association of General Surgeons Residents Committee as a representative organization has focused on clarifying the opinions of these key stakeholders. Our objective was to assess the perspectives of Canadian general surgery residents on current work-hour regulations and their impact on surgical residency training.

An anonymous 13-item online survey was circulated to all general surgery residency programs in Canada in 2011. Simple counts and means were then calculated.

A response rate of 46% was obtained, with 263 of 578 general surgery residents completing the survey. The majority of residents (90%) reported that quality of life might be improved with work-hour regulations, and would provide additional opportunity for academic activities (80%). However, 58% of resident respondents stated that an increased length of residency might be required in compensation. Respondents held mixed views regarding further work-hour regulations: 35% believed further restrictions would be detrimental to surgical training, 28% beneficial and 32% were unsure. In terms of patient care, 64% stated there might be fewer medical errors as a result and 57% thought that the quality of patient care might improve. Overall, 57% of respondents supported some degree of work-hour regulation.

Canadian general surgery residents perceive that work-hour regulations may improve patient care and safety, and promote their quality of life. However, there remains a strong undercurrent of concern regarding the impact of future work-hour restrictions on both duration and quality of surgical training.

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Timing of surgical intervention and its outcomes in acute appendicitis. ***B. MacDonald, D. Mercer, W. Hopman.*** **From Queen's University and the Kingston General Hospital, Kingston, Ont.**

Appendicitis is a common surgical presentation, and the priority of surgical intervention has been debated. A retrospective review was organized to determine factors to triage patients into emergent or urgent surgery for appendicitis.

All appendectomies at a single academic hospital were included over 14 months. The patients were grouped by time interval from presentation to surgical intervention. The main outcomes were perforation rates (PR), hospital length of stay (LOS) and wound complication rates (WCR). Multistep logistic regression analysis was performed to determine findings on presentation that predicted perforation.

The analysis included 234 patients with overall PR of 24.4%. There was no statistical difference in PR for a time interval to surgery up to 24 hours ($p = 0.73$). Length of stay ($p < 0.001$) and WCR ($p < 0.001$) were significantly increased with perforation. In the regression analysis, 6 features were identified with increased risk of perforation. They included age greater than 50 years, history of anorexia, tachycardia on presentation, documented fever, peritonitis on exam and radiologic evidence of perforation.

A separate analysis revealed 59 of 234 patients had 3 or more of these findings on presentation and were retrospectively considered high risk. Compared with the normal risk group, these patients had increased LOS ($p < 0.001$), increased WCR ($p = 0.005$) and increased operation time ($p = 0.005$). Of 12 patients whose surgery was delayed 16 hours, 10 had perforations, but this was not statistically significant.

Surprisingly, an increased time interval to surgery was not a significant independent predictor of perforation. However, a clinical model to predict patients at high risk for perforation indicated a trend toward increased perforation with time intervals greater than 16 hours to surgery. This model shows these patients have more wound complications and longer hospitals stays, and we conclude that their operations should be performed emergently rather than at a convenient time.

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Preparing surgical trainees to deal with adverse events. An outline of learning issues. ***G. Rakovich, J.-F. Latulippe.*** **From the Divisions of Thoracic Surgery and General Surgery, Hôpital Maisonneuve-Rosemont, University of Montréal, Montréal, Que.**

Adverse events are a part of life in surgical practice. During surgical residency, emphasis is placed on the medical aspects of managing these complications. Emotional and psychological effects on the surgeon and trainees are rarely discussed.

Our goals were to assess current attitudes of surgical trainees toward the emotional and psychological impact of surgical complications on the surgeon and to identify ways of approaching this subject during residency training.

General surgery residents were invited to answer a 20-item questionnaire conceptually divided into 5 categories: emotional aspects, legal aspects, intraoperative crisis management, disclosure and coping strategies. Items on the questionnaire were rated on a 4-point Likert scale (1 = strongly disagree, 4 = strongly agree).

Out of 18 trainees, 17 (94%) answered the questionnaire. Respondents overwhelmingly agreed that surgical complications have a significant emotional and psychological impact on the surgeon (mean score 3.65 ± 0.49). Most respondents also felt that the ability to deal with complications increases predictably with experience and years in practice (mean score 2.82 ± 0.529). Intraoperative crisis situations emerged as a particularly significant source of stress. All respondents (13 of 13, 100%) felt that the priority in dealing with such situations was organizing an efficient team around a team leader, although many (7 of 16, 44%) were unaware that no established protocols exist. Theoretical training and simulation were considered essential in preparing to deal with intraoperative crisis situations. The majority (10 of 16, 63%) of respondents felt that group discussions were the best way to approach the subject of stress related to surgical complications during training.

Trainees consider emotional and psychological effects of complications on the surgeon as an important part of surgical practice. Intraoperative crisis emerge as a particularly significant source of stress. Simulation and group discussion are potentially effective ways of addressing this issue during training.

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Acute care surgical service: surgeon agreement at the time of handover. ***R. Hilsden, S. Knowles, B. Moffat, N. Parry, K. Leslie.*** **From the University of Western Ontario, London, Ont.**

Acute care surgical teams are dedicated teams responsible for emergent surgical patients who require regular handover and coordination between different surgeons. Minimal research has been conducted to determine the rate of clinical agreement during patient handover.

This prospective cohort study was carried out with our acute care surgical service at a tertiary care teaching hospital. Participating attending surgeons were given a second copy of the handover patient list each morning where, in a concealed manner, they indicated whether they agreed or disagreed with the patient management plan. Aspects of care over which they disagreed were also described. Disagreements were classified as major if they involved a change in diagnosis, time to the operating room, operative procedure or patient disposition. All others were classified as minor. Rate of disagreement was then calculated.

We contacted 6 staff surgeons to participate in this research, and 6 agreed to participate. The study was conducted from January 2012 to March 2012. A total of 417 unique patients were handed over, giving an average of 7.4 patients handed over daily. For the primary outcome, a total of 41 disagreements were recorded, for a disagreement rate of 9.8%. Of the 41 disagreements, 15 were classified as major, for a major disagreement rate of 3.4%. Among the major disagreements, 3 involved a delay to the operating room, 4 represented a disagreement in diagnosis, 3 represented disagreements over operative decision-making, and 5 represented a disagreement over disposition decisions. The level at which the disagreement occurred could be determined for 27 of 41 disagreements. Consultant to consultant disagreements were classified as major disagreements 62.5% of the time, and consultant to resident disagreements were major 21% of the time ($p = 0.112$). Patients among whom there was clinical disagreement were on average older (63 v. 57 yr, $p < 0.05$).

Despite frequent handovers, little research has been completed to determine the rate of disagreement over patient management among surgeons participating in acute care surgery. This study demonstrated that the rate of clinical disagreement is low among surgeons who work closely together in a teaching hospital environment.

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Predicting discharge of elderly patients to prehospitalization residence following emergency general surgery. ***S. Merani, N. Switzer, R.G. Khadaroo, Y. Tul, S. Widder.*** **From the University of Alberta, Edmonton, Alta.**

By 2025, 20% of the Canadian population is expected to be older than 65 years. Elderly patients represent a spectrum of independence and medical comorbidity. Frailty among the elderly has been associated with poor outcomes in elective surgery; however, the outcomes of these patients admitted for emergency surgery remains to be clearly described.

Our aim was to describe the characteristics of elderly patients admitted for emergency general surgery and to identify which patient demographic and clinical factors are associated with the ability of the patient to return to their prehospitalization residence.

A retrospective cohort study of all patients aged 80 years and older admitted for emergency general surgery at a single centre over the course of 3 years was completed. Demographic, physiologic, biochemical and surgical data were collected. Univariate and logistic regression analysis identified factors associated with discharge to prehospitalization residence.

A consecutive 184 admissions were investigated (2008–2010). Average age at admission was 84 years, and 52% were female. The most frequent diagnoses were bowel obstruction (16%), bleeding/perforated viscus (16%) or incarcerated/strangulated hernia (14%). Many patients were discharged to prehospital residence (54.6%). Factors negatively associated with an ability to return included comorbid cardiac (RR 0.63) or respiratory (RR 0.56) disease, administration of oxygen therapy at admission (RR 0.69) and intensive care unit admission (RR 0.35; all $p < 0.05$). Patients returning to prehospital residence had lower ASA score, were on fewer medications, were younger and had higher systolic blood pressure at admission (all $p < 0.05$).

Factors identified in this investigation could form a score predictive of the likelihood of residential relocation following admission for emergency surgery. This would be useful to patients, their families, health care providers and administrators to manage the care requirements of elderly patients.

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Morbidity and mortality after emergency abdominal surgery in octo- and nonagenarians. ***P. Davis, M. Molinari, A. Levy, P. Johnson.*** **From the Division of General Surgery, Dalhousie University, Halifax, NS**

By 2050, the population over 80 years old will triple. As adults age, they are more likely to require emergency surgery. However, little is known about the outcomes associated with such procedures in octo- and nonagenarians. The purpose of this research was to describe the morbidity and mortality associated with emergency abdominal surgery in patients 80 years of age and older.

Consecutive patients 80 years of age and older who were admitted to an acute care general surgery service at a tertiary care hospital were prospectively enrolled from July 1, 2011, to Jan. 1, 2012. Patients with conditions not related to the abdomen or abdominal wall were excluded. Data were collected regarding demographics, treatments and outcomes. Follow-up interviews were conducted by telephone 3 months after discharge to determine patient status. Complications were categorized using the Pierre Clavien classification.

Among the 69 patients 80 years old and older who were admitted during the study period, 32 (65% female; median age 83, range 80–92 yr) underwent surgery, including right hemicolectomy (16%), hernia repair (9%), hernia repair with bowel resection (9%), lysis of adhesions (9%) and other (43%). The median postoperative length of stay was 10 days. At 3 months after discharge, the postoperative complication rate was 84% (Pierre Clavien I or II 81%, III or IV 19%). The most common complications were wound infection (9%), delirium (7%), urinary tract infection (7%) and urinary retention (7%). The in-hospital postoperative mortality rate was 20%, and after 3 months of follow-up it was 26%. The most common cause of in-hospital mortality was sepsis.

Emergency abdominal surgery in patients over 80 years of age is associated with high morbidity and mortality. These findings highlight the need for further research to identify factors associated with poor outcomes in these patients.

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The impact of acute abdominal illness and urgent admission to hospital on the living situation of elderly patients. ***P.J.B. Davis, J. Bailey, M. Molinari, J. Hayden, P. Johnson.*** **From the Department of Surgery, Division of General Surgery and the Department of Community Health and Epidemiology, Dalhousie University, Halifax, NS**

Acute illness and urgent admission to hospital may negatively impact the functional status of elderly patients, preventing them from returning to their usual living situation. The purpose of this research was to determine the impact of acute abdominal disease on the living situation of elderly patients.

Patients 70 years old and older admitted to an acute care general surgery service at a tertiary care centre between July 1, 2011, and Oct. 15, 2011, were prospectively enrolled. Data were collected regarding demographics, living situation, treatments, outcomes and discharge disposition.

Of the 100 patients (47% male; median age 77, range 70–93 yr) enrolled in the study, 23% had a bowel obstruction, 21% had gallstone disease, 11% had diverticulitis and 11% had a gastrointestinal bleed; 50 patients were treated nonsurgically. At admission, 12 patients (24%) were living alone and 70% returned home alone, 10% went to live with others and 20% were transferred to a rehabilitation or home hospital. Of the 34 nonsurgically treated patients (68%) who were living with others at admission, 91% returned to living with others, 6% were transferred to rehabilitation and 3% died. Of patients were admitted from a nursing home, 8% returned to their facility. Of the 50 patients who had surgery, 10 (20%) were living alone at admission, and at discharge 25% returned home, 38% went to live with others, 25% were transferred to another hospital and 12% went to a nursing home. Of the 35 (70%) surgical patients who were living with others at admission, 72% returned to living with others, 18% were transferred to a rehabilitation or home hospital and 10% died. Only 5 (10%) of the surgical patients were admitted from a nursing home, and all were discharged back to their facility.

Acute abdominal illness and urgent admission to hospital result in a change in living situation for many elderly patients, particularly those who require surgery. This has implications for patient counselling, discharge planning and resource allocation.

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A comparison of laparoscopic versus open subtotal gastrectomy for antral gastric adenocarcinoma: a North American perspective. ***J. Cools-Lartigue, S. Benlolo, V. Marcus, L. Ferri.*** **From the Departments of Surgery and Pathology, McGill University Health Centre and the Steinberg-Bernstein Centre for Minimally Invasive Surgery, Montréal, Que.**

Laparoscopic gastrectomy (LG) is being employed with increasing frequency in the management of gastric cancer. However, the short-term benefit and oncologic adequacy of this approach remains incompletely characterized, precluding its routine employment in many institutions. Accordingly, we sought to evaluate the results of LG in patients with distal gastric adenocarcinoma compared with those undergoing open surgery.

All patients undergoing gastrectomy from 2005 to 2011 at a North American university hospital were identified from a prospectively collected database. In an attempt to limit confounding factors, we elected to study only patients undergoing resection of distal gastric adenocarcinoma. Patients undergoing subtotal gastrectomy for antral adenocarcinoma were divided into 2 groups, depending on the surgical approach (laparoscopic v. open gastrectomy). Laparoscopic and open gastrectomy were compared in terms of patient demographics, histologic tumour type, tumour size, adequacy of oncologic resection (lymphadenectomy and R0 resection), AJCC stage, incidence and severity of postoperative complications and hospital length of stay. Postoperative complications were classified according to the scale proposed by Clavien (0 = none, 1–2 = minor, 3–5 = major). Data are presented as median (and range). Mann–Whitney *U* and Fischer exact tests were used to determine significance (*$p < 0.05$).

In all, 107 patients underwent gastrectomy over the study period, of whom 37 underwent subtotal gastrectomies for antral adenocarcinoma (LG 17, open 20). Patient age (LG 75 [52–86] yr v. OG 76 [49–87] yr) and sex (LG 12 of 17 male v. OG 11 of 20 male) did not differ between the 2 groups. Tumour size was similar (LG 4 [1–6.5] cm v. OG 4 [1.5–10] cm), but there were more stage I cancers in the LG group (11 of 17 v. 3 of 20).* No difference was observed in those who achieved R0 resection (LG 15 of 17 [88%] v. OG 18 of 20 [90%]). There was no difference in lymph node retrieval (LN 26 [12–84] v. OG 27 [12–89]) between the 2 groups, but more OG patients received a formal D2 dissection (LG 10 of 17 [59%] v. OG 16 of 20 [80%], not significant). Patients in the OG group were more likely to harbour positive lymph nodes and in greater numbers than patients in the LG group (LG 0 (0–19) v. OG 2 [0–14]).* There was a trend for decreased rate and severity of complications (none/minor/major) in patients undergoing laparoscopic resection (LG 10/5/2 v. OG 8/7/5). This translated into more LG patients discharged by postoperative day 5 than OG (6 of 17 [35%] v. 0 of 20).*

In selected patients, laparoscopic gastrectomy is associated with improved short-term outcomes and provides an appropriate oncologic resection compared with the open approach. Additional prospective randomized studies are required to further define the role of laparoscopy in the resection of gastric cancer.

65

Minimally invasive excision of ectopic mediastinal parathyroid adenomas. ***J. Ojah, R. Finley, D. Anderson.*** **From the Departments of General Surgery and Otolaryngology, and the Division of Thoracic Surgery, University of British Columbia, Vancouver, BC**

The management of parathyroid adenomas has changed with improved preoperative localization with nuclear scintigriphy and video-assisted thoracoscopic surgery (VATS).

From November 2001 to March 2012, 11 patients (7 female, 4 male; mean age 54, range 41–70 yr) with primary hyperparathyroidism underwent removal of mediastinal parathyroid adenomas. Mean (and standard deviations) were calculated for numeric

outcomes, and a 2-tailed paired *t* test ($p < 0.05$) was used to compare pre- and postoperative ionized calcium (iCa) and parathyroid hormone (PTH) serum concentrations.

Previous neck explorations for parathyroidectomy were performed in 3 of 11 patients. Nuclear scintigriphy positively localized the masses in 8 of 11, and computed tomography in 10 of 11 patients. In total, 4 right VATS, 6 left VATS and 1 cervical video mediastinoscopy were done; 3 patients required simultaneous cervical incisions for dissection of the adenomas. Operative time was 70.3 (20) minutes. No patients required conversion to sternotomy. Complications included pneumothorax (1), pleural effusion (1) and hoarseness (1). Mean length of stay in hospital was 2 (1) days. Comparative testing revealed statistically and clinically significant decreases to normal levels in parathyroid and ionized venous calcium concentrations at a mean follow-up of 27.5 (18) days postoperatively (pre-iCa 2.65 [0.58] mmol/L v. post-iCa 1.88 [0.49] mmol/L, $p = 0.004$, and pre-PTH 32.72 [36.42] pmol/L v. post-PTH 5.58 [2.18] pmol/L, $p = 0.029$).

Minimally invasive removal of mediastinal parathyroid adenomas is a clinically effective and safe procedure with low attendant morbidity, once accurate preoperative localization is obtained.

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Perioperative outcomes of laparoscopic hernia repair in a tertiary care centre: a single institution's experience. ***F. Julien, J.-P. Gagné.* From the Centre de chirurgie minimalement invasive de Québec, Québec, Que.**

This study evaluates the perioperative outcomes of laparoscopic ventral hernia repair (LVHR) done by 1 surgeon in a tertiary care centre over a 6 year period.

This is a retrospective study of 99 consecutive cases of LVHRs performed between August 2005 and July 2011. Data included patient demographics, BMI, ASA classification, hernia size, operative time, length of stay, conversion and complication rates.

Of the 99 patients, 46 were men. Median age at surgery was 65 (28–88) years, and median BMI was 30 (22–46) kg/m^2. Most patients (69) were classified as having moderate surgical risk according to ASA classification. Median hernia size was 120 (9–560) cm^2, and our median operative time was 150 (30–720) minutes. The conversion rate was 8%. All conversions were due to adhesions. Median hospital stay was 4 days. In the subgroup of 8 patients converted to laparotomy, the median operative time was 260 (180–720) minutes, with a median hospital stay of 6 days. Morbidity rate was 12% occurring postoperatively and 2% occurring intraoperatively. There was no early postoperative infection and no 30 day mortality. There was 1 enterotomy recognized 1 week postoperatively, resulting in peritonitis, stoma creation and a prolonged hospital stay.

Laparoscopic ventral hernia repair can be considered as a safe procedure that provides excellent immediate results and short hospital stay; the infection rate in this study is much lower than most reported series of open approach. However, the most feared complication is a missed enterotomy; thus, a low conversion threshold might be the best way to avoid such catastrophic events.

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Evaluation of a student-run, practical and didactic curriculum for preclerkship medical students. ***D. Carter, S. Chan, S. Wong, J. Li, A. Michael, D. Choi, E. Liu, J. Hoogenes, D. Dath.* From McMaster University, Hamilton, Ont.**

Preclerkship exposure to surgical skills and topics enhances confidence during surgical rotations and can inspire students to choose a surgical career. At McMaster University, clerks designed and delivered an optional surgical skills laboratory and lecture curriculum for preclerkship students. We sought to gain a comprehensive understanding of the efficacy of these initiatives and to explore reasons why students choose whether or not to attend.

We used rigorous qualitative methodology to explore our findings. We conducted 4 focus groups of 5–6 students each, irrespective of their career interest (2 groups consisting of students who chose not to attend), to elucidate student attitudes and thoughts about choosing the curriculum and its effectiveness. Transcripts were thematically analyzed and coded. Member checking, data and investigator triangulation were used to ensure validity.

Students in all focus groups expressed a desire for early exposure to surgery and for learning in a structured environment. They appreciated the applicability of surgical skills to other specialties. Participants found these highly effective student-run events comparable to other faculty-run events. Students were dissatisfied with the limited enrolment allowed, and with the lack of resources to practise learned skills following these sessions.

Such student-run initiatives in an undergraduate curriculum satisfied students' need for early surgical exposure and increased their perceived proficiency with surgical principles and skills. Additionally, all students demonstrated a desire for universal access to preclerkship surgical skills training. This study shows that these initiatives addressed student learning goals and provides evidence for increasing preclerkship surgical education.

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Joseph Lister: Father of Modern Surgery. ***D. Pitt, J.-M. Aubin.* From the Division of General Surgery, The Ottawa Hospital, Ottawa, Ont.**

On the centenary of Joseph Lister's death, it is appropriate to remember and honour his remarkable accomplishments that earned him the title "Father of Modern Surgery."

Lister's inquisitive mind was inspired by his father's own research. James Syme then contributed to Lister's interest in surgery. Lister's series of mentors continued with Sir J.E. Erichsen, under whom Lister worked as a wound dresser. This role focused Lister's interest on wound healing. It was Lister's genius to take Pasteur's work on the etiology of fermentation and envision this process as the same that was causing infection and gangrene in patients' wounds.

Having heard of creosote being used to disinfect sewage, he applied carbolic acid compounds as an antiseptic on surgical wounds. He began his antiseptic method with compound fracture wounds because the standard treatment of amputation was always available should his method fail. Within months, his wards became free of gangrene, and his patients survived.

Lister changed the treatment of compound fractures from amputation to limb preservation and opened the way for abdominal and other intracavity surgery.

Although asepsis and sterile technique have replaced antisepsis as the primary principle in combating infection, it was Lister's application of germ theory to the care of surgical patients that

laid the foundation for what surgeons do now. Joseph Lister remains an inspiration for surgeons today.

69

Comparisons of melanoma sentinel lymph node biopsy prediction nomograms in a cohort of Canadian patients. ***B.A. Banks, D. Mew, Y. McConnell.*** **From the University of Calgary, Calgary, Alta.**

Two prediction tools are commonly applied to sentinel lymph node biopsy (SLNBx) in patients with melanoma: the CancerMath.net (CM) Melanoma Nodal Status Calculator and the Memorial Sloan-Kettering Cancer Center (MSKCC) Melanoma Nomogram for Sentinel Node Metastases. These tools employ characteristics such as age, location and depth of tumour invasion to predict the likelihood of a positive result on SLNBx preoperatively.

The aim of this study is to demonstrate and describe the difference in the predicted likelihood of a positive sentinel lymph node between the 2 tools for a cohort of patients treated at a Canadian cancer centre.

A retrospective chart review was undertaken of cases performed by a single surgical oncologist in 2011 using the Cancer Surgery Alberta/WebSMR database. For each case, the predicted risk of a positive SLNBx was calculated in accordance with the CM and MSKCC nomograms.

The mean predicted probability of a positive SLNBx result was found to be 5.3% ($p = 0.038$) higher when applying the CM nomogram versus the MSKCC version. Subgroup analysis involving 9 of 27 patients (33.3%) who were found to have positive sentinel lymph node biopsies on pathologic examination revealed a mean predicted probability of a positive biopsy of 28.4% and 23.6% for CM and MSKCC, respectively.

Overall, we were able to demonstrate a consistent and statistically significant difference between 2 commonly used melanoma nomograms. Future directions include expanding analysis to additional patient groups and determining which nomogram is most accurate in our patient population.

70

Local experience with myocutaneous flaps after extensive pelvic surgery. ***A. Rudovics, D. Classen, S. Kanthan.*** **From the University of Saskatchewan, Saskatoon, Sask.**

Neoadjuvant radiotherapy for perineal malignancies leaves the surgeon with the problem of a complex wound closed under tension in an irradiated bed. Complication rates and impaired healing rates are high in such wounds. One of the strategies to deal with this problem is to bring in a flap of tissue to provide the wound with well vascularised, nonirradiated tissue. This is a review of a local experience with myocutaneous flaps after extensive pelvic surgery. A retrospective review of patients who underwent extensive perineal resections with flap reconstruction from November 2000 to February 2009 at the local institution was conducted. Outcome measures included demographics, comorbidities, wound complications, morbidity and mortality. In all, 16 patients with a mean age 58.6 years underwent 17 perineal resections with flap reconstruction; 2 of the patients underwent resection for benign disease and 14 for malignancy. All the malignancies were locally advanced T4 tumours. The malignancies included anorectal melanoma, vulva melanoma, anal squamous cell carcinoma, vulva squamous cell carcinoma, anal adenocarcinoma and rectal adenocarcinoma. The types of flaps used were vertical rectus abdominis ($n = 10$, 58.8%), gracilis ($n = 3$, 17.6%), gluteal ($n = 3$, 17.6%) and a combination of gracilis and gluteal flaps ($n = 1$, 5.8%). The overall rate of perineal morbidity was 47.1%. The major perineal wound complication rate requiring reoperation was 23.5%. The donor site morbidity rate was 23.5%. There were no cases of complete flap loss. There was no in-hospital or 30 day mortality. Myocutaneous flaps provide a reasonable solution to dealing with complex perineal wounds. Complication rates at this institution are comparable to others in literature.

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The treatment of noncirrhotic splanchnic vein thrombosis: Is anticoagulation enough? ***P. Ravichandran, K.P. Croome, M.J. Kovacs, A. Lazo-Langner, R. Hernandez-Alejandro.*** **From the University of Western Ontario and the London Health Sciences Centre, London, Ont.**

Spontaneous splanchnic vein thrombosis (SVT) — namely, thrombosis of the portal, splenic, or mesenteric veins — is a rare occurrence. Treatment with anticoagulant therapy (ACT) has consistently led to high recanalization rates, decreased recurrence and improved survival, but it is not always sufficient to manage SVT complications. We aimed to identify risk factors predicting a need for further interventions beyond ACT.

We reviewed all cases of first-episode noncirrhotic SVT referred to hematology and hepatobiliary surgery at our institution from 2008 to 2011.

Of the 23 patients studied (mean age 52 ± 13 yr, 10 female), 9 had multivessel SVT and 14 had isolated thrombosis of the portal ($n = 8$) or superior mesenteric veins ($n = 6$). Indefinite ACT was indicated in those with systemic thrombophilias, including Factor V Leiden, $JAK2^{V617F}$ tyrosine kinase mutation and prothrombin gene variant. Short-course ACT was indicated in those with local/transient etiologies for SVT, such as recent abdominal surgery or malignancy. Anticoagulant therapy alone achieved resolution of SVT symptoms in 70% of patients (resolved group); the remaining 30% experienced a recurrence or progression of symptoms requiring additional treatment, such as variceal band ligation, splenectomy, liver transplant or bowel resection (unresolved group). Patients in the unresolved group were more likely to have thrombophilias ($p < 0.03$), completely occluded vessels ($p < 0.03$) and signs of portal hypertension at presentation ($p < 0.004$). The presence of at least 2 of these features predicted the need for further intervention with a sensitivity of 100% (95% CI 0.46–1) and a specificity of 83% (95% CI 0.50–0.97).

Anticoagulant therapy is a safe and effective first-line treatment for the majority of patients with SVT. The presence of thrombophilias, occlusive thrombi or portal hypertensive pathology at presentation can help to identify patients who are at risk of developing complications and are likely to require further interventions beyond ACT.

72

Implementation of an acute care surgery service does not affect wait-times for elective cancer surgeries: an institutional experience. ***R. Anantha, K. Vogt, S. Crawford,***

N. Parry, K. Leslie. **From the London Health Sciences Centre, London, Ont.**

Acute care surgical services are emerging in many centres to provide comprehensive emergency general surgical care while optimizing the use of limited resources. At our institution, 50% of operating time allocated for dedicated daily Acute Care Emergency Surgery Service (ACCESS) operating room time came from elective general surgery operating room time. This study assessed whether this strategy of resource allocation had an adverse impact on wait-times for elective cancer surgeries.

This single-centre retrospective case–control study compared adult patients identified from a tertiary-care hospital operative database who underwent elective cancer surgeries between Sept. 1, 2009, and June 30, 2010 (pre-ACCESS), to those between Sept. 1, 2010, and June 30, 2011 (post-ACCESS). Wait-times were calculated as the time between booking and surgery dates for cases. The priority level, a measure of a case's urgency as determined by the surgeon, was also compared pre- and post-ACCESS. Frequencies were compared using the χ^2 test.

A total of 732 cases were identified (367 pre-ACCESS and 365 post-ACCESS). The number of cases remained similar, but there was a 25% decline in breast cancer cases post-ACCESS (22% v. 28%, $p = 0.02$, $\chi^2 = 18$), a 27% rise in colorectal cancer cases (41% v. 32%, $p = 0.02$, $\chi^2 = 18$) and a 125% rise in hepato-pancreaticobiliary cancer cases (5% v. 2%, $p = 0.02$, $\chi^2 = 18$). There was no difference in average wait-times pre- and post-ACCESS (25 v. 23 d), regardless of the priority level ($p = 0.8$, $\chi^2 = 0.43$).

The implementation of ACCESS has not adversely impacted wait-times for elective cancer surgeries, suggesting that despite a significant shift of operating resources toward emergency general surgery, timely access to surgical care for patients with cancer is not compromised.

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Use of human collagen mesh for closure of a large abdominal wall defect, after colon cancer surgery, a case report. *I. Aad.* From the Centre de santé et de services sociaux de Rouyn-Noranda, Rouyn-Noranda, Que.

Large abdominal wall defects still constitute a challenge to closing any laparotomy, especially when combined with poor skin conditions.

We report the case of a morbidly obese woman with a very large abdominal wall defect owing to previous surgeries and synthetic mesh insertion followed by mesh removal for infection. No muscular structures were left in the abdominal wall, and the intestines were merely covered by a thin skin layer with scattered ulcerations. The patient received a diagnosis of right colon cancer, and surgery was challenged by the substantial lack of muscular tissue for closure. Two large sized human collagen meshes were used for closure with skin coverage above the collagen sheet.

The patient recovered well, and no major complications were noted.

Collagen grafts constitute a reasonable and life-saving solution in extreme cases of large abdominal wall defects, when surgery is mandatory, and the medium is contaminated.

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The role of miR-200b in 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 a developmental defect of the diaphragm associated with abnormal lung development. MicroRNAs (miRNA) are regulatory molecules that control gene expression. MiR-200b is a miRNA involved in regulation of epithelial-to-mesenchymal transition (EMT), which has been implicated in tumour metastasis and idiopathic pulmonary fibrosis. In this study, we investigated the role of miR-200b and EMT in pulmonary hypoplasia using a rat model of CDH.

Timed-pregnant dams were given an oral dose of nitrofen on day 9 of gestation to induce CDH and pulmonary hypoplasia. Lungs were isolated from rat fetuses on days 13, 15, 18 and 21 of gestation. In situ hybridization was carried out on 4 μm sections of lung tissue using a probe against miR-200b. Markers of EMT were detected using an antibody against vimentin. Interactions between miR-200b, nitrofen and transforming growth factor β (TGF-β) signalling were evaluated using a dual-luciferase assay in cultured human bronchial epithelial cells (BEAS-2B).

MiR-200b expression is decreased at various stages of lung development in CDH compared with control lungs. In early stages of lung development, miR-200b expression is highest at the tips of the elongating lung branches. These tip cells have features of mesenchymal cells that are lost during differentiation into more proximal bronchial epithelial cells. At 21 days of gestation, just before birth, fetuses with diaphragmatic agenesis have the lowest levels of miR-200b expression, particularly in terminal saccules and distal alveoli. Inhibitor of miR-200b and nitrofen increase TGF-β signalling, whereas mimics of miR-200b abolish the effects of nitrofen.

In summary, hypoplastic lungs in CDH have reduced miR-200b expression and display an enhanced mesenchymal phenotype through upregulation of TGF-β signalling.

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Systematic review and meta-analysis of electrocautery versus scalpel for incising epidermis and dermis. *L.N.F. Aird, C.J. Brown.* From the Department of General Surgery, University of British Columbia and St. Paul's Hospital, Vancouver, BC

Incisions of the epidermis and dermis has historically been performed using a cold scalpel, and the introduction of electrocautery for this purpose has been controversial with respect to patient safety and surgical efficacy. A systematic review and meta-analysis of randomized controlled trials (RCTs) was conducted to compare skin incisions made by electrocautery and scalpel.

A systematic electronic literature search of studies published between January 1985 and March 2012 was performed using 3 electronic databases (EMBASE, MEDLINE and PubMed). Outcomes evaluated included scar cosmesis, wound infection rate, incision time, incisional blood loss and postoperative incision pain. Results were pooled in meta-analyses as relative risk (RR) and weighted mean differences (WMD) using a random effects model.

In all, 9 RCTs comparing electrocautery ($n = 807$) and scalpel ($n = 805$) for skin incisions were included in the meta-analysis. There was no significant difference in wound infection rates (RR 1.20, 95% CI 0.77–1.86) between treatment groups. Likewise,

scar cosmesis, evaluated using objective and subjective scores, showed no significant difference ($p = 0.903$ and $p = 0.518$, respectively). Electrocautery was also found to significantly reduce incision time (WMD 20.14, 95% CI 3.17–43.45) and to decrease incisional blood loss (WMD 8.06, 95% CI 5.72–10.40). A trend toward less postoperative wound pain was found in the electrocautery group.

Electrocautery is a safe and effective method for incising epidermis and dermis, as the resulting incision has an equivalent cosmetic outcome and no increased risk of wound infection. In addition, using electrocautery provides a benefit with respect to incision time and incisional blood loss.

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Accuracy of sentinel lymph node biopsy for early breast cancer in the community setting in St. John's, Newfoundland: results of a retrospective review. ***S.L. Wong, D. Isa, D. Pace.*** **From the Memorial University Hospital, St. John's, Nfld.**

Sentinel lymph node biopsy (SLNB) has evolved to be the standard of care in the staging of early stage breast cancer. The aim of this study is to evaluate and compare the outcomes of SLNB in 2 community hospitals in St. John's, Newfoundland, with the international standards.

A retrospective chart review was performed for all breast cancer patients with SLNB from 1999 to 2006 in St. John's, Newfoundland. From 1999 to 2006, there were 116 cases of SLNB performed; 4 were excluded as 2 were found to be ductal carcinoma in situ and 2 did not have adequate documentation.

Our SLNB identification rate was 97.4%. There were 73 training cases where SLNB was followed by axillary lymph node dissection (ALND) as part of an initial audit on the accuracy of the SLNB. The false negative rate was 0%. The sensitivity and negative predictive value were 100%. In the SLNB only group, the axillary recurrence rate was 2.5% (1 of 39 cases) over a median follow-up of 52.3 months.

In conclusion, the early performance of SLNB in St. John's, Newfoundland, is comparable to international standards. Adoption of SLNB across Newfoundland will reduce the morbidity of ALND while achieving the same therapeutic outcomes.

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Acute surgical outcomes in the 80 plus population. ***J.R.M. Payne, S. Widder, Y. Tul, M. Primrose, D. Hudson, R.G. Khadaroo.*** **From the ACES Research Group, University of Alberta, Edmonton, Alta.**

North America's aging population is increasing. This increase can create many challenges for the health care system, including providing appropriate medical interventions while maintaining a sustainable health care system. Information regarding outcomes of interventions in the aging population is important for health service providers and policy makers to consider in order to better allocate resources. This study better characterizes the condition and disposition of patients 80 years and older following acute emergency surgeries.

A retrospective study was completed for the population 80 years and older who underwent a surgical procedure performed by the acute care emergency surgery service in the years 2008–2010. Variables identified from medical charts included admission diagnosis, comorbidities, medications, surgical procedures, operative diagnosis, in-hospital complications, length of stay and disposition upon discharge.

In all, 199 surgical procedures were performed on 170 patients 80 years and older in 2008–2010. The most common procedures were performed for small bowel obstruction (13%), colic perforation (9.5%) and neoplasm (7.5%). The mean length of stay was 22 days. In all, 62% required additional services, rehabilitation or transfer to another hospital, whereas the remaining 38% were discharged home without services. The in-hospital mortality rate was 15%.

North America's aging population will continue to put strains on the health care system. This study demonstrates the high rate of mortality and additional resources required by the 80 plus population following acute care surgery. This will have important clinical utility in terms of preoperative counselling of expected outcomes with patients and families. Early resource utilization planning can occur if we better understand this population's predicted demand for acute care beds and longer term need for appropriate supportive care, alternate level of care and rehabilitation beds.

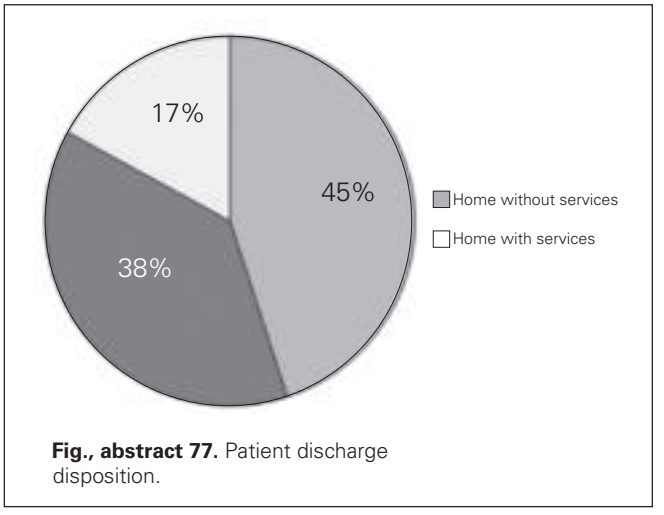

Fig., abstract 77. Patient discharge disposition.

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The liberal use of platelets transfusions in the acute phase of trauma resuscitation: a systematic review. ***J. Hallet, F. Lauzier, O. Mailloux, V. Trottier, P. ARchambault, R. Zarychanski, A.F. Turgeon, O. Mailloux.*** **From the Centre de Recherche FRQS du CHA (Hôpital de l'Enfant-Jésus), Traumatologie—Urgence—Soins Intensifs, Departments of Surgery and Medicine, Université Laval, Québec, Que., the Department of Surgery, Family Medicine and Emergency Medicine and Anesthesiology, Université Laval, Québec, Que., and the Department of Medical Oncology and Hematology, Cancercare Manitoba, Winnipeg, Man.**

This systematic review examined the impact of an aggressive approach (higher platelet:red blood cell [PLT:RBC] ratios) compared with restrictive PLT transfusions (lower PLT:RBC ratios) in the acute trauma resuscitation.

We systematically searched MEDLINE, EMBASE, Web of Science, BIOSIS, Cochrane Central and Scopus to identify relevant

randomized controlled trials (RCTs) and observational studies comparing 2 or more different PLT:RBC ratios in trauma resuscitation. We excluded studies using whole blood or systematically addressing the use of hemostatic agents. Two independent reviewers selected the studies, extracted data and assessed the risk of bias using the Newcastle-Ottawa scale and a checklist of key methodological elements. Disagreements were solved by consensus or a third party. The primary outcome was mortality. Secondary outcomes were multiple organ failure, lung injury and sepsis.

From 6123 citations, 7 observational studies were included (n = 4230 patients). No RCT was identified. All studies presented a low risk of bias and addressed confounders with multivariable regression or propensity scores. A decrease in mortality with higher PLT:RBC ratios in massive bleeding was reported in 4 studies (n = 1978), and 1 study observed no mortality difference (n = 1181) in nonmassive bleeding. The implementation of a massive transfusion protocol was reported in 2 studies: 1 revealed a survival benefit (n = 211). Of the 3 studies accounting for survival bias, 2 demonstrated a survival benefit (n = 1300). Of 2 studies reporting on the secondary outcomes (n = 854), 1 observed an increase in multiple organ failure with higher PLT:RBC ratios. Clinical heterogeneity and methodological limitations precluded the use of a meta-analysis.

There is insufficient evidence to strongly support the use of a specific PLT:RBC ratio for acute trauma resuscitation, especially considering survival bias and nonmassively bleeding patients. Randomized controlled trials examining both safety and efficacy of liberal PLT transfusions are warranted.

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Implementation of an acute care surgical on call program in a Canadian community hospital. *L. Farries, P. Hardy, R.M. Muirhead.* From the Red Deer Regional Hospital, Red Deer, Alta.

General surgery departments in academic centres have been moving toward providing call through an acute care surgical model, although there is little reported about similar programs in community hospitals. This study describes a community hospital model that separates elective and emergency general surgery work. A day surgeon (10 h shifts) and a night surgeon (14 h shifts) provide on-call coverage for 7 days in a row. Each surgeon takes 2 weeks of call out of an 8 to 10 week rotation while eliminating elective work during their on-call week. All elective resources of the on-call surgeons are routinely allocated to elective surgeons. This study measured on-call workload and surgeon satisfaction.

The average number of consultations and surgical procedures for the on-call surgeons were determined by retrospective review of selected billing data over a 1 year period.

Surgeons were surveyed with a brief, anonymous questionnaire to gauge satisfaction toward the acute care surgery model among surgeons and their spouses.

The day surgeon performed an average of 45.5 consultations and 16.4 surgeries per week. The night surgeon averaged 31.0 consultations and 20.5 surgeries per week.

Survey results indicated a high degree of satisfaction among surgeons and spouses, with little interest in returning to the traditional 24 hour model of call. Surgeons did not perceive an unacceptable drop in income.

The model resulted in working shifts of 14 hours' maximum duration and avoidance of elective surgery the day after being on call. Challenges included regular transfer of care each day, with a more detailed handover every Friday. Occasional locum help to was required to handle the workload, and a willingness to work closely together was important. Other community hospitals may accrue similar benefits by adapting this model.

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Short-term outcomes following paraesophageal hernia repair in the elderly patient. *I. Raiche, J. Masters, F. Haggar, H. Moloo. E.C. Poulin, G. Martel, J. Mamazza.* From the Minimally Invasive Research Group, University of Ottawa, Ottawa, Ont.

The elderly population often presents an increased surgical risk, which is always balanced against the risk of the primary disease when elective operations are performed. The aim of this study was to compare the short-term postoperative outcomes between the different surgical approaches for paraesophageal hernia (PEH) repair in elderly patients, and to evaluate the short-term postoperative outcomes following emergency and elective procedures.

Data were obtained on patients 70 years of age or older who underwent PEH repair from a prospective database compiled between 2005 and 2010 at a single centre. The surgical approach was left to the surgeon discretion, whereas length of stay (LOS), postoperative morbidity and mortality were analyzed.

In all, 95 patients with a median age of 77 years undergoing laparoscopy (54.7%), laparotomy (31.6%) and thoracotomy (13.7%) were included. The median LOS for elective patients (74.7%) was 6.0 days. Patients undergoing laparoscopy stayed on average 4.8 days, significantly shorter than laparotomy (9.2 d, p = 0.02) and thoracotomy (14.2 d, $p < 0.0001$) groups. The postoperative complication rate for laparoscopy was 34.0% (p = 0.02), 57.1% for laparotomy and 70.0% for thoracotomy. The mortality rate was 2.8% (n = 2), without significant difference between approaches.

Emergencies accounted for 25% of cases (n = 24). These patients had a longer LOS (44.1 d, p = 0.02) and higher odds of complications (OR 3.13, 95% CI 1.16–8.47, p = 0.025) and death (OR 9.09, 95% CI 1.63–50, p = 0.012) compared with elective patients.

Despite underlying comorbidities, individuals older than 70 years of age tolerate elective laparoscopic PEH surgery relatively well. Emergency procedures for PEH are associated with an increased risk of serious adverse events or fatality. Referring practitioners need to be informed of the potential risk and encouraged to refer patients earlier.

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First experience with single incision surgery: feasibility in the pediatric population and cost evaluation. *C. Botkin, C. Milbrandt, R. Keijzer.* From the University of Manitoba, the Children's Hospital, the Health Sciences Centre and the Manitoba Institute of Child Health, Winnipeg, Man.

Laparoscopic surgery has become widely accepted throughout Canada, with an increasing breadth of surgery being performed yearly. Single-incision laparoscopic surgery has been present since the mid-1990s, but has garnered little attention in Canadian surgical practice, let alone in pediatric surgery.

We describe our initial experience in a Canadian pediatric hospital with single-incision techniques, and have evaluated their feasibility as well as the incremental cost increase compared with conventional laparoscopic surgery. Our initial experience has included 22 patients, with 3 different surgical procedures, including appendectomy, cholecystectomy and limited ileocecal resections for Crohn strictures. All cases have involved 2 staff surgeons at the Children's Hospital in Winnipeg, Manitoba.

We evaluated 3 ports from 3 different manufacturers to determine ease of use and the associated cost of each system. We found that each port had distinct advantages and disadvantages. The cost increase ranged from $140 to $700, depending on the port used. Conversion to conventional laparoscopy occurred in 8.3% of attempted appendectomies (1 of 12) and 50% of ileocecal resections (1 of 2). No intraoperative complications were noted.

The cosmetic result, though not the primary goal of the procedures, was highly appreciated by the patients, especially image-conscious teenagers. The cost increase was highly variable depending on the port system and case type, and could be further decreased by the use of reusable instrumentation. Single-incision laparoscopic surgery in children is feasible, both in terms of the technical aspects of the operation, as well as the minimal cost increase associated with the use of the procedure.

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The impact of the establishment of an acute care surgery unit on the outcomes of appendectomies and cholecystectomies. ***D. Morency, L. Sideris, P. Grenier-Vallée, J.-F. Latulippe, P. Dubé.*** **From the Maisonneuve-Rosemont Hospital, Université de Montréal, Montréal, Que.**

The acute care surgery (ACS) model has gained in popularity over the past few years, mostly in centres with a high volume of emergencies. It was designed to ensure better coverage of surgical emergencies, to maximize resources and to improve outcomes. The aim of this study was to evaluate the impact of establishing an ACS unit for the treatment of frequent surgical conditions in a tertiary care institution.

We conducted a retrospective control study comparing 50 consecutive cases of acute cholecystitis and appendicitis operated on before the establishment of an ACS unit (February 2009 to April 2009) with 50 consecutive cases of each of these conditions during the ACS period (February 2010 to April 2010). An extra 50 appendicitis cases were evaluated 1 year after ACS implementation (February 2011 to April 2011) to evaluate the trend. The main outcome variables were timing of surgery (day v. evening/night), delay for surgery, readmission rate and length of hospitalization.

During the ACS period, more cholecystectomies were performed during daytime (79% v. 50%, $p = 0.018$), and the mean hospital length of stay was reduced by 2.2 days (7.2 v. 5 d, $p = 0.04$). Furthermore, fewer cholecystectomies were realized as an elective surgery on a second hospitalization (14% v. 40%, $p = 0.006$). More appendectomies were performed during daytime in the ACS periods of 2011 and 2010 compared with 2009 (32% v. 24% v. 10%, $p = 0.005$). However, there was no improvement in mean hospital length of stay (3.4 v. 3.3 d v. year 2011, p = NS).

The establishment of an ACS unit permitted us to increase the number of cholecystectomies and appendectomies performed during the day. It decreased the need to readmit patients for elective cholecystectomy and the hospital length of stay of patients presenting with acute cholecystitis.

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Description and preliminary evaluation of a low-cost simulator for training and evaluation of flexible endoscopic skills. ***D. Berger-Richardson, Y. Kurashima, P. Kaneva, L.S. Feldman, G.M. Fried, M.C. Vassiliou.*** **From McGill University, Montréal, Que.**

Flexible endoscopy is an important skill for general surgeons. Despite this, training opportunities are limited.

The purpose of this study was to create and validate a low-cost mechanical simulator to train and evaluate the fundamental skills required for flexible endoscopy.

We created 4 models. All tasks used a flexible endoscope (Olympus GIF Q160) and tower (Olympus Exera CV-160) and were scored using time and precision metrics. Novice (N; previously performed fewer than 50 endoscopies) and experienced (E; performed 50 or more endoscopies) participants were evaluated on the 4 tasks. Groups were compared using independent t tests and χ^2 tests. Data are expressed as means.

A box contains scattered symbols. The endoscopist was asked to identify as many symbols as possible with the endoscope in the retroflexed position.

The model consists of a hollow tube containing paired metal targets. The endoscopist must use open biopsy forceps to touch both targets simultaneously, which closes an open electric circuit and sounds a buzzer. Study participants were asked to complete 4 targets.

A Slinky (Poof-Slinky Inc.) is covered in material and secured in a box. This task allows endoscopists to practice navigating the curves of the slinky. The slinky is prone to loop formation, thus creating opportunities for loop reduction. Study participants were evaluated as to whether or not they could reach the end of the lumen.

The same model as in task 3 is used to test mucosal evaluation. Within folds, there are stud earrings. The study participants were asked to identify as many of them as possible.

There were 6 participants in each group. The total cost of the materials was under $CAD65. Tasks included, (1) symbols identified: N 11.2 (± 3.9); E 21.8 (± 2.6; $p = 0.02$); (2) completing all 4 targets: E 67%; N 17%; (3) reaching the end of the lumen: E 100%; N 17%; and (4) targets identified: E 7.8 (± 1.33); N 6.2 (± 1.6; $p = 0.08$).

A low-cost simulator for training and evaluation of the fundamental skills of flexible endoscopy was developed. These tasks and metrics demonstrate preliminary evidence for construct validity. This simulator has the potential to be a valuable educational tool.

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Tumour lysis syndrome in metastatic colon cancer: a case report. ***A.D. Isa, A.H.-L. Kwan.*** **From the Memorial University of Newfoundland and the Eastern Health, Health Sciences Centre, St. John's, Nfld.**

Tumour lysis syndrome (TLS) is an oncologic emergency characterized by metabolic derangements (hyperuricemia, hyperphosphatemia, hyperkalemia and hypocalcemia) secondary to massive tumour cell lysis with the release of intracellular contents into the systemic circulation. Whereas it is mostly seen in hematological

malignancies, case reports of TLS in solid tumours have been described, but these are considered rare.

We present the case of a 44-year-old woman with a history of laparoscopic anterior resection for colon cancer. She presented 4 years later with increasing abdominal pressure, lower extremity edema, night sweats and fevers. Subsequent investigations revealed a $10 \times 10 \times 13$ cm pelvic mass which was biopsied percutaneously and turned out to be metastatic colorectal cancer. She was given chemotherapy, and the pelvic mass remained stable in size.

After completing her initial course of chemotherapy, she presented again with abdominal discomfort and worsening lower extremity edema. The tumour had increased in size to 32 cm at its largest diameter. Surgical debulking was planned. The day before her planned surgery, she developed clinical TLS. She was stabilized medically, and her TLS was managed by surgical debulking. The patient did well postoperatively, and eventually all her metabolic derangements and her kidney dysfunction resolved.

We present a case of TLS in a patient with a rapidly growing Krukenberg tumour from a colorectal primary treated by surgical debulking after medical stabilization.

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Acute care surgery service model implementation study at a single institution. ***I Dupuis, S.A. Fraser.*** **From McGill University and the Jewish General Hospital, Montréal, Que.**

The Montreal Jewish General Hospital (JGH) has implemented an acute care surgery (ACS) service that has been staffed weekly by a junior surgical trainee and an attending surgeon since January 2011. The aim of this study was to examine the management of surgical emergencies at our institution, including time intervals concerning process of care. We hypothesized that patients would have expedited work-up and treatment decisions compared with the more traditional model in place; however, without additional access to operation room resources, they would continue to experience delays in ultimate surgical management.

This study population included all patients presenting to the JGH emergency department requiring a general surgery consultation 3 months before ACS service implementation and 3 months after. A data collection form was completed by house staff when the cases were seen. The form included demographic parameters, time intervals (triage, consultation request and completion), information about imaging and the disposition. Statistical comparisons were made using *t* tests.

Data from 286 patients were included: 136 pre-ACS and 150 post-ACS. There was heterogeneity between the 2 groups with respect to presenting diagnoses: bowel obstruction was the most common diagnosis pre-ACS versus biliary post-ACS. A CT scan was the most common imaging modality used (61.7% pre-ACS and 52.3% post-ACS). The emergency department in both groups requested most of the imaging; wherea the ACS service ordered 26.6% of the imaging pre-ACS versus 17.2% post-ACS. The mean time between triage and consultation was unchanged (7:02 h pre-ACS v. 7:59 h post-ACS, $p = 0.26$). However, the mean time between consultation requisition and accomplishment was significantly shorter (4:30 h pre-ACS v. 3:08 h post-ACS, $p = 0.02$). Disposition was admission in 42.7% in the pre-ACS group, whereas 50.4% of patients in the post-ACS underwent an operation within 24 hours.

As expected, implementing an ACS service at our institution decreased the time taken to assess and determine the disposition of emergent general surgical patients. We were also able to identify areas for improved quality of patient care and future study. However, this service model is unable to impact time to the operation room given its current limited access.

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Colonic disasters approached by emergent subtotal and total colectomy: lessons learned from 120 consecutive cases. ***M. Schweigert, N. Solymosi, N. Rauh, A. Dubecz, M. Renz, D. Ofner, H.J. Stein.*** **From the Department of General and Thoracic Surgery, Klinikum Nuremberg Nord, Nuremberg, Germany, the Szent István University, Budapest, Hungary, and the Department of Surgery, Paracelsus Medical University, Salzburg, Austria**

Diverse abdominal emergencies result in irreversible devitalization of the colon. Morbidity and mortality are significant, and adequate surgical strategies are still controversially discussed. The aim of this study is to investigate the results of emergent colectomy.

Records of 120 consecutive patients who underwent emergent subtotal or total colectomy at a German tertiary referral hospital during a 5-year period were reviewed in a retrospective study. Indication groups as well as age groups were formed for statistical analysis.

There were 73 male and 47 female patients with a mean age of 70 years. Altogether, 81 total and 39 subtotal colectomies were performed for mainly ischemia-related large intestine infarction (62), obstructing carcinoma (17), fulminant diverticulitis (10), ulcerative colitis (9) and pseudomembranous colitis (7).

Mean ASA score was 3.47. Severe sepsis or even septic shock was present in 82 cases. In-hospital mortality was 42. Patients with ulcerative colitis were significantly younger than the rest ($p < 0.01$). Colectomy for ischemic bowel infarction showed significantly higher mortality than for pseudomembranous colitis ($p = 0.018$), whereas there were no further significant differences amidst the indication groups. Between the age groups, there was neither significant difference in mortality nor in prevalence of sepsis. However, sepsis (OR 16.81, 95% CI 3.89–153.32, $p < 0.001$), an ASA score of 4 or greater (OR 5.84, 95% CI 2.33–16.00, $p < 0.001$) and total colectomy (OR 4.40, 95% CI 1.57–14.12, $p = 0.02$) were associated with higher mortality. Patients younger than 70 years had 3 times higher odds for reconstruction of alimentary tract continuity (OR 3.05, 95% CI, 1.06–9.38, $p = 0.032$).

Emergent colectomy is feasible and provides a practical solution for a wide range of heterogeneous abdominal emergencies resulting in colonic disintegration and necrosis. With colectomy, all ischemic, perforated and distended colon is removed while simultaneously bowel obstruction is relieved. Outcomes depend on indication, ASA score, extend of colonic resection and presence of sepsis, whereas age shows no significant influence.

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Acellular collagen matrix stent to protect bowel anastomoses. ***S. Koubi, M. Borgaonkar.*** **From the Memorial University of Newfoundland, St. John's, Nfld.**

An anastomotic leak is not an uncommon complication of bowel surgery. We present a method to help achieve a tension-free,

protected anastomosis with potential for lower leak rates. This method involves the use of a stent made of acellular collagen matrix (ACM) that is fixed inside the bowel. The stent relieves tension at the anastomotic site and provides mechanical protection at the most critical stages of healing. Acellular collagen matrix was chosen since it is a biologic material that can be placed in a nonsterile environment and for its strength, which can take the tension off the suture/staple line. This method is designed for stapled or sutured end-to-end anastomoses.

This method was tested using 5 pig animal models. The ascending colon was divided and reconnected using an ACM stent to protect the suture line. Each animal had another division and anastomsis, nonstented. This was done to enable the comparison of the stented anastomosis to a nonstented one. The animals were euthanized at different time intervals, and the anastomoses were examined.

No serious complications were observed. Burst pressure was measured for each anastomosis. No significant pressure difference was measured between stented and nonstented anastomoses. Stents were observed to be at different stages of decomposition grossly. The anastomotic sites looked grossly healthy.

Our described method is as safe as a hand-sewn anastomosis in this model. It has the potential of improving outcomes of bowel resections by decreasing leak rates. Further studies are needed to determine if there is significant merit to this method.

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Lessons we learned from preoperative MRI-guided wire localization of breast lesions: the University Health Network (UHN) experience. ***M. Ernjakovic, P. Crystal, A. Easson, J. Escallon, M. Reedijk, T. Cil, W.L. Leong, D.R. McCready.***

From the University of Toronto, Toronto, Ont.

This study examined the indications, accuracy and clinical applications of preoperative MRI-guided wire localization of breast lesions.

We retrospectively reviewed data from 58 patients who were treated conservatively and who underwent MRI-guided surgical excision of 59 breast lesions between March 2005 and July 2011. All lesions were primarily detected on MRI.

In all, 27 (46.5%) patients underwent a preoperative MRI to screen the breast contralateral to a known breast cancer; 18 (31.1%) were part of a high-risk MRI screening program and 13 (22.4%) had the MRI as a diagnostic test.

Preoperative core biopsy was performed in 33 lesions (19 by ultrasound, 13 under MRI, 1 under mammography); 5 showed cancer and 16 were high-risk lesions of which 11 (68.7%) were upgraded to cancer upon excision, and 12 had benign findings of which 5 (41.6%) were upgraded to cancer.

Final pathology of the MRI-guided excisions showed cancer in 25 (42.4%) lesions, high-risk pathology (atypical ductal hyperplasia, flat epithelial atypia, lobular carcinoma in situ) in 21 (35.6%) and benign conditions in 13 (22%). Asymptomatic synchronous contralateral cancers were found in 6 patients (6 of 27, 24%). Margins were negative in 22 (88%) of 25 cancers; 3 were positive (all for ductal carcinoma in situ). One lesion was missed at surgery, identified on postoperative MRI and then excised.

MRI-detected lesions that show high-risk histology on core biopsy should be excised under MRI guidance. If an ultrasound-guided core biopsy is performed for an MRI-detected worrisome lesion, and benign results are obtained, one should consider excising the lesion under MRI guidance, as the ultrasound may be discordant.

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Interim cost comparison for the use of platinum microcoils in the operative localization of small peripheral lung nodules. ***K. Grant, J. Clifton, J. Mayo, R. Finley.*** **From the University of British Columbia, Vancouver, BC**

An interim cost comparison was performed as part of an ongoing randomized controlled trial examining the use of platinum microcoils in the operative localization of small undiagnosed peripheral lung nodules to be resected for diagnosis using video-assisted thoracoscopic surgery (VATS).

Between March 2010 and March 2012, patients with small peripheral lung nodules less than 15 mm in diameter requiring surgical diagnosis were recruited for the study. They were randomized to either preoperative computed tomography (CT)-guided placement of platinum microcoils or to standard intraoperative VATS localization techniques. All patients underwent attempted VATS wedge resection for diagnosis. Costs were estimated from the health care payer perspective using charge-based values. Patient-level utility databased on the EQ-5D is currently being obtained and analyzed for a future cost–utility analysis.

A total of 45 patients were included in the analysis (23 in the microcoil group and 22 in the control group). The 2 groups were similar in terms of age, sex, smoking history, preoperative pulmonary function and nodule size. The mean operative time to nodule excision was 0.6 hours for the microcoil group and 1.5 hours for the control group ($p < 0.05$). The average number of intraoperative stapler firings required to excise the nodule was 3.2 for the microcoil group and 5.1 for the control group ($p < 0.05$). The average cost per patient for the microcoil group was $4752.65 and for the control group was $5544.47.

The costs associated with the CT-guided placement of platinum microcoils and their detection by fluoroscopy in the operating room appear to be offset by the cost savings in operative time and the decrease in number of stapler firings required intraoperatively.

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Routine barium esophagram has minimal impact on the postoperative management of patients undergoing esophagectomy for esophageal cancer. ***J. Cools-Lartigue, M. Noreau-Nguyen, D.S. Mulder, L.E. Ferri.*** **From McGill University, Montréal, Que.**

Esophagectomy is currently the treatment modality of choice in patients with esophageal carcinoma. Postoperatively, routine fluoroscopic imaging with barium sulfate is employed in order to detect occult anastamotic leaks (AL) before resumption of enteral feeding. This modality is plagued by a low sensitivity, and its routine use has been called into question. Accordingly, we sought to demonstrate the clinical impact of routine barium esophagography (BE) in the postoperative management of patients undergoing esophagectomy for malignant disease.

All patients undergoing esophagectomy from 2005 to 2011 for malignant disease at a North American university hospital were identified from a prospectively collected database. All patients were subject to BE within the first week postoperatively. Patients were dichotomized according to whether they had an AL or not, and the sensitivity and specificity of barium swallow was determined. In patients who had an AL, the relationship between barium swallow results and time to AL, hospital length of stay and start of enteral feeding were determined. Furthermore, the effect of BE results on postoperative management, defined as cessation of enteral feeding, additional interventions or delay in discharge was recorded. Data are expressed as median (range). Mann–Whitney *U* and Fisher exact test determined significance ($^*p < 0.05$).

In all, 227 patients underwent esophagectomy over the study period: 29 patients (12.8%) developed an AL, of whom 12 (41.4%) had a positive BE, 11 (37.9%) had a negative BE and the remaining 6 (20.7%) were not subject to BE and received a diagnosis either clinically (1 of 6), by CT (4 of 6) or endoscopically (1 of 6). Anastomic leaks in patients with a negative BE was confirmed either clinically (4 of 11 patients), by CT (5 of 11 patients), endoscopically (1 of 11 patients) or at reoperation (1 of 11 patients). In patients who had an AL, those with a positive BE leaked earlier than those with a negative BE (postoperative day [POD]7 [2–8] v. POD10.5 [6–22],* respectively). The sensitivity and specificity of barium BE in this series were 36.3% and 99.7%, respectively. Results of BE in patients with an AL did not correlate with hospital length of stay or date of commencement of enteral feeding. Overall, BE altered postoperative management in 6 of 227 (2.6%) patients with 4 of 227 (1.7%) patients undergoing further testing which went on to confirm a leak. Conversely, 2 of 227 (0.9%) patients demonstrated clinically insignificant AL, having their discharge delayed without additional intervention.

Barium esophagram has a poor sensitivity in the detection of anastamotic leak and has minimal impact in the postoperative management of patients undergoing esophagectomy for malignant disease. The routine use of contrast esophagograms after esophageal resection should be abandoned.

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Iron deficiency anemia is a common presenting issue with giant paraesophageal hernia and resolves following repair. ***P. Carrott, S. Markar, J. Hong, D.E. Low.*** **From Virginia Mason Medical Center, Seattle, Wash.**

Iron deficiency anemia is an underappreciated condition associated with giant paraesophageal hernia (PEH). The aim of this study was to evaluate the incidence of iron deficiency anemia in a cohort of patients with giant PEH and to assess the incidence of resolution associated with operative PEH repair.

Between 2000 and 2010, 270 patients underwent operative repair of PEH and were prospectively entered into an institutional review board–approved database. In all, 123 (45.6%) patients demonstrated a pre-existing diagnosis of iron deficiency anemia; 77 patients had a documented preoperative hemoglobin level (Hb) consistent with iron deficiency anemia and a follow-up Hb level at least 3 months following surgery. They constituted the study population.

In all, 72 patients (94%) underwent elective PEH repair. Cameron erosions were endoscopically documented preoperatively in 25 patients (32%). The average preoperative Hb value was 11.8 (7.6–16). Postoperatively at 3–12 months follow-up, the average Hb level was 13.2 (10.7–17), and at more than 1 year's follow-up it was 13.6 (9.2–17.2). Anemia was fully resolved postoperatively in 55 (71%) patients. This resolution was observed more commonly in women than men (80% v. 56%, $p < 0.05$). Also, patients younger than 70 years were more likely to resolve their anemia (29 of 33 v. 26 of 44, $p < 0.05$). In all, 29 (73%) of 40 patients were able to discontinue iron supplementation following surgery. There was no significant difference in the resolution of anemia in patients with or without Cameron erosions (19 of 25 v. 36 of 52, $p = 0.54$).

This single-institution study shows a high incidence of iron deficiency anemia (45.6%) in patients with giant PEH. Elective repair results in resolution of the anemia and discontinuation of iron supplementation therapy in more than 70% of patients. This improvement in Hb is independent of the presence of preoperative Cameron erosions. This study demonstrates the clinical and potential economic benefits of elective PEH repair of patients with giant PEH and iron deficiency anemia.

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A randomized comparison of different ventilation strategies during thoracotomy and lung resection. ***T. Stafford, A. Maslow, K. Davignon, T. Ng.*** **From the Departments of Surgery and Anesthesiology, Alpert Medical School of Brown University, Providence, RI**

Protective lung ventilation is reported to benefit patients with acute lung injury, but it is not known whether this strategy is also beneficial to patients with relatively healthy lungs undergoing elective thoracic surgery. We assessed the impact of 2 different ventilation strategies delivered to patients undergoing pulmonary resection.

In an institutional review board–approved prospective randomized trial, 32 adult patients undergoing elective thoracotomy and pulmonary resection requiring single-lung ventilation were enrolled. Patients were randomized to 1 of 2 groups: high tidal volume (HiTV; 10 mL/kg, rate of 7 breaths/min and 0 positive end expiratory pressure [PEEP]) or low tidal volume (Lo-TV; 5 mL/kg, rate of 14 breaths/min and 5 cm H_2O PEEP). Ventilator settings were continued during both double- and single-lung ventilation. Pulmonary functions were recorded on initial double-lung ventilation, at several time periods during single-lung ventilation and after resuming double-lung ventilation. Intraoperative hemodynamics and postoperative outcomes were also recorded. Epidural analgesia was used in all patients.

Patient demographics, operative characteristics, intraoperative hemodynamics and postoperative pain and sedation scores were similar between the 2 groups. During most time periods, airway pressures (peak and plateau) were significantly higher in the Hi-TV group; however, plateau pressures remained lower than 30 cm H_2O at all times for all patients. During most time periods, patients in the Hi-TV group had significantly lower FiO_2, $PaCO_2$, $PaCO_2$-$ETCO_2$ gradient (dead-space ventilation) and higher pulmonary compliance. There was no difference in postoperative morbidity and number of hospital days between the 2 groups, but the atelectasis score on postoperative days 1 and 2 were lower in the Hi-TV group.

Hi-TV during pulmonary resection resulted in no increase in morbidity and is associated with use of lower FiO_2, less hypercarbia, less dead-space ventilation and less postoperative atelectasis.

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The Canadian Lung Volume Reduction Surgery study: an 8-year follow-up. ***R. Malthaner, L. Tan, J. Aruranian, S. Kosa.*** **From the University of Western Ontario and the Canadian Lung Reduction Surgery Trial Group, London, Ont.**

What has happened to the patients in the Canadian Lung Volume Reduction Surgery (LVRS) Trial originally published in 2006? What was the long-term impact of lung reduction surgery? Despite evidence of early benefit and symptoms relief, LVRS did not become a standard treatment for management of symptomatic advanced emphysema. A great deal has been learned about both the disease and treatment during this time, but little has been reported about the long-term impact of LVRS. We wanted to report on the Canadian experience and evaluate the long-term impact on life and death after LVRS.

We have reviewed patients in both arms of the study (lung volume reduction surgery [LVRS] and best medical care plus rehabilitation [BMC+R]), as well as patients from the pilot studies across Canada. Patient enrolment into the study began in 1997; follow-up ranges from 8 to 15 years.

In Canada, chronic obstructive pulmonary disease (COPD) was the fourth leading cause of death in Canada in 2009, causing 10 515 deaths nationwide (Canadian Community Health Survey 2009). Unlike other leading causes of death, COPD is the only disease where mortality rates continue to climb (Canadian Lung Association 2005). In 2009, 4.2% of Canadians aged 35 and older reported that they had been diagnosed with COPD (Canadian Community Health Survey 2009). The hospitalization and deaths associated with COPD are a significant social and economic burden on society (Chapman 2010).

Medical management consisting of bronchodilators, corticosteroids and oxygen is currently the most common form of management of severe emphysema. Lung volume reduction surgery continues to be offered in the management of selected patients with severe emphysema (O'Donnell 2007). Despite the results of 8 randomized trials demonstrating a benefit to patients, physicians remain reluctant to routinely recommend surgery to their patients (Criner 1999; Gelb 1999; Geddes 2000; Pompeo 2000; Lofdahl 2000; Goodnight-White 2000; Goldstein 2003; NETT 2003).

The Canadian LVRS trial was a multicentred randomized controlled trial designed to assess the therapeutic benefit of lung volume reduction surgery compared with best medical care (Miller 2003). Publication of this study in 2005 reported that there was average improvement over the 2-year study in forced expiratory volume in 1 second of 265 mL ($p = 0.013$), a 30% improvement

from baseline, an improvement in the 6 minute walk test of 78 m (p = 0.045), and an increase in utility (HUI3) of 0.1786 (standard error 0.076, p = 1.635) over 2 years. Overall, there was a gain in quality adjusted life years of 0.0893 (p = 0.045). The study concluded that lung volume reduction surgery improves the impairment and handicap for at least 2 years in selected patients with advanced emphysema.

This study is an observational follow-up study of patients previously randomized in 4 of the 5 centres of the Canadian LVRS Trial. The objective of this study is to compare the difference in outcomes of patients randomized to best medical management or lung volume reduction since the trial's completion. The difference between surgery and best medical care in the months survived since randomization in the trial is the primary end point. Of the 47 patients from the 4 sites in Eastern Canada that participated in the LVRS trial, 43 were followed-up. Based on the available data, a Kaplein-Meier survival analysis (Collett 2003) was performed comparing the time survived since randomization between the 2 treatment groups. The mean survival in the surgical group was 52.3%, 46.5%, and 7.3% compared with 31%, 25% and 0% at 3 years, 5 years and 10 years in the conventional medical care group, with no significant differences (Figure).

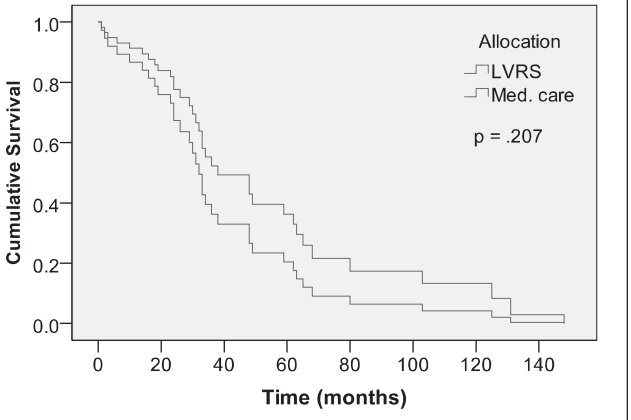

Fig., abstract 93. Cumulative survival by type of intervention.

Current Canadian Thoracic Society guidelines for the management of COPD support the use of LVRS for selected patients with the caveat that due to the cost, adopting it as a treatment plan should be balanced against the available resources (O'Donnell 2007). Less than 15 LVRS operations are performed monthly under the auspices of Medicare, indicating that a procedure that in a defined subset of advanced emphysema patients has been demonstrated to improve lung function, exercise tolerance, and quality of life continues to be underutilized (Edwards 2009, Berger 2010).

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A comparison of minimally invasive versus open Ivor-Lewis esophagectomy. ***M. Sudarshan, L.E. Ferri.*** **From McGill University, Montréal, Que.**

Surgery of the esophagus remains a procedure associated with high morbidity and mortality. Recent advances in minimally invasive esophagectomy (MIE) attempt to decrease these postoperative risks while providing an oncologically sound operation. Our objective is to analyze the outcomes of MIE versus the traditional open Ivor-Lewis (I-L) surgery for cancer of the esophagus.

A prospectively maintained clinical database was queried for all patients undergoing esophageal resection at a single high-volume referral centre from 2006 to 2011. Patient demographics, tumour characteristics, operative variables and short-term postoperative outcomes were compared between MIE and open esophagectomies. In an attempt to limit bias, we elected to compare MIE to open I-L resections only. Data are presented as median (and range). Fisher exact and Mann–Whitney U tests determined significance ($^*p < 0.05$).

Of 240 patients undergoing esophagectomy, 102 had I-L and 42 had MIEs (laparoscopic/thoracoscopic/cervical incision). Age did not differ (I-L 64 [24–81] v. MIE 66 [38–83]), but there tended to be more octogenarians in the MIE group (7 of 43 [16%] v. 3 of 102 [3%]). Time in the operating room was longer for MIE (270 min v. 315 min).* There were more episodes of severe bleeding (> 500 mL) in the open group (22 of 102 v. 1 of 42).* There was no difference in overall complication rate (I-L 54 of 102 [53%] v. MIE 20 of 42 [48%]), cardiac (I-L 22% v. MIE 12%) and pulmonary complications (I-L 23% v. MIE 36%), but there was a trend for higher anastomotic leaks in MIE (I-L 8% v. MIE 19%). Length of stay (I-L 10 [6–86] d v. MIE 11 [6–146] d) and in-hospital postoperative mortality did not differ (I-L 3 of 102 v. MIE 1 of 42). The frequency of R0 resections was comparable (I-L 97% v. MIE 95%), but open esophagectomy yielded a greater number of lymph nodes (I-L 34 (8–73) v. MIE 25 [5–60]).*

Esophagectomy, irrespective of approach, is associated with significant morbidity. When applied to a carefully selected patient population in combination with enhanced multimodal postoperative recovery program, MIE can prove to be a valuable and oncologically acceptable alternative to open esophagectomy.

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A new paradigm in the follow-up after curative resection for lung cancer: minimal-dose CT scan allows for early detection of asymptomatic cancer activity. ***W.C. Hanna, G. Murphy, F. Allison, H. Moshonov, G.E. Darling, T.K. Waddell, M. De Perrot, M. Cypel, K. Yasufuku, S. Keshavjee, N.S. Paul, A.F. Pierre.*** **From the University of Toronto, Toronto, Ont.**

The majority of recurrences after curative resection for lung cancer present as distant metastases before they are detected by surveillance chest radiographs (CXR). We hypothesized that a minimal-dose CT scan of the chest (MDCT), which delivers an effective radiation dose only 1.25 times that of CXR, can allow for earlier detection of asymptomatic cancer activity.

All patients after curative resection for lung cancer were invited to enroll in this prospective, blinded study. Patients underwent simultaneous MDCT and CXR at 3, 6, 12, 18, 24, 36, 48 and 60 months after surgery. Tests were interpreted by separate and blinded radiologists. Asymptomatic cancer activity was defined as radiological evidence of recurrent disease or new primary cancer without symptoms. Sensitivity analysis determined the diagnostic performance of MDCT and CXR. The χ^2 and Fisher exact tests were used for statistical comparison. Logistic regression was used to identify risk factors for asymptomatic cancer activity.

From 2007 to 2012, 311 patients were enrolled, and 1096 pairs

of MDCT and CXR were analyzed. Follow-up is complete on 148 patients. The overall rate of new cancer activity was 21% (65 of 311), and the majority (79%, 51 of 65) was diagnosed as early asymptomatic cancer activity. Minimal-dose CT scan of the chest was significantly more sensitive (94% v. 21%, $p < 0.0001$) but slightly less specific (86% v. 99%, $p < 0.0001$) than CXR in the diagnosis of early asymptomatic cancer activity, and MDCT had a higher negative predictive value (99% v. 96%, $p = 0.007$). Logistic regression analysis identified the following subset of patients as high-risk for early asymptomatic cancer activity: bilobectomy (OR 6.813, 95% CI 1.108–41.89), stage III disease (OR 2.962, 95% CI 1.157–7.584), presence of nonspecific lung nodules on CT scan (OR 2.205, 95% CI 0.982–4.951), video-assisted thoracoscopic approach (OR 2.094, 95% CI 1.13–3.88) and male sex (OR 1.845, 95% CI 0.995–3.423). A third of patients (14 of 51) with early asymptomatic cancer activity on MDCT received further treatment with curative intent.

After curative resection for lung cancer, MDCT of the chest constitutes an excellent modality for early diagnosis of asymptomatic cancer activity, especially in a subset of high-risk patients. Minimal-dose CT scan of the chest allows for earlier initiation of further treatment, and more studies are required to determine its impact on survival.

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Predictors of lymph node metastasis in early esophageal adenocarcinoma: Is endoscopic resection worth the risk? ***L. Lee, G. Darling, C. Pedneault, V. Marcus, D.S. Mulder, L.E. Ferri.*** **From the McGill University Health Centre, Montréal, Que., and the University Health Network, Toronto, Ont.**

Endoscopic resection has been described as an organ-sparing option for early esophageal adenocarcinoma (EAC). However, this approach should only be used in patients with a negligible risk of lymph node metastasis (LNM). Very few data on the risk factors for LNM in EAC exist to help guide treatment, therefore we sought to identify predictors for LNM in early EAC.

All primary esophagectomies performed at 2 university centres from 1999 to 2011 were reviewed for cases with T1 EAC that had not received neoadjuvant therapy. Patient and pathological characteristics were compared between patients with lymph node metastases (LN+) and those without (LN–). Fisher exact and Mann–Whitney *U* tests determined significance ($p < 0.05$) on univariate analysis. Multivariate analysis identified independent predictors of LNM.

A total of 79 patients with primary T1 EAC were identified (32 of 79, 41% T1a, 47 of 79, 69% T1b). Lymph node metastasis was present in 20% (16 of 79) of patients with T1 adenocarcinoma (T1a 7 of 32, 22% and T1b 9 of 47, 19%, $p = 0.782$). The LN+ group had larger tumours (3.1 v. 2.0 cm, $p = 0.001$) and had more lymphovascular invasion (LVI; 44% v. 8%, $p = 0.002$). There were no differences in age, sex, differentiation, depth of invasion, presence of tumour ulceration or perineural invasion between LN+ and LN– groups. Multiple logistic regression identified T1b status (OR 8.7, 95% CI 1.2–64.4), tumour size (OR 2.6 per cm increase in size, 95% CI 1.4–4.9) and LVI (OR 11.9, 95% CI 2.1–66.1) as independent predictors of LNM. This model demonstrated excellent discrimination in predicting LNM (c-statistic 0.89, 95% CI 0.81–0.97; Hosmer-Lemeshow $p = 0.201$).

Lymph node metastases were present in a larger than expected proportion of T1 EAC. Invasion of the submucosa, a larger tumour size and LVI independently predicted LNM. Until the evidence demonstrates otherwise, endoscopic therapy for early EAC should be performed only in small T1a tumours in the absence of LVI.

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How well can thoracic surgery residents operate? Comparing resident and program director opinions.

The Canadian Thoracic Manpower and Education (T-MED) survey determined that Canadian thoracic surgery residents were generally satisfied with their training programs. In an effort to address questions raised by this survey, this study aims to identify core thoracic surgery procedures that may require additional training based on disagreement in resident and program director (PD) opinions about resident operative ability as well as resident perceptions of their own operative ability and exposure to these procedures.

In the absence of a suitable validated instrument, the T-MED study questionnaire was developed de novo using a modified Delphi process. Residents (12) and PDs (8) were surveyed regarding residents' ability to perform 19 core thoracic surgery procedures independently without additional training after completing their training programs. Residents were also questioned about the adequacy of their operative exposure to these same procedures during their training. Questionnaires were administered via SurveyMonkey, and responses were aggregated to ensure anonymity. Applying the Bonferroni correction, Fisher exact and Pearson χ^2 tests were conducted to determine differences between groups.

No statistical differences were found between resident and PD perceptions on resident ability to perform the surgical procedures. Statistical differences ($p < 0.001$) were found between residents' reported operative ability and exposure to open and laparoscopic giant paraesophageal hernia repair, and to laparoscopic myotomy.

We conclude that thoracic surgery residents and PDs agree on the operative competency in core thoracic surgery procedures that residents are achieving during their training. Perceived insufficiencies in operative ability and exposure of residents to benign esophageal diseases may be the result of changes in case volume during training owing to overlap with general surgical practice and may require enhanced training within residency programs.

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The impact of extremes of age on short- and long-term outcomes following surgical resection of esophageal malignancy. ***S. Markar, D. Low.*** **From the Virginia Mason Medical Center, Seattle, Wash.**

There is an impression that young patients presenting with esophageal cancer present with more advanced disease and have a poorer prognosis, and that elderly patients experience greater mortality following esophagectomy. The aim of this study was to evaluate the effect of extremes of age on outcomes following esophagectomy for cancer.

In all, 500 patients undergoing esophagectomy by a single surgeon for cancer between 1991 and 2011 had information prospectively entered in an institutional review board–approved database.

The "young" group comprised 58 patients 50 years or younger; they demonstrated an increased likelihood for delayed presentation

as shown by an increased length of dysphagia and increased weight loss. Clinical stage was similar; the younger cohort of patients demonstrated a significantly increased incidence of adenocarcinoma and Signet ring pathology. Patients 50 years or younger demonstrated significantly shorter intensive care unit stay, reduced incidence of postoperative complications and reduced overall cost. Overall survival and mortality was similar for both groups.

The "older" group comprised 32 patients 80 years and older; they showed a significantly increased average Charlson comorbidity index (6.6 ± 0.9 v. 4.2 ± 1.3) and reduced use of neoadjuvant chemoradiotherapy. These older patients had significantly increased total postoperative complications (68.8% v. 44.9%), particularly arrhythmia and pneumonia. There were no in-hospital mortalities in patients 80 years and older (0 v. 0.4%), and there was no significant difference in overall survival between the groups.

In spite of having a more delayed presentation and a higher incidence of adenocarcinoma, younger patients presented with a similar stage and demonstrated similar overall survival. Elderly patients undergoing esophagectomy are at greater risk of postoperative complications. However, there were no significant differences in other major parameters including mortality and survival, indicating that patients' 80 years and older can and should be assessed by an experienced surgeon.

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

In this study, we sought to evaluate a human epidermal growth factor receptor (EGFR)-targeted nanotechnology-based radiation enhancer in the treatment of non–small cell lung cancer (NSCLC). We evaluated the in vitro radiation enhancing properties of 3 gold nanoparticle platforms: gold nanoparticles alone (GNP), GNPs functionalized with polyethelene glycol (GNP-PEG) and the anti-EGFR monoclonal antibody cetuximab (GNP-cetux). We then sought to investigate the in vivo biodistribution properties of GNP-PEG versus GNP-cetux after systemic administration, as GNP-PEG have previously been demonstrated to have superior pharmacokinetics as compared with GNP alone.

In vitro radiation enhancement was examined in 3 NSCLC cell lines (H460, SKMES-1, A549 [radiation resistant]) using MTS assay, clonogenic assay and flow cytometry. Bilateral SKMES-1 xenografts were subcutaneously implanted into the flanks of Balb/c nude mice. In each mouse, 1 tumour was exposed to a single administration of radiation (8 Gy, 200 kVp). The organ/tumour biodistribution profiles of GNP-PEG and GNP-cetux were examined after intravenous administration evaluating the effects radiation impose on tumour uptake of GNPs. Uptake of GNPs in various tissues was calculated as the percentage of the injected dose per gram of tissue (%ID/g).

H460 and SKMES-1 cells demonstrated increased apoptosis and significantly decreased viability with GNP-PEG and GNP-cetux combined with external beam radiation (4 Gy, 200kVp) as compared with radiation alone or GNP combined with radiation. GNP-PEG demonstrated significantly increased intratumour localization compared with GNP-cetux, with the peak intratumour GNP concentration occurring 3 days after administration (5.1%ID/g v. 2.4%ID/g, $p < 0.01$). Tumour pre-exposure to radiation resulted in a 2-fold uptake increase in both the GNP-PEG and GNP-cetux groups.

GNP-cetux demonstrated a small radiation enhancement effect over GNP-PEG. This effect was achieved independent of the cytotoxic effects of cetuximab, as H460 and SKMES-1 are kras mutant cell lines, rendering them relatively insensitive to free cetuximab therapy. However, the biodistribution data demonstrated GNP-PEG to have significantly enhanced intratumour localization as compared with GNP-cetux. GNP-PEG appears to have promise as a potential radiation enhancer in the treatment of NSCLC.

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Laparoscopic Heller myotomy results in excellent outcomes in all subtypes of achalasia as defined by the Chicago classification. ***S.C. Bharadwaj, B.E. Louie, A.S. Farivar, S.P. McHugh, R.W. Aye.*** **From the Swedish Medical Center, Division of Thoracic Surgery, Seattle, Wash.**

Laparoscopic Heller myotomy (LHM) with partial fundoplication and pneumatic dilation are the primary options to palliate idiopathic achalasia. Recently, a new classification of achalasia based on high-resolution manometry (HRM) suggested different response rates to the aforementioned therapies in each of the 3 subtypes of achalasia, but only 24% of patients were treated with LHM. We reviewed our surgical outcomes in achalasia patients to determine if this new classification system can predict response to LHM.

We retrospectively reviewed consecutive patients treated with LHM for achalasia from 2005 to 2012. Patients were placed into 1 of the 3 Chicago classification types, and symptom resolution, preoperative and postoperative dysphagia scores (Dakkak 1992) and timed barium swallows were compared with determine treatment response.

In all, 55 patients were identified, with 40 having HRM: 13 type I, 20 type II and 7 type III. The dominant presenting symptom in type I and II was dysphagia, whereas type III patients described regurgitation, chest pain and respiratory symptoms as well. The average symptom duration was not significantly different across groups.

Postoperative satisfaction rates were 84%, 90% and 80%, with median follow-up times of 13, 13 and 24 months in types I, II and III, respectively.

Comparison of pre- and postoperative dysphagia scores showed improvement in all groups (type I: pre 11 v. post 33 [$p = 0.01$]; type II: pre 17 v. post 32 [$p = 0.02$]; type III: pre 15 v. post 35 [$p = 0.02$]). Esophageal clearance in 1–5 minutes on timed barium swallows was also improved in each type.

Laparoscopic Heller myotomy results in significantly improved swallowing as evaluated by subjective and objective means in all Chicago classification subtypes.

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Neoadjuvant chemoradiation versus surgery in managing esophageal cancer. ***A.S. Ashrafi, C. Tan-Tam, M. De Vera,***

R.J. Bond, S.R. Ong, B. Johal, D. Schellenberg, M. Po, S. Nissar, C. Lund, S.Y. Ahmadi. **From the Surrey Memorial Hospital, Surrey, BC, the University of British Columbia, Vancouver, BC, the Fraser Health Authority, Surrey, BC, the BC Cancer Agency, Surrey, BC, and the Surrey Thoracic Surgery Group, Surrey, BC**

Given the curative potential of surgery as well as chemoradiation in treating esophageal cancer, there has been interest in combining the 2. However, to date there has been no conclusive evidence for the tenability of trimodality as a preferred mode of treatment. In a bid to contribute to the current debate, we conducted a retrospective cohort study of esophageal cancer patients treated at our centre.

A total of 146 patients underwent esophagectomy at our centre between April 2000 and March 2012 for esophageal cancer. They had a mean age of 64 ± 11 years and included 36 (25.0%) female patients. Exactly 73 (50.0%) patients were managed by surgery without any neoadjuvant therapy. Among these, 57 (78.1%) underwent surgery alone and did not receive any adjuvant treatment (group 1). The other 73 (50.0%) patients received neoadjuvant therapy before surgery. Among these, 12 (16.4%) received radiation only, 6 (8.2%) chemotherapy only and 55 (75.3%) chemoradiation, the latter forming group 2.

In group 1, the 30 day mortality was 2 (3.5%), median hospital length of stay (LOS) 14 days and mean 21.8; 42 (73.7%) of the patients had adenocarcinoma, 1 (1.8%) adenosquamous and 14 (24.6%) squamous cell carcinoma.

In group 2, the 30 day mortality was 4 (7.3%), median LOS 10 days and mean 18.6; 22 patients (40.0%) had pathologic complete response, 36 (65.5%) had adenocarcinoma and 19 (34.5%) squamous cell carcinoma.

Using the Kaplan–Meier method, we calculated mean and median survival times of 1328 ± 293 (1111) and 753 ± 112 (616) days for groups 1 and 2, respectively. Kaplan–Meier curves for the 2 groups were significantly different ($p = 0.002$).

Findings from this study suggest better survival for esophageal cancer patients undergoing surgery alone compared with those undergoing chemoradiation and surgery. More prospective studies are needed to further compare these treatment modalities.

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Quality of life postesophagectomy for cancer! ***D. Ouellette, N. Wakil, G. Rakovich, G. Beauchamps.*** **From the University of Montréal, Hôpital Maisonneuve-Rosemont, Montréal, Que.**

Esophageal cancer has a very poor prognosis. Most patients present with advanced malignancy and therefore are not candidates for curative resection. Reviewing our data, 34.9% of patients referred to our service underwent an esophagectomy. The survival rate of this selected group of resected patients is poor, with a median survival of 14.3 months. Therefore what quality of life can we provide these patients after an esophagectomy?

Quality of life is very subjective and rendering it objective is difficult. Reviewing the literature, most authors use general questionnaires on quality of life in cancer patients. Few articles deal with disease-specific questionnaires. Finley developed and validated a disease-specific quality of life questionnaire (EQOL) for potentially curable patients with carcinoma of the esophagus consisting of 15 specific questions.

We attempted to contact all living patients who underwent an esophagectomy between 1994 and 2008. We reached 33 patients, and all accepted to answer the questionnaire. They consisted of 29 male and 4 female patients with a median age of 60 years, of whom 29 patients presented with an adenocarcinoma. Time elapsed between resection and the administration of the questionnaire varies between 50 days to 14.9 years. The results of this questionnaire demonstrated that based on a maximal score of 7, the lowest score was 2.86 with a median at 6.06. An improvement with time has been noted.

Globally, these patients are pleased with the quality of their life postesophagectomy. The topics which fared worse in patients' evaluations were difficulty exercising, increased sensitivity to cold and inability to participate in activities that require physical exertion, whereas the topics that faired best were absence of limitation in visiting friends or relatives, ability to eat sufficient food and the absence of fear for recurrences.

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The implementation, evolution and translocation of standardized clinical pathways can improve perioperative outcomes following surgical treatment of esophageal cancer. ***S. Markar, S. Preston, C. Baker, D. Low.*** **From the Virginia Mason Medical Center (VMMC), Seattle, Wash., the Royal Surrey County Hospital (RSC), Guildford, United Kingdom**

A standardized esophagectomy clinical pathway (SECP) was established at a single institution (VMMC) in 1991 and has undergone 5 revisions up to 2011. In March 2011, a multidisciplinary team from another institution (RSC) visited VMMC and instituted a similar pathway in April 2011. The aim of this study is to determine the effect of the implementation, evolution and translocation of an esophagectomy care pathway on postoperative outcome.

In all, 500 patients undergoing esophagectomy for cancer at VMMC between 1991 and 2011 had outcomes prospectively documented in an institutional review board–approved database: 12 RSC patients who underwent surgery before the introduction of the SECP were compared with 12 RSC patients managed according to the SECP.

The VMMC data showed that age and BMI remained consistent over time. The use of neoadjuvant chemoradiotherapy (19.3% to 52.7%, $p < 0.05$), Charlson comorbidity index (2.3 ± 0.7 to 2.5 ± 0.8, $p < 0.05$) and individual comorbidities such as arrhythmia, diabetes, hypertension and chronic obstructive pulmonary disease increased over time. Operative time remained consistent; however, we observed significant reductions in estimated blood loss and intraoperative intravenous fluid administration. The immediate extubation rate was consistent across the study groups (98.8% to 100%). The median length of stay in the intensive care unit and in hospital (10 [5–50] to 8 [6–54] d, $p < 0.05$) decreased over time. The incidence of postoperative complications (37.9% to 46.7%) remained consistent.

The RCS data showed that following the introduction of the SECP, significant improvements were noted in complications (75% to 33%), first-day mobilization (8.3% to 100%) and length of stay in the intensive care unit and in hospital (17 [12–30] to 7 [6–37] d).

The results of this study show that continued evaluation and revision of esophagectomy clinical pathways can lead to progressive improvement in postoperative outcome. This study also

demonstrates the potential for accelerated improvement in esophagectomy outcomes within 6 months following translocation of validated standardized postoperative pathways across health care systems.

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A tissue-mimicking phantom for applications in thoracic surgical simulation. ***D.A. Bottoni, G. Campbell, R.A. Malthaner.*** **From the London Health Sciences Centre, University of Western Ontario, Divisions of Thoracic Surgery and Surgical Oncology, the National Research Council Canada, London, Ont.**

Materials with realistic haptics and tactile properties that simulate biologic soft tissues are essential to surgical simulation. These demands have created the need for the development of a tissue-mimicking platform to serve as a consistent, reproducible and accurate test bed for innovative surgical experimentation and performance evaluation.

We have quantified the mechanical properties of human lung tissue using a portable soft-tissue indentation device. Force-displacement curves for ex vivo human lung tissue samples were generated via low strain indentation testing with a small spherical contact point. The force-displacement curve for human lung parenchyma is described by the equation $y = 0.0963 \times -0.0207$ ($R^2 = 0.9981$). These data have been used in the development of an anthropomorphic tissue-mimicking human lung phantom. Our phantom is constructed from a biologically inert organic polymer (polyvinyl alcohol) and conforms to computed tomography data from a human subject. The phantom simulates the soft-tissue properties of human lung parenchyma. The tactile properties of our lung phantom were subjectively validated by experienced thoracic surgeons. To our knowledge, this work embodies the first description of the development of an anthropomorphic lung phantom with true-to-life mechanical and handling properties. The tissue-mimicking phantom is easily reproducible, inexpensive and can be implemented in the development and refinement of advanced thoracoscopic and robotic procedures, skills and instrumentation.

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Sublobar resection compared with lobectomy for early stage non–small cell lung cancer: a single institution study. ***C. Knickle, D. Bethune, H. Henteleff, M. Johnston, G. Buduhan.*** **From the Dalhousie University Medical School and the Faculty of Medicine, Dalhousie University, Halifax, NS**

Lung cancer is the most common cause of cancer-related death. Early stage non–small cell lung cancer (NSCLC) is potentially curable with surgery. Whereas lobectomy is the standard operation performed, some studies report similar survival with sublobar resections. This study compares the results of sublobar resections and lobectomy for early stage NSCLC in terms of disease-free (DFS) and overall survival (OS).

This study was a retrospective cohort of patients who underwent lobectomy or sublobar resection for NSCLC from October 2005 to December 2007 at the Queen Elizabeth II Health Sciences Centre in Halifax, Nova Scotia.

In all, 190 (73.6%) patients underwent lobectomy and 68 (26.4%) underwent sublobar resection; 21 (30.9%) had segmentectomies and 47 (69.1%) had wedge resections. Whereas there was no significant difference in OS or DFS between those who underwent lobectomy versus sublobar resection, local recurrence was higher in the sublobar group (36.2% v. 17.9%, $p = 0.04$). Multivariate Cox regression demonstrated that N0 node status was an independent predictor of OS (HR 2.14, 95% CI 1.2–3.8, $p = 0.014$,), and lobectomy was an independent predictor of DFS (HR 2.16, 95% CI 1.01–4.6, $p = 0.048$,). Of sublobar resections, 60.3% had no lymph nodes sampled at the time of resection, versus 2.6% of lobectomies ($p < 0.0001$).

There was a higher incidence of local recurrence for patients having sublobar resection compared with lobectomy; lobectomy was an independent predictor for improved DFS. Nodal status was the strongest predictor of OS. Over half of sublobar resections had no sampled lymph nodes. Lobectomy should be considered standard care for resectable NSCLC. Surgeons should incorporate nodal sampling for all NSCLC resections regardless of extent of resection.

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Not all reviews are equal: the quality of systematic reviews and meta-analyses in thoracic surgery. ***S. Coughlin, H. Emmerton Coughlin, L. Roth, M. Bhandari, R. Malthaner.*** **From the University of Western Ontario, London, Ont., and McMaster University, Hamilton, Ont.**

Systematic reviews and meta-analyses are a valuable resource for surgeons. Their validity, however, can be limited by the use of unsound methodology. We conducted a review of the quality of systematic reviews and meta-analyses in thoracic surgery to determine the prevalence of methodological deficiencies.

A search of MEDLINE, the Cochrane database and EMBASE was performed to identify all meta-analyses of randomized controlled trials in thoracic surgery. Two independent reviewers assessed each study. Quality scores from 0 to 11 were assigned using the validated AMSTAR tool. Reviews with scores greater than 8 were considered high quality, whereas those less than 5 were considered low quality. Disagreement between reviewers was resolved by consensus. Multivariate analysis was used to determine if the year of publication, journal impact factor, the type of study (either surgical or medical) and positive findings were associated with study quality.

The search identified 1026 studies from 1992 to 2011; 54 reviews met eligibility criteria and were included in this study (kappa = 0.82). Only 11% of studies were of high quality. The most frequent methodological deficiency was the failure to incorporate the quality of included studies into the conclusions and recommendations of the systematic review. An increase in publication date of 1 year was associated with a 0.307 point increase in AMSTAR quality score (95% CI 0.179–0.436, $p < 0.001$). Despite this, only 10% of studies published in 2010 and 2011 were of high quality. Impact factor of the journal, type of study and positive outcomes were not significantly associated with study quality.

Most systematic reviews and meta-analyses in thoracic surgery contain significant methodological flaws. Thoracic surgeons should be aware of potential sources of bias in the majority of systematic reviews. All studies should by critically appraised and the conclusions from flawed studies interpreted with caution.

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Do postoperative complications affect health-related quality of life after video-assisted thoracoscopic lobectomy for patients with lung cancer? A cohort study. ***S. Gazala, J. Johnson, J. Kutsogiannis, E. Bédard.*** **From the University of Alberta, Edmonton, Alta.**

Surgical resection is the main treatment modality for early stage non–small cell lung cancer (NSCLC) with a curative intent. The aim of any cancer treatment, including surgery, extends well beyond increasing survival. The benefit of existing surgical approaches for the treatment of lung cancer needs to weighted against their possible complications and patient quality of life.

Our aim was to assess the effect of postoperative complications based on the Clavien classification system on health-related quality of life (HRQL) in patients with early stage NSCLC undergoing video-assisted thoracoscopic (VATS) lobectomy.

We performed a cohort study of NSCLC patients undergoing VATS lobectomy at our tertiary care, teaching centre. Before surgery, baseline assessment of HRQL was captured using the SF-36, the EORTC QLQ30 and QLQ13 and the EQ-5D questionnaires. Postoperative assessment of HRQL was conducted at regular intervals (2, 4, 8 and 12 wk) after surgery using the same questionnaires administered at baseline. Postoperative complications were assessed on a daily basis during the patients' stay in the hospital by a research team delegate not part of the treating team, using a priori defined criteria for the individual complications. Based on the Clavien classification system, the cohort was classified as experiencing high-grade (defined as grade III or IV) complications or not. Changes in HRQL scores over the follow-up period were compared using linear regression with generalized estimating equations.

Between March and September 2011, 44 eligible patients were recruited into the study. The mean age was 65.1 (SD 8.7, range 46–81) years; 24 (55%) patients were male. Tumour stage was IA in 55%, IB in 30%, IIA in 7%, IIB in 7% and IIIA in 2%. The median chest tube duration was 3 (mean 5, SD 3.9) days. The median length of stay was 5 (mean 6.1, SD 4.7) days. The majority of patients (n = 31, 71%) had no or low-grade complications, whereas 13 patients (30%) experienced high-grade complications. In all, 3 patients had conversion to thoracotomy (1 who subsequently had high-grade complications) and remained in the study. Patients experiencing high-grade complications had significantly worse HRQL outcomes in the following 4 of 8 domains of the SF-36: global health, vitality, physical functioning and role limitations — emotional ($p < 0.05$ for all). On the EORTC QLQ30 and QLQ13, patients with high-grade complications had worse HRQL outcomes in the dyspnea, emotional function and cognitive function scales, as well as worse shoulder pain and financial difficulties ($p < 0.05$ for all). The EQ-5D questionnaire showed no significant differences between the 2 groups.

The severity of postoperative complications after VATS anatomic lung resections for NSCLC, as measured by the Clavien classification system, negatively impacts patient-centred outcomes in the first 3 months postoperatively.

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Thoracoscopic plication for palliation of dyspnea secondary to unilateral diaphragmatic paralysis: A worthwhile venture? ***S. Gazala, K. Rammohan, K. Stewart, E. Bédard.*** **From the University of Alberta, Edmonton, Alta., and the University Hospital South Manchester, Wythenshawe, Manchester, United Kingdom**

The dominant symptom for patients with unilateral diaphragmatic paralysis is dyspnea. Despite the proven efficacy of plication as a treatment option in children with dyspnea secondary to diaphragmatic paralysis, it remains an infrequent operation in adults. The largest published series of thoracoscopic plication had only 20 patients with long-term follow-up.

Our objective was to evaluate our experience with video-assisted thoracoscopic (VATS) plication in adults from a patient-centred, health-related quality of life (HRQOL) perspective.

In order to assess the HRQOL after VATS diaphragmatic plication in our tertiary care, teaching hospital, patient demographics, hospital admission and follow-up data were tabulated from patient charts. In addition, 2 reliable and validated dyspnea questionnaires were administered to patients at baseline and 6 months postoperatively (London Chest Activity of Daily Living Scale and St. George Respiratory Questionnaire). Pulmonary function tests at the same time points were used for construct validity.

In the period between January 2006 and September 2011, 8 adult patients underwent VATS plication for unilateral diaphragmatic plication; 6 patients were male. The mean age was 51.3 (41–58) years. The mean BMI was 32.5 (27.4–40). The etiology was idiopathic in 2, traumatic in 2, post–viral infection in 2 and postoperative in 2. The mean time elapsed from diagnosis to treatment was 13 (range of 6–22) months. Thoracoscopic plication was performed using 3–4 ports, with #1 Ethibond or Prolene plication sutures. The median chest tubes duration was 1 day, and the median hospital stay was 2 days. Postoperative complications included empyema and pneumonia (1, same patient) and chronic postoperative pain (1). The mean and median values for all relevant spirometric parameters (forced expiratory volume in 1 second, forced vital capacity, forced residual capacity, total lung capacity and diffusion capacity) showed an improvement at 6 months. The significant subjective improvement in dyspnea demonstrated by 7 out of 8 patients correlated well with the questionnaire analysis.

Thoracoscopic plication is a worthwhile venture for unilateral diaphragmatic paralysis in adults. It confers both subjective and objective improvements in patient-centred HRQOL outcomes. Further follow-up of this patient cohort will substantiate the longevity of dyspnea palliation afforded by VATS diaphragmatic plication.

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Thoracic surgery experience in Canadian general surgery residency programs. ***L. Donahoe, G. Buduhan.*** **From Dalhousie University, Halifax, NS**

The value of a mandatory rotation in thoracic surgery during general surgery residency training has never been studied. We sought to determine the opinions of program directors (PDs), recent graduate general surgeons (RGs) and current general surgery senior residents (SRs) regarding the value of a thoracic surgical rotation as a component of general surgery training programs.

Participants were identified through postgraduate office administrators and directories for all Canadian English-speaking general surgery residency programs. The target group was emailed a link for an online survey.

Of 13 programs, 10 participated; the response rate was 57% (91 of 160). Most respondents felt that a thoracic rotation was beneficial (87.5% of SRs, 89% of RGs, 90% of PDs), and 60% of SRs, 73% of RGs and 60% of PDs stated that the thoracic rotation experience in their program was positive/very positive. Institutions with a Royal College thoracic fellowship program had significantly lower mean scores for overall experience in their thoracic rotation (3.55 v. 4.37, $p = 0.001$) and opinion regarding the necessity of a thoracic rotation (3.82 v. 4.42, $p = 0.013$). Academic surgeons and subspecialists/those not taking trauma call had a nonsignificant trend toward lower mean scores regarding the necessity of a thoracic rotation (3.9 v. 4.2, $p = 0.06$ and 3.69 v. 4.1, $p = 0.08$, respectively). Community and trauma call surgeons had higher mean scores regarding the benefit of thoracic rotations (4.38 v. 4.0, $p = 0.05$).

Most respondents feel that a thoracic rotation is beneficial during general surgery residency. Respondents within Royal College thoracic centres, as well as subspecialists and nontrauma surgeons, were associated with less positive opinions toward thoracic rotations. Future efforts should be directed toward identifying trainee objectives to enhance resident experiences on thoracic rotations.

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Perioperative morbidity and pathologic response rates following neoadjuvant chemotherapy and chemoradiation for locally advanced esophageal carcinoma. *K. Walker, J. Gruchy, Z. Xu, G. Buduhan.* From Dalhousie University, Halifax, NS

Our institution recently adopted neoadjuvant chemoradiation as primary induction therapy for locally advanced esophageal carcinoma. Previously, patients were treated with neoadjuvant chemotherapy alone, mainly because of the presumed increased perioperative complications associated with preoperative radiation. We wanted to evaluate the short-term outcomes of both neoadjuvant modalities.

We looked at a retrospective cohort of esophageal cancer patients treated by esophagectomy with curative intent at the Queen Elizabeth II Health Sciences Centre from January 1997 to January 2012

In all, 202 patients were identified; 149 (73.8%) patients were treated with surgery only, 33 (16.3%) received neoadjuvant chemotherapy and 20 (9.9%) had neoadjuvant chemoradiation. The majority of neoadjuvant chemotherapy and chemoradiation patients completed their treatment without any modification (78.7% chemotherapy v. 75.0% chemoradiation). The major pathologic response rate was higher among neoadjuvant chemoradiation patients compared with neoadjuvant chemotherapy patients (66.7% v. 18.2%, $p < 0.001$). Neoadjuvant chemoradiation was also associated with a significantly higher incidence of tumour-free lymph nodes and a lower incidence of lymphovascular invasion ($p = 0.001$ for both). There was no difference in distribution of total pulmonary, cardiovascular, infectious, surgical or overall postoperative complications among all 3 treatment arms. Treatment arm was not associated with major complications on multivariate regression analysis.

Postoperative morbidity was not associated with neoadjuvant therapy. Patients receiving neoadjuvant chemoradiation were more likely to have a major pathologic tumour regression. Long-term follow-up is needed to determine correlation with survival.

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An enhanced recovery pathway reduces length of stay after esophagectomy. *C. Li, L.E. Ferri, D.S. Mulder, A. Ncuti, A. Neville, P. Kaneva, D. Watson, M. Vassiliou, F. Carli, L.S.Feldman.* From McGill University, Montréal, Que.

Enhanced recovery pathways (ERP) reduce morbidity and length of stay following colorectal surgery. There is little information about their role in complex procedures such as esophagectomy. The purpose of this study was to determine the impact of an ERP on length of stay, complications and readmissions after esophagectomy.

Patients undergoing esophagectomy for cancer or high-grade dysplasia from June 2009 to December 2011 were identified from a prospectively maintained database. Beginning in June 2010, all patients were enrolled in a 7 day multidisciplinary ERP including written patient education with daily treatment plan, indications for admission to the intensive care unit, early structured mobilization, and diet and drain management. Short-term (30 d) outcomes were compared for patients undergoing esophagectomy pre- and postpathway. Data are expressed as median (and IQR).

In all, 106 patients were identified: 47 underwent esophagectomy before ERP implementation and 59 after. Patients were similar with respect to age, sex, diagnosis and operative time. Hospital stay was shorter in the ERP group (8 [7–17] v. 10 [9–17] d, $p = 0.01$). There were no differences in rates of complications (59% v. 62%) or readmissions (6% v. 5%).

Implementation of a multidisciplinary enhanced recovery pathway for esophagectomy was associated with decreased length of stay, without an increase in complications or readmissions.

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Predictors of dysplastic and neoplastic progression of Barrett's esophagus. *S. Alnasser, R. Av, S. Mayrand, E. Franco, L.E. Ferri.* From McGill University, Montréal, Que.

Barrett's esophagus (BE) is a premalignant condition that progresses through a stepwise process to invasive adenocarcinoma (IAC). It is unknown why some BE patients progress to IAC more rapidly than others. The aim of this study is to identify the demographic and endoscopic factors that can be used as predictors of dysplastic and neoplastic progression in BE patients, and thereby be used to stratify BE patients into different surveillance protocols according to the risk of neoplastic progression.

All BE patients at the McGill University Health Centre between January 2000 and December 2010 were reviewed from a pathology database. Patients with intestinal metaplasia in esophageal biopsies were identified. Only those with endoscopic findings of columnar lined mucosa were included in this study. Data included demographic variables (age and sex) and endoscopic variables (presence of hiatus hernia, esophagitis, ulcers, mucosal irregularities and strictures). Neoplastic and dysplastic progression were examined by time to event analysis. Cox proportional hazard regression modelling and a generalized estimating equation were used to identify the variables that are most predictive of neoplastic progression.

From 1054 patients confirmed to have BE by pathology, only 518 patients had BE by pathology and endoscopy included into final analysis. From nondysplastic BE baseline, 35 (6.7%) patients progressed to dysplastic or neoplastic grades, and 10 (1.9%)

patients progressed to high-grade dysplasia (HGD) or IAC. Long BE segment (HR 1.2, 95% CI 1.1–1.3) and advanced age (HR 3.5, 95% CI 1.7–7.4) were independent predictors of progression from nondysplastic BE to dysplastic or neoplastic grades. However, mucosal irregularities (HR 8.6, 95% CI 2.4–30.4) and advanced age (HR 5.1, 95% CI 1.7–16.6) were the independent predictors of progression from nondysplastic BE to HGD/IAC.

Advanced age, long BE segment and presence of mucosal irregularities are associated with increased risk of dysplastic and neoplastic progression in BE patients. In addition to the presence of dysplasia, these factors may help to stratify BE patients according to their risk of neoplastic progression and therefore can be used to individualize the BE surveillance.

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Recurrent esophageal cancer complicated by tracheoesophageal fistula: management by means of palliative airway stenting. ***M. Schweigert, A. Dubecz, M. Renz, R.J. Stadlhuber, D. Ofner, H.J. Stein.*** **From the Department of General and Thoracic Surgery, Klinikum Nuremberg Nord, Nuremberg, Germany, and the Department of Surgery, Paracelsus Medical University, Salzburg, Austria**

Recurrent esophageal cancer is a crushing condition. Cancer-related fistulization between the esophagus and tracheobronchial tree adds further difficulty. Unless closure of the fistula is achieved, death from pulmonary sepsis is imminent. Surgical options are limited by local tumour growth, previous operations and radiotherapy as well as by impaired functional status. Here, endoscopic stent insertion might provide a reasonable alternative.

The outcome of patients who received endoscopic stent implantation for tracheoesophageal fistula due to recurrent esophageal cancer between 2006 and 2011 were reviewed in a retrospective case study.

Altogether, 7 patients were identified: 6 male and 1 female, with a median age of 57.4 years. Tumour entity was squamous cell carcinoma and adenocarcinoma in 4 and 3 cases, respectively. Successful stent placement was always feasible. Double stenting of the trachea and esophagus was carried out in 3 patients, whereas insertion of a solitary tracheal or esophageal stent was performed each in 2 patients. Complete closure of the communication between the esophagus and respiratory system was accomplished in all cases by stent implantation. Mean survival following stent insertion was 77 (5–162) days; 1 patient is still alive 91 days after placement of a tracheal stent. After adequate oral intake had been achieved, 5 patients were finally discharged home. Fatal aspiration pneumonia with respiratory failure occurred in 2 patients.

Endoscopic stent implantation provides an easy and ubiquitous available technique for closure and palliation of tracheoesophageal fistula caused by recurrent esophageal cancer. Immediate sealing of the fistula and relief of symptoms related to aspiration is achieved while hazardous operations are avoided. Therefore, we recommend endoscopic stent insertion as treatment of choice in case of tracheoesophageal fistula caused by recurrent esophageal cancer.

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Pancreaticopleural fistula-induced empyema thoracis: principles and results of surgical management. ***M. Schweigert, M. Renz, A. Dubecz, N. Solymosi, L. Thumfart, D. Ofner, H.J. Stein.*** **From the Department of General and Thoracic Surgery, Klinikum Nuremberg Nord, Nuremberg, Germany, the Szent István University, Budapest, Hungary, and the Department of Surgery, Paracelsus Medical University, Salzburg, Austria**

Pancreaticopleural fistula is a very uncommon complication of pancreatitis resulting from pancreatic duct disruption with leakage of pancreatic secretions into the pleural cavity. Fistulization occurs either through the esophageal hiatus or straight through the diaphragm. Pleural effusion with dyspnea is the main presenting symptom, and delayed diagnosis is frequent. Initial conservative treatment fails in a significant number of cases. Ascending infection via the fistulous tract results in pleural empyema and life-threatening septic disease. The aim of this study is to investigate the results of operative management.

All patients who underwent surgery for a pancreaticopleural fistula-induced empyema thoracis at a tertiary referral hospital from 2008 to 2011 were included in a retrospective case study.

Altogether, 6 patients with pancreaticopleural fistula and associated pleural empyema were identified. There were 4 male and 2 female patients. The median age was 50.8 years. All patients had recurrent pancreatitis with pseudocysts and received initial medical and endoscopic treatment. Despite all nonsurgical treatment efforts, superinfection led to left-sided pleural empyema in 4 and bilateral empyema in 2 patients. The contagious spread took place through the fistulous tract connecting the pancreatic duct, respectively the pseudocysts with the pleural cavity. The patients were referred to thoracic surgery with considerable delay and already advanced pleural empyema. Minimal invasive thoracic surgery with pleural debridement was performed in all cases. Furthermore, left pancreatic resection was mandatory in 5 patients and cystostomy in 1 patient. All patients recovered well, and upon follow-up there were no further complications.

Surgical management combining minimal invasive thoracic surgery and removal of the fistulous tract is highly effective. If initial medical treatment fails, surgery should be considered early to prevent severe sepsis. Further improvement seems achievable by reducing the time gap between fruitless conservative efforts and surgical intervention.

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Prognostic factors of early postoperative mortality following right extended hepatectomy. ***A. Zhuruk, K. Croome, R. Leeper, R. Hernandez.*** **From the University of Western Ontario, London, Ont.**

The number of extended hepatectomies (resection of ≥ 5 segments) performed has continued to rise as surgeons continue to push the limits of resectability in liver surgery. Extended hepatectomy is associated with higher morbidity and increased risk of postresection liver failure (PLF) compared with smaller resections. There is a need to identify predictors of early mortality after extended hepatectomy.

A retrospective analysis of our prospectively maintained database was performed to identify all cases of right extended hepatectomy between the dates 2005 and 2011. A Cox univariate regression for survival up to 90 days post–right extended hepatectomy was performed. Variables investigated included age, BMI, preoperative chemotherapy, liver steatosis, operative time, intraoperative blood transfusion, bilirubin on postoperative day (POD)5 and international normalized ratio (INR) on POD5.

A total of 36 patients were identified, which included 5 patients with benign lesions, 5 cholangiocarcinomas and 26 patients with metastatic liver disease. On Cox univariate regression, significant predictors for survival post–extended right hepatectomy were age at the time of resection (p = 0.045), number of packed red blood cells (PRBCs) transfused (p = 0.028), steatosis greater than 30% (p = 0.049), bilirubin on POD5 (p = 0.002) and INR on POD5 (p = 0.003). The rate of postoperative mortality was significantly higher in those patients meeting the "50–50" criteria (60%) compared with those not meeting the criteria (6.4%, p = 0.001). Of all patients undergoing portal vein embolization (PVE), none developed PLF (based on 50–50 criteria) postoperatively compared with 17% in patients not undergoing PVE.

Advanced age, steatosis and number of PRBCs transfused predict postoperative survival following extended hepatectomy. Portal vein embolization appears to be protective against PLF and should be strongly considered in patients undergoing extended hepatectomy, particularly in those patients with advanced age or high likelihood of steatosis. The 50–50 criteria is a good predictor of early mortality in the population of patients post–right extended hepatectomy.

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Optimizing steatotic livers for transplantation using a cell-penetrating peptide CPP-fused heme oxygenase. ***A. Hanouf, S. Livingstone, J. Sapp, D. Woodhall, I. Alwayn.*** **From Dalhousie University, Halifax, NS**

Owing to a shortage of donor livers and in order to meet demand, transplantation programs increasingly use steatotic livers that are more susceptible to ischemia-reperfusion injury (IRI), leading to primary nonfunction and rejection. Heme-oxygenase-1 (HO-1) is an inducible protein that has beneficial effects in reducing the degree of IRI. Our laboratory has previously reported the generation of a HO-1 protein tagged with a cell-penetrating peptide (CPP), which is a short amino acid sequence capable of crossing plasma membranes.

CPP-HO-1 functionality was confirmed in a bilirubin assay of CPP-HO-1–treated HEK293T cells. CPP-HO-1 was able to catalyze the production of bilirubin in vitro at a rate of 7 nM/mg HO-1/hr. Cell penetration was assayed in vitro by CPP-HO-1 treatment of cell lines grown in tissue culture. Ex vivo, portal vein, cold-perfusion of rat livers was performed on a Langendorff apparatus with 2 mg of CPP-HO-1 in histidine-tryptophan-ketoglutarate solution. HO-1 penetration from in vitro and ex vivo experiments was visualized by immunohistochemistry and fluorescence microscopy.

Immunofluorescent staining of in vitro and ex vivo experiments demonstrated cellular internalization of CPP-HO-1. Importantly, CPP-tagged proteins were abundantly present in cell layers surrounding the vessels of the portal triad.

CPP-HO-1 is functional and is able to penetrate cells in vitro and ex vivo. If future experiments ascertain the ability of CPP-HO-1 to protect against IRI in a rat steatotic liver transplantation model, it will provide a novel method to upregulate HO-1 in steatotic livers and will optimize them, for transplantation, hence increasing the donor pool.

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Video outlining the technical steps for a robot-assisted laparoscopic pancreaticoduodenectomy. ***T. Vanounou, S. Bergman.*** **From McGill University, Montréal, Que.**

Minimally invasive pancreaticoduodenectomy remains one of the most challenging abdominal procedures, and its application is poorly reported in the literature so far. Its feasibility has been proven, but how to start a minimally invasive program remains challenging. In this video, we outline the steps for a laparoscopic pancreaticoduodenectomy followed by a robotic-assisted pancreaticojejunostomy and hepaticojejunostomy. This video highlights the critical steps required for a successful minimally invasive pancreaticoduodenectomy.

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Establishment of a collaborative group to conduct innovative clinical trials in Canada. ***P. Karanicolas, J. Lam-McCulloch, F. Balaa, S. Jayaraman, D. Quan, A. Wei, G. Guyatt.*** **From the Sunnybrook Health Sciences Centre and the Sunnybrook Research Institute, Toronto, Ont., The Ottawa Hospital, Ottawa, Ont., St. Joseph's Health Centre, Toronto, Ont., the London Health Sciences Centre, London, Ont., the University Health Network, Toronto, Ont., McMaster University, Hamilton, Ont., and the Hepatopancreaticobiliary Community of Surgical Oncologists Clinical, Evaluative, and Prospective Trials Team (HPB CONCEPT Team)**

The newly formed Hepato-Pancreatico-Biliary Community of Surgical Oncologists: Clinical, Evaluative, and Prospective Trials Team (HPB CONCEPT Team) will identify and develop the HPB research priorities in Ontario. All 31 HPB surgeons in Ontario are members of the HPB Surgeons of Ontario Community of Practice (HPB CoP). We conducted an online survey of all HPB CoP members and asked each to indicate his/her interest in participating in collaborative prospective research that the HPB CONCEPT Team plans to develop. Members were also asked to suggest specific trials they would like to develop. Results indicated 100% interest in participating in HPB CONCEPT research. The HPB CoP also identified over 50 potential trials/research ideas. When asked to attend a face-to-face meeting later this year to discuss research priorities, all HPB CoP members indicated a willingness to attend. This is overwhelming mandate for the HPB CONCEPT Team to form the clinical trials arm of the HPB CoP.

The research that we conduct will improve the care of HPB patients through investigator-initiated research, and provide a forum for developing high-impact clinical trials for HPB surgery. The infrastructure already in place through the HPB CoP and the extent of regionalization in Ontario makes this the optimal site to begin this collaboration, but our hope is to ultimately expand the HPB CONCEPT Team to become a nation-wide and international collaborative research group. We invite HPB surgeons from other provinces to participate in the development and submission of grant proposals that this project will generate. Furthermore, the model that we develop may serve as a template for other disease sites within Canada to develop similar collaborations.

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Hepatic resection for metastatic malignant melanoma: a systematic review and meta-analysis. ***J.-M. Aubin, J.F. Rekman, R.J. Fairfull-Smith, R. Mimeault, F.K. Balaa, G. Martel.*** **From the Division of General Surgery and the Liver and Pancreas Surgery Unit, The Ottawa Hospital, Ottawa, Ont.**

The recent decades have seen an increase in hepatic resections for noncolorectal metastatic disease. Though only small series have been published, hepatic resections for metastatic melanoma have been carried out. The objective of this review was to evaluate the safety and adequacy of oncologic outcomes of liver resection for metastatic melanoma.

Two authors reviewed the literature from MEDLINE, EMBASE and the Cochrane Library and independently screened qualifying articles. Studies with a minimum of 10 patients with metastatic melanoma undergoing liver resection were included. Included outcomes of overall survival and/or disease-free survival were abstracted and synthesized. Hazard ratios were derived from survival curves. Meta-analysis was carried out using random effects models.

A total of 371 deduplicated studies were screened; 17 studies were included, for 811 patients (1.4%–44% of patients with melanoma metastatic to the liver). Median follow-up was 9–59 (0–258) months. Median disease-free survival postresection was 8.3–23 months. Median overall survival postresection was 8.4–28 months (R0 resection 23–65.6 mo, R1 14–22 mo, R^2 8.4–16 mo). Documented overall survival was 59%–77% at 1 year, 30%–53% at 3 years and 0%–29% at 5 years. Median overall survival with a solitary metastasis was 28–81.3 months, and 7–27 months for multiple metastases. Nonoperative management (systemic therapy and best supportive care) yielded a median overall survival of 3–12 months, with a 5-year survival of 4%–6%. When compared with best supportive care, curative liver resection was significantly associated with improved overall survival (HR 0.33, 95% CI 0.23–0.48, $I^2 = 0\%$, 4 studies).

Hepatic resection appears to improve survival in selected patients with metastatic melanoma, particularly so with low metastatic burden and R0 resection. Given the certain selection bias, these findings should be confirmed in a multi-institutional clinical trial.

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Acellular normothermic ex vivo liver perfusion for donor liver preservation. ***J.C. Yeung, M.S . Boehnert, F. Bazerbachi, J.M. Knaak, Nazia Selzner, I.D. McGilvray, O.D. Rotstein, O.A. Adeyi, G.A. Levy, S. Keshavjee, D.R. Grant, M. Selzner.*** **From the Multi Organ Transplant Program, Toronto General Hospital, Department of Surgery, Toronto, Ont.**

Normothermic ex vivo liver perfusion for donor liver preservation can offer additional opportunities for graft assessment and repair over the current standard of cold static storage. Because the liver has a high metabolism and oxygen demand, whole blood has previously been used as the perfusate. However, blood can contain mediators of reperfusion injury and can carry a risk of infection. We therefore investigated acellular perfusion in a porcine model.

Normothermic perfusion of a porcine liver with an oxygenated, acellular solution was compared with oxygenated whole blood for 8 hours. Oxygen extraction, liver function, perfusion characteristics and markers of cellular injury were assessed.

There were no differences in perfusion characteristics between acellular- and blood-perfused grafts as measured by hepatic artery flow (360 ± 85 mL/min v. 420 ± 120 mL/min, $p = 0.08$), portal venous flow (910 ± 45 mL/min v. 920 ± 55 mL/min, $p = 0.7$) or perfusate pH (7.35 ± 0.1 v. 7.32 ± 0.1, $p = 0.67$). Average oxygen extraction of the liver was identical during acellular and blood perfusion with maintenance of high post–liver oxygen tensions with both acellular (168 ± 20 mm Hg) and blood perfusion (198 ± 19 mm Hg, $p = 0.3$). Liver function, as measured by bile production and urea synthesis, was similar in acellular- and blood-perfused livers. Alanine aminotransferase levels after 8 hours of perfusion (40 ± 8 U/L v. 45 ± 12 U/L, $p = 0.8$) and the extent of necrosis on hematoxylin and eosin staining (< 5% in both groups) were similar in both groups.

Our data suggest that the oxygen demands of the normothermic ex vivo perfused liver can be satisfied with the use of a continuous oxygenated acellular perfusate through the transfer of dissolved oxygen alone.

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Pancreatic cancer and predictors of survival: comparing the CA 19–9/bilirubin ratio with the McGill Brisbane Scoring System. ***S. Dumitra, J. Abou Khalil, M. Jamal, P. Chaudhury, G. Zogopoulos, P. Petrakos, J. Tchervenkov, J. Barkun.*** **From the Department of Surgery, McGill University, Montréal, Que.**

There are few tools that predict survival for pancreatic cancer (PAC). We have developed and validated the McGill Brisbane

Symptom Score (MBSS) based on symptoms at presentation: weight loss (> 10%), pain, jaundice and smoking. CA 19–9 and the CA19–9 to bilirubin ratio have also been shown to predict survival and resectability. We compared the ability of 4 strategies to predict 9 month survival: MBSS, CA 19–9 alone, CA 19–9 to bilirubin ratio and a combination of MBSS and CA 19–9 to bilirubin ratio.

We performed a retrospective review of the McGill University Health Centre database of 98 patients who received a diagnosis of PAC between 2005 and 2011. Actual survival was determined from the Quebec civil registry. Clinical symptoms were recorded from the charts and nutritional assessments. Blood CA 19–9 and bilirubin values were collected when available (n = 55) at the time of diagnosis. Receiver operating characteristic (ROC) curves were used to determine a cut-off for optimal test characteristics of CA 19–9 to total bilirubin ratio, the MBSS and the combined score CA 19–9 to bilirubin ratio with the MBSS (using Stata 13).

The most accurate test in predicting 9 month survival was the MBSS, with a sensitivity of 86.7% (95% CI 69.3%–96.2%) and specificity of 54.4% (41.9%–66.5%). The ROC area (ROCA) was significant at 0.71 (0.62–0.79), as was the negative predictive value (NPV; 90.2% [76.9%–97.3%]), whereas the positive predictive value (PPV) was not. The ability of CA 19–9 levels alone to predict survival was low, with an ROCA of 0.54 (0.42–0.65). For CA 19–9 to bilirubin ratio, the test characteristics improved but remained nonsignificant (ROCA 0.62 [0.49–0.75]). When adding the MBSS to the ratio, the sensitivity, specificity, PPV and NPV increased (58.3% [36.6%–77.9%] and 77.4% [58.9%–90.4%], respectively). Significantly, the ROCA was similar to that of the MBSS alone.

In our study, CA 19–9 levels and CA 19–9 to bilirubin ratio were poor predictors of survival from PAC, whereas the MBSS was found to be more valuable, confirming its clinical value. By adding the MBSS to the CA 19–9 to bilirubin ratio, we significantly improved the value of the CA 19–9. This combined score also improved the PPV of the MBSS while essentially maintaining its NPV. Given the small sample of patients on which peridiagnostic CA 19–9 levels were available, these results will need to be confirmed.

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Staged liver resections for bilobar hepatic colorectal metastases: a single centre experience. *E. Simoneau, M.H. Jamal, M. Hassanain, P. Chaudhury, S. Wong, A. Salman, T. Tran, P. Metrakos.* From McGill University, Montréal, Que., and the King Saud University, Riyadh, Saudi Arabia

Bilobar colorectal cancer liver metastases (BCLM) are challenging to resect. Given the survival advantage of liver resection, a portion of these patients may benefit from a staged liver resection strategy. In this study, we describe our staged resection experience.

From January 2003 to January 2011, patients who were put on the staged resection pathway were identified from the McGill University Health Centre's hepato-pancreato-biliary database. All patients underwent neoadjuvant chemotherapy, liver resection (LR) to clear 1 side of the liver, portal vein embolization of the contralateral side, followed by the second stage LR. Those who had only a single LR were considered a failed staged resection (FSR), whereas those who completed the second stage were considered to have had a successful staged resection (SSR). Survival was calculated from the date of diagnosis of the BCLM. Complete follow-up and dates of deaths were obtained from the government of Quebec population database.

A total of 87 patients was identified; 44 patients (51%) had an SSR, whereas 43 patients (49%) had an FSR. The overall 5 year survival was 28% for the entire group. The SSR median survival was 45.6 (28.8–61.2) months, versus 21.6 (15.6–31.2) months in the FSR group. The SSR 5 year survival was 46%, versus 5% in FSR group ($p < 0.001$).

Two-staged hepatic resections for CRC metastasis is feasible and prolongs survival even in complex bilobar hepatic metastasis. A multidisciplinary approach is essential in the management of bilobar hepatic metastasis.

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Economic model of observation versus immediate resection of hepatic adenomas. *T.T. Vanounou, R.T. Groeschl, D.A. Geller, J.W. Marsh, T.C. Gamblin.* From the Department of Surgery, McGill University, the Jewish General Hospital, Montréal, Que., the Division of Surgical Oncology, Department of Surgery, Medical College of Wisconsin, Milwaukee, Wis., the Division of Transplantation, Department of Surgery, University of Pittsburgh School of Medicine, Pittsburgh, Pa.

For small asymptomatic hepatic adenomas (HA), available data are insufficient to establish the superiority of either observation or surgery. We sought to investigate the cost-effectiveness of 2 initial management strategies.

We performed a comparative analysis of 2 theoretical cohorts of 100 patients with small (< 5 cm), asymptomatic HA. Discounted cash flow models compared the net present value of both treatment options at year 10 under 3 distinct progression rate scenarios. A break-even analysis was used to determine the break-even point at which the net present value for observation and immediate surgery intersect.

The net present value for immediate surgery was $1 733 955. The net present value for observation varied between $2 065 315 and $2 745 631 for computed tomography (CT), $2 264 575 and $2 929 541 for magnetic resonance imaging (MRI) and $802 837 and $1 580 413 for ultrasound (US). The break-even point was between 6 and 8 years for CT and 5 and 7 years for MRI. The break-even point for US was not reached except in the highest progression rate scenario (12 yr).

This study highlights the importance of the underlying progression rate and the cost of imaging when following patients with asymptomatic HA. Overall, US surveillance is the most cost-efficient approach to observing small asymptomatic HA. If cross-sectional imaging is used, then immediate surgery is the most cost-effective decision at 5–8 years.

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Resection of colorectal liver metastasis in the elderly. *B. Howe, K. Croome.* From the University of Western Ontario, London, Ont.

Colorectal liver metastases (CLM) develop in 50% of those diagnosed with colorectal cancer. Current management strategies of surgical liver resection combined with chemotherapy has resulted

in 5 year survival rates in the range of 37%–58%. More cancers are being diagnosed at advanced ages as our population continues to live longer. The objective of the present study was to evaluate the outcomes in patients over the age of 70 years who underwent a liver resection for CLM compared with patients less than 70 years of age.

A retrospective analysis of our prospectively maintained database was performed to identify all patients who underwent major hepatic resection for CLM between Jan. 1, 2002, and Dec. 31, 2011. Patients greater than 70 years of age (group 1) were compared with those patients younger than 70 years of age (group 2) at the time of resection.

A total of 194 patients who underwent a major hepatic resection for CLM were identified. There were 29 (14.9%) who were 70–74 years old and 26 (13.4%) who were 75–79 years old at time of resection; 2 (1.0%) were 80 years of age or older.

There was a 55% increase in the number of liver resections for CLM from 2007 to 2011. Elderly patients had a similar size and number of liver metastasis compared with younger patients. Primary tumour site and stage were also similar between the 2 populations. Elderly patients were less likely to have synchronous lesions. The 90 day mortality rate was not significantly different for patients greater than 70 years of age (2%) compared with those younger than 70 (0.8%, $p = 0.49$). Mortality at 1 year was also not significantly different for patients greater than 70 years of age (8.1%) compared with those younger than 70 (2.9%, $p = 0.47$). Perioperative morbidity was similar in the elderly group compared with the younger population (17.5% v. 11.7%, $p = 0.27$).

Although age was previously perceived to be a predictor for morbidity and mortality in liver resections, it appears well selected elderly patients (≥ 70 yr) have similar outcomes to younger patients (< 70 yr) in our centre. This is important, as it is likely we will see more cancers being diagnosed in an older population of individuals in the upcoming years. Our findings suggest that age alone does not appear to independently predict a worse outcome for resection of CLM. Long-term follow-up is needed with this patient population to further evaluate the outcomes elderly patients experience with liver resections.

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Acceptable long-term survival in patients undergoing liver resection for metastases from noncolorectal, non-neuroendocrine, nonsarcoma malignancies.

J. Hawel, K. Croome, D. Quan, R. Hernandez. **From the London Health Sciences Centre, London, Ont.**

The benefits of liver resection in the setting of colorectal cancer and neuroendocrine metastasis are well described. The role of liver resection for noncolorectal, non-neuroendocrine, nonsarcoma metastases (NCNNNS) remains ill-defined. This study aimed to examine long-term outcomes in patients undergoing liver resection for NCNNNS metastases and compare them to a cohort of patients undergoing resection for colorectal liver metastases (CRLM) during the same period.

A retrospective analysis of our prospectively maintained database was performed to identify all patients who underwent liver resection for true hematogenous NCNNNS metastases from 1998 to 2012. Liver resection was offered on a case by case basis to patients with stable disease. Survival in patients with NCNNNS metastases was compared with patients who underwent resection for CRLM during the same period on Kaplan–Meier curves.

We identified 28 patients who underwent liver resection for NCNNNS. Overall 5 year survival was 55%: 100% for adrenal metastases, 61% for breast metastases, 50% for ocular melanoma, 32% for renal cell carcinoma, 32% for gastresophageal and 68% for other. Overall 5 year survival in our cohort undergoing resection for CRLM was 57%. There was no significant difference in survival between patients undergoing resection for NCNNNS and CRLM based on Kaplan–Meier curves ($p = 0.17$).

Liver resection is an effective option in the oncologic management of highly selected patients with metastatic NCNNNS malignancies. Despite the small size and retrospective nature of our study, we have demonstrated a 5 year survival comparable to that for CRLM in carefully selected patients. Further, larger studies are required to help identify potential prognostic variables and aid in decision-making in this heterogeneous population.

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Patient and clinicopathological features and prognosis of CK19+ hepatocellular carcinomas: a case–control study.

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Cytokeratin 19 (CK19) expression is a poor prognostic factor for hepatocellular carcinoma (HCC). However, given the scarcity of CK19+ HCC cases, few studies have looked at these tumours. The objective of this study was to identify patient and clinicopathological features that differentiate CK19+ and CK19– HCCs and to describe the survivorship of these patients postresection.

In all, 386 patients who underwent liver resection for HCC between 1992 and 2011 at our institution were identified through retrospective chart review. Of these, 11 CK19+ HCC cases were identified and matched 1:2 with CK19– HCC controls on underlying liver disease and number of tumours. Age, microvascular invasion and tumour size were statistically adjusted for in regression models.

The mean average age for patients ($n = 11$) and controls ($n = 22$) was 63 years (standard deviation [SD] 11 and 13 yr, respectively), and the majority was male (patients 73%, controls 68%). The most common underlying liver disease was hepatitis B (55%). Most patients' largest lesions were between 2 and 5 cm (patients 70%, controls 70%), and most had no microvascular tumour invasion (patients 64%, controls 71%). Whereas CK19+ HCC tumours initially appeared to be associated with poor tumour grade (OR 10.67, 95% CI 1.91–59.62), this association was null after multivariate adjustment. Being overweight/obese, receiving hepatitis treatment preresection and tumour size on preoperative imaging were not significantly associated with CK19+ HCC tumours. Postresection, median overall survivals were 30 and 44 months, whereas median survivals after recurrence were 19 and 30 months for patients and controls, respectively.

To our knowledge, our study represents the largest series of CK19+ HCC cases outside of Asia. Congruent with previous findings, patients with CK19+ HCC tumours appear to have shorter survivorship. Patient and clinicopathological features differentiating CK19+ and CK19– HCC tumours were not identified.

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The management of blunt hepatic trauma in the age of angioembolization: a single centre experience. ***K. Bertens, K.N. Vogt, R. Hernandez-Alejandro, D.K. Gray.*** **From the University of Western Ontario, London, Ont.**

Nonoperative management (NOM) of blunt hepatic injury (BHI) is increasingly common. Although the literature suggests that overall mortality has decreased, liver-related morbidity remains high. This study was undertaken to explore the management of BHI during the age of angioembolization (AE) at a single centre.

Patients for this retrospective cohort study were selected using our prospective trauma database. All trauma patients with BHI who were assessed at our lead trauma hospital from January 1999 to December 2011 were identified. Logistic regression was undertaken to identify factors increasing the likelihood of operative management (OM) and mortality.

In all, 396 patients with BHI were managed primarily at our centre. Their mean age was 38 (SD 18) years, mean injury severity score (ISS) was 33 (SD 14), and 62 (18%) patients had severe liver injuries (≥ AAST grade 4). Laparotomy occurred in 109 (44%) patients, with 71 (65%) requiring intervention for their liver injury (OM). Logistic regression revealed high ISS (OR 1.07, 95% CI 1.05–1.10) and lower systolic blood pressure on arrival (OR 0.98, 95% CI 0.97–0.99) to be associated with the need for OM. In all, 7 patients underwent a total of 8 hepatic AEs, 4 of which occurred for pseudoaneurysm formation identified on routine repeat CT imaging (24–48 h postinjury). All of these patients had a grade 4 liver injury. The overall mortality was 17%, with older patients (OR 1.05, 95% CI 1.03–1.07), those with higher ISS (OR 1.11, 95% CI 1.08–1.14) and those requiring OM (OR 2.89; 95% CI 1.47–5.69) more likely to die. Complications associated with liver injury management occurred with equal frequency in the OM (23%) and AE (25%) groups ($p = 0.67$). Only 3% of those with NOM experienced morbidity.

Though the majority of patients with BHI had successful NOM, AE is not commonly required for the management of BHI at our institution. Morbidity associated with NOM in our series was low. Patients requiring AE had morbidity similar to OM. Though patients with BHI are routinely assessed for delayed pseudoaneurysm formation, our data suggest that this practice may not be justified in patients with less severe liver injuries. Further studies are warranted to assess this association.

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Liver resections for noncolorectal and non-neuroendocrine metastases: an evaluation of oncologic outcomes. ***J.F. Rekman, J.M. Aubin, J.J. Fairfull-Smith, R. Mimeault, F.K. Balaa, G. Martel.*** **From the Liver and Pancreas Surgery Unit and the Division of General Surgery, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.**

The management of noncolorectal and non-neuroendocrine (NCNN) liver metastases is controversial. The objective of this work was to examine the oncologic outcomes of patients who underwent liver resection for NCNN metastases and to identify predictors of survival and disease recurrence.

A retrospective review of cases of liver resection for NCNN metastases was carried out (1994–2011). Consecutive patients were identified from health records and case records of surgeons. Relevant data were extracted. Descriptive continuous and dichotomous statistics were generated. Survival outcomes were analyzed using actuarial life tables and the Kaplan–Meier method. Predictors of survival were identified using the multivariate Cox proportional hazard method.

A total of 31 patients underwent liver resection for NCNN metastases (primaries: breast 16%, melanoma 16%, gastrointestinal stromal tumour [GIST] 13%, others 55%). None had known extrahepatic disease. Most (61%) had synchronous disease presentation (< 12 mo from primary surgery). Major liver resections (≥ 3 segments) were necessary in 32% of patients. The 90 day postoperative mortality rate was 3.2% ($n = 1$). R0 resection was achieved in 87% of patients. The actuarial 5 year disease-free survival was 25.2% (SE 0.0851). The actuarial 5 year overall survival was 42.6% (SE 0.0960). On multivariate analysis, R0 resection was predictive of disease-free survival (HR 0.188, 95% CI 0.054–0.658), whereas having a breast/melanoma/GIST primary was predictive of overall survival (HR 0.166, 95% CI 0.044–0.632).

Liver resection can be safely performed for NCNN metastases. Satisfactory oncologic outcomes can be achieved with R0 resection in selected patients. Those with breast/melanoma/GIST primary tumours may benefit most. A multi-institutional trial is warranted to test the role of metastatectomy against the best supportive systematic therapy.

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Developing an evidence-based clinical pathway for patients undergoing pancreaticoduodenectomy. ***A.C. Wei, K.S. Devitt, A. Ramjaun, S. Gallingher.*** **From the University Health Network, Toronto, Ont.**

Pancreatectomy is complex surgery that requires specialized expertise to perform safely. 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. Clinical pathways can bring evidence to the point of care. The objective of this project is to develop an evidence-based CPW for pancreatectomy.

Nominal group workshops were held at designated high-volume hepato-pancreato-biliary (HPB) centres in Ontario to establish institution-specific quality improvement needs in pancreatic surgery. These multidisciplinary groups identified and ranked key interventions. Qualitative and quantitative data were collected. Quantitative data were reported as frequencies. Qualitative data relating to potential barriers and enablers of CPW implementation were sought. A literature review was performed for each key intervention to determine best practice recommendations for the CPW.

We conducted 7 workshops with 78 participants: nurses (41%), allied health professionals (26%), HPB surgeons and trainees (25%) and anesthesiologists (8%). At present, considerable variation exists between surgeons and institutions in several processes of care for pancreatectomy. All sites identified a need for a CPW. There was high agreement on the essential CPW components (89% agreement on the primary CPW domains). Input from users is being incorporated into a final CPW.

Clinical pathways are an important quality improvement and knowledge translation tool that can be used to improve quality of care. We have worked with stakeholders to develop an evidence-based CPW for pancreatectomy. We anticipate that this quality improvement tool will be implemented at HPB sites in Ontario.

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Hepatitis C infection and hepatocellular carcinoma in liver transplant: a 20 year experience. ***S. Dumitra, S. Alabbad, D. Constantinos, M. Hassanein, J. Barkun, P. Metrakos, S. Paraskevas P. Chaudhury, J. Tchervenkov.*** **From the Department of Surgery, McGill University, Montréal, Que.**

Hepatitis C infection (HCV) and hepatocellular carcinoma (HCC) are 2 of the main causes of liver transplantation. Both HCV and HCC have been shown to reduce survival after orthotropic liver transplantation. We wanted to assess if HCV and HCC impact survival after orthotropic liver transplantation more when they occur together when compared with HCC or HCV alone.

Patients who underwent orthotropic liver transplantation ($n = 601$) at our institution from 1992 to 2011 were reviewed. Patients who died within 30 days ($n = 69$) or underwent retransplantation ($n = 49$) were excluded. Recipients were divided into 4 groups: those transplanted for other causes ($n = 252$, control group), those with HCC alone ($n = 58$), those with HCV ($n = 106$) and those with both HCV and HCC ($n = 67$). Demographics, donor risk index (DRI), model for end-stage liver disease (MELD) score, survival, complications within 90 days and tumour characteristics when available ($n = 113$) were collected. Statistical analysis was done using ANOVA for demographics, Cox or Kaplan–Mayer for survival, logistic regression for recurrence and χ^2 or Fisher exact tests for univarite analysis.

Groups were comparable for MELD, DRI, complications and length of stay in the intensive care unit, but HCC patients were older. After adjusting for age, MELD, sex and DRI, survival was lower in the HCC–HCV group (59% at 5 yr); the hazard ratio was 1.90 (95% CI 1.23–2.94, $p < 0.004$) and 1.45 (95% CI 0.98–2.11, $p = 0.057$) for HCC and HCV, respectively. The HCC survival was comparable to controls (1.16 [0.70–1.93], $p = 0.55$). Recurrence rates and recurrence-free survival for HCV and HCC were similar among groups. Tumour characteristics and pre-OTL treatment were similar except for Milan criteria (50% v. 31%, $p < 0.04$) and microvascular invasion (40% v. 22%, $p < 0.04$). Survival for HCC–HCV versus HCC alone remained lower (1.99, CI 1.02–3.87, $p < 0.04$) after correcting for tumour characteristics and treatment.

Patients with HCV have significantly lower survival after liver transplantation when compared with HCV-negative patients, whereas HCC alone had almost no impact on patient survival in our group. Patient survival is dramatically decreased when HCC and HVC are both present, but the attributable impact of HCV is greater than that of HCC.

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The effect of medication on the risk of post-ERCP pancreatitis. ***S. Koubi, M. Borgaonkar.*** **From the Memorial University of Newfoundland, St. John's, Nfld.**

Pancreatitis remains the most common and significant complication of ERCP. Previous observational studies have suggested a protective effect from various medications. We set out to determine the risk of post-ERCP pancreatitis in patients using unfractionated heparin (UFH), low molecular weight heparin (LMWH), nonsteroidal anti-inflammatory drugs (NSAIDs), nitrates and statins.

A database of all inpatient ERCPs performed by 1 therapeutic endoscopist that has been compiled prospectively was retrospectively reviewed from July 2000 to November 2008. The endoscopic and patient outcomes had been recorded prospectively. Medication exposure was determined by reviewing the electronic file for each patient. Exposure to the medications of interest within 1 week before the procedure was recorded. The rates of pancreatitis were compared between the different groups using χ^2 analysis. Logistic regression analysis was used to identify risk factors for the outcome of pancreatitis. Each medication was considered separately. When a patient was on more than 1 medication of interest, the interaction of the medications was analyzed. We used SPSS (version 17.0) to perform the statistical analysis; $p < 0.05$ was considered statistically significant.

A total of 494 patients were included in this study. The mean age of the patients was 59 ± 19.75 years; 46.8% were male. The overall rate of pancreatitis was 5.9% (5.2% in men and 6.5% in women); 144 patients received UFH, 13 received LMWH, 24 received NSAIDs, 26 received nitrates and 46 received statins within 1 week of the procedure. In univariate evidence, pancreatic filling with contrast medium was associated with an increased rate of pancreatitis: 2.4% in patients with no pancreatic filling and 11.2% in patients with any degree of filling ($p < 0.001$). Logistic regression found age and pancreatic filling to be risk factors for the occurrence of pancreatitis (OR 0.98, $p = 0.041$ and OR 5.12, $p < 0.001$, respectively). Use of UHF and NSAIDs showed nonsignificant trends toward reduction in the rate of pancreatitis (OR 0.685, $p = 0.38$ and OR 0.580, $p = 0.35$, respectively), whereas LMWH, nitrates, statins and the different combinations of the above medications did not show any significant effect.

Although there was a nonsignificant trend toward benefit in patients exposed to unfractionated heparin and NSAIDs, these results suggest that the medications of interest are not effective for prevention of pancreatitis post-ERCP.

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Temporal trends in the use of diagnostic imaging for patients with hepato-pancreato-biliary (HPB) conditions: How much ionizing radiation are we really using? ***J.-F. Ouellet, D. Tanyingoh, E. Dixon, G.G. Kaplan, R.P. Myers, T.J. Howard, F.R. Sutherland, N.J. Zyromski, C.G. Ball.*** **From the Departments of Surgery and Medicine, University of Calgary, Calgary, Alta., and the Department of Surgery, Indiana University, Indianapolis, Ind.**

Ionizing radiation from medical imaging has been indirectly linked with subsequent cancers. Whereas the general population's background radiation exposure is 1–3 mSv/year, the mean effective dose for common medical tests (CT abdomen/pelvis 8 mSv, endoscopic retrograde cholangiopancreatography [ERCP] 12 mSv) is significantly higher. The primary goal of this study was to define the temporal trends and effective radiation dose associated with diagnostic imaging for inpatients with hepato-pancreato-biliary (HPB) conditions.

Using the Healthcare Cost and Utilization Project Nationwide Inpatient Sample (NIS) database from 2000 to 2008, specific liver and pancreas ICD-9 diagnostic/procedural codes were matched to relevant imaging modalities obtained during hospital admissions.

In total, 17.1%, 15.4% and 7.8% of patients admitted for pancreatitis, pancreatic neoplasms and liver malignancies, respectively, underwent a diagnostic imaging examination. A decrease in

the total number of imaging tests across all diagnoses was observed over the study interval. This was most obvious in patients with pancreatitis. The specific use of CT decreased for all conditions, whereas ERCP remained the most common imaging modality performed for pancreatic neoplasms. Although ERCP use decreased significantly in patients with pancreatitis, intraoperative cholangiography remained frequent and stable. For patients with pancreatic and liver conditions overall, MRI remained infrequent, although its use did increase in pancreatitis over time.

Patients admitted with a pancreatic condition are more likely to require a diagnostic imaging exam than patients with liver diagnoses. This correlates with the complexity and potential complications associated with pancreatic diseases. Education of physicians regarding the potential side effects of radiation may account for decreased CT use over time.

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A phase II study of aggressive metastasectomy for intra- and extrahepatic metastases from colorectal cancer. ***A.C. Wei, N. Coburn, C.-A. Moulton, S.P. Cleary, C.H. Law, P. Greig, G. Steven.*** **From the University Health Network and the Sunnybrook Health Sciences Centre, Toronto, Ont.**

Resection of intrahepatic metastases (IHM) from colorectal cancer (CRC) is associated with an excellent 5 year survival of up to 60%, but as many as 80% of patients are ineligible for liver resection, many owing to the presence of extrahepatic metastases (EHM). The objective of this study was to evaluate the results of complete metastasectomy for patients with IHM and EHM from CRC.

A phase II study of metastasectomy for both IHM and EHM from CRC was conducted at 2 high-volume hepato-pancreato-biliary (HPB) centres. Eligible patients with resectable IHM and up to 3 foci of EHM were identified prospectively and offered metastasectomy. Clinical and survival data were analyzed using standard statistical methods.

In all, 25 patients were enrolled with a median age of 57 (32–84) years; 14 of 25 (56%) patients presented with synchronous disease. The median number of IHM, EHM and combined sites were 2, 1 and 3, respectively. The lung was the most common site of EHM (12 of 25, 48%). Protocol surgery was completed in 18 of 25 (72%), including 11 of 25 (44%) planned sequential resections. Perioperative morbidity and mortality was 11 of 25 (44%) and 1 of 25 (4%), respectively. At last follow-up, 21 of 25 (84%) had developed recurrent disease, with a median disease-free survival of 6 months.

Complete metastasectomy of multisite CRC is feasible and safe. However, disease will recur in the majority of patients. Thus, metastasectomy for multisite CRC metastases should still be considered experimental, and these procedures should be performed in the context of a clinical trial.

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Why do women choose mastectomy for breast cancer treatment? A conceptual framework for understanding surgical decision-making in early-stage breast cancer. ***A. Covelli, N. Baxter, M. Fitch, F. Wright.*** **From the Institute of Health Policy Management and Evaluation, the Keenan Research Centre of the Li Ka Shing Knowledge Institute of St. Michael's Hospital, the Odette Cancer Centre at Sunnybrook Health Sciences Centre, the University of Toronto, Toronto, Ont.**

Mastectomy rates (ipsilateral and contralateral) as treatment for early-stage breast cancer have been increasing since 2003. Although we know women who are candidates for breast-conserving therapy are choosing mastectomy, we do not know why. Surgical decision-making is a complex, multicontext process. In light of these changing trends, it is important to have a better understanding of factors influencing decision-making; development of a conceptual model is a key step to guide further research.

We conducted a systematic review of the breast cancer literature in MEDLINE, EMBASE, CINAHL, PsychINFO and the Cochrane Database of Systematic Reviews. Both quantitative and qualitative studies underwent thematic analysis. Emergent themes were organized into a conceptual model.

A total of 417 studies were included in the thematic analysis. Overall, 4 major domains emerged as being influential in surgical decision-making: patient-related, surgeon-related, health care services and social/external environment. Within each of these domains, several key factors were identified.

- Patient-related: fear of recurrence/mortality, cosmesis, adjuvant treatment, social support systems, disease education, previous cancer experience, decision-making style
- Surgeon-related: location of practice, training, treatment preference as perceived by the patient
- Healthcare services: access to radiation and reconstruction
- Social/external environment: media representations, Internet information, social networking tools

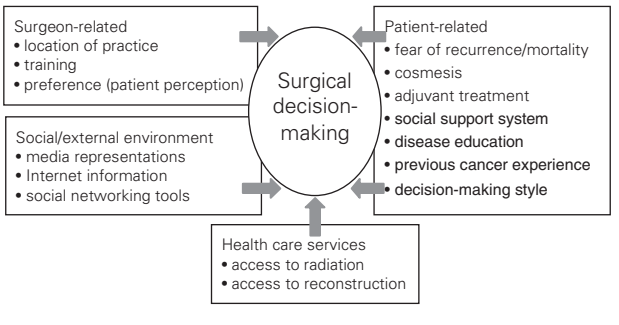

Fig., abstract 133. Factors that influence surgical decision-making in breast cancer: breast conservation therapy versus mastectomy.

Our thematic analysis revealed 4 major domains, each with a number of subfactors, which may variably influence the surgical decision-making process. Whereas we currently do not understand how these factors may influence mastectomy rates, our conceptual model serves as a valuable tool providing a foundation upon which future research can be established. Better understanding of the factors influencing decision-making will further promote our understanding of patient choices.

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Synoptic operative reporting: documentation of quality of care data for rectal cancer surgery. ***R. Maniar, D.J. Hochman, D.A. Wirtzfeld, A. McKay, C.S. Yaffe, B. Yip, R. Silverman, J. Park.*** **From the University of Manitoba, Winnipeg, Man.**

Operative reports can be used as a source of data to document the performance of quality of care indicators that affect the care of surgical patients. This study assessed the degree to which synoptic reports document pre- and intraoperative quality of care indicators for rectal cancer surgery compared with traditional dictated reports.

Two surgeons independently reviewed 40 prospectively collected synoptic operative reports from rectal cancer cases and a case-matched (surgeon and resection) historical cohort of 40 dictated reports. Two separate, previously validated checklists of rectal cancer–specific quality measures were used to score the degree to which the reports document the performance of these care indicators.

Synoptic reports had significantly higher overall scores compared with dictated reports on both checklist 1 (mean adjusted score ± standard deviation 76 ± 4 v. 41 ± 19, $p < 0.01$) and checklist 2 (mean adjusted score 54 ± 3 v. 24 ± 11, $p < 0.01$; maximum score of 100 for both checklists). Checklist 2 contained 3 individual subsections. The synoptic reports had significantly higher scores on the preoperative evaluation and intraoperative care subsections, but not the patient-provider discussion section. Data were extracted significantly more quickly from synoptic reports than dictated reports (mean 3:46 v. 6:21, minutes:seconds per report to complete both checklists, $p < 0.05$).

Synoptic reports were associated with improved documentation of quality of care data for rectal cancer surgery. This finding was confirmed using 2 separate quality of care indicator checklists. However, our analysis also shows that there is still room for improvement as we continue to refine our synoptic templates to better document quality measures and enhance reporting standards for complex oncologic procedures.

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Learning curve analysis for cytoreductive surgery: a useful application of the cumulative sum (CUSUM) method. ***S. Sun, Y.J. McConnell, W.J. Temple, L.A. Mack.*** **From the Departments of Oncology and Surgery, University of Calgary, Tom Baker Cancer Centre, Calgary, Alta.**

Cytoreductive surgery (CRS) with hyperthermic intraperitoneal chemotherapy (HIPEC) for peritoneal malignancy is complex surgery associated with major morbidity rates of 29%–54%. This morbidity rate appears to decline as surgeons undergo a "learning curve" (LC) for CRS+HIPEC. Methods for quantifying this learning curve have not yet been explored. Cumulative sum (CUSUM) graphing plots the cumulative deviation of a process from an established target; LC-CUSUM analysis estimates the number of cases required to achieve a threshold limit, given preset values for type I/II errors.

Our goal was to use CUSUM and LC-CUSUM analysis techniques to quantitate the learning curve associated with CRS+HIPEC at a high-volume Canadian centre.

Using a prospective database maintained by the operating surgeons, sequential patients who underwent primary CS+HIPEC between January 2000 and December 2010 were included. Their clinicodemographic characteristics and perioperative morbidity (Dindo-Clavien grade III/IV/V) were extracted. Graphing (CUSUM) was conducted for target major morbidity rates of 0.20. 0.25. 0.30, 0.35 and 0.40. Analysis (LC-CUSUM) was conducted for the same range of target major morbidity rates, with $\alpha = 0.05$ and $\beta = 0.20$. Ethics review board approval was obtained (IRB#25871).

A total of 197 patients were included, of whom 72 (36.5%) experienced a major complication. The CUSUM graphing analysis demonstrated stabilization of the learning curve for target morbidity rates of 0.30–0.40. The LC-CUSUM analysis signalled completion of the LC at 138 cases for a target morbidity of 0.30–0.40, and 91 cases for a target morbidity of 0.35–0.45.

Major morbidity following CRS+HIPEC is common. There is a substantial learning curve, estimated at 90–140 cases using LC-CUSUM analysis, associated with achieving a stable rate of 30%–40% morbidity.

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Pancreatic cancer is strongly associated with a unique urinary metabolomic signature. ***V.W. Davis, D.E. Schiller, O.F. Bathe, M.B. Sawyer.*** **From the University of Alberta, Edmonton, Alta., and the University of Calgary, Calgary, Alta.**

Earlier detection of pancreatic cancer could improve outcomes, and metabolomic technologies are being developed for noninvasive screening. We applied metabolomics as a potential discriminating tool in the diagnosis of early stage pancreatic cancer, and propose to establish a clearly defined metabolomic signature for early stage and locally advanced pancreatic adenocarcinoma.

Urine samples from pancreatic cancer patients ($n = 32$) and healthy age- and sex-matched controls ($n = 32$) were examined with ^{1}H-NMR spectroscopy. Paired samples were also analyzed in a subset ($n = 20$) comparing pre– and post–complete R0 resection. Targeted profiling of Chenomx NMR spectra quantified 66 discrete metabolites. Unsupervised (principal component analysis) and supervised (orthogonal partial least squares discriminant analysis [OPLS-DA]) multivariate pattern recognition techniques were then applied using SIMCA-P$^+$ software.

Definitive separation was observed between urinary metabolite concentrations in pancreatic cancer versus healthy controls ($p < 0.001$), and clear distinction was noted with OPLS-DA. Goodness of fit (R^2) and predictive capability (Q^2) were high ($R^2 = 0.40$, $Q^2 = 0.60$). Model validity was confirmed using cross validation and permutation testing. Sensitivity and specificity of multivariate OPLS-DA data were summarized with receiver operating characteristics, with an area under the curve (0.98), demonstrating strong predictive power. Preliminary analysis further suggests that the pancreatic cancer metabolomic signature was extinguished following R0 resection.

Thus, urinary metabolomic profiles were distinctly different in pancreatic cancer versus healthy controls, and suggest that metabolomics could be used both for early cancer detection and discovery of novel biomarkers.

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Concurrent neoadjuvant chemo/radiation in locally advanced breast cancer. ***M. Brackstone, L. Scott, T. Vandenberg, F. Perera, K. Potvin, A. Chambers.*** **From the London Regional Cancer Program, London, Ont.**

Locally advanced breast cancer (LABC) represents 15% of all new breast cancers, with a 5 year survival of 30%–42% using standard treatment that includes neoadjuvant chemotherapy, surgery and adjuvant radiation. Although requiring multimodal therapies, these patients are typically managed and diagnosed by surgeons.

Given the poor prognosis of this patient cohort, we devised to alter the sequence of therapy to take advantage of radio-sensitizing chemotherapy, as is typically done for head and neck, lung, cervical and rectal cancers. Pathological complete response (pCR) at surgery is considered the surrogate marker for overall survival following neoadjuvant chemotherapy.

In total, 32 patients with stage III LABC were enrolled at a single institution between 2009 and 2011. They were treated with neoadjuvant 5-fluorouracil, epirubicin and cyclophosphamide every 3 weeks followed by weekly docetaxel (35 mg/m^2) concurrently with regional radiation for the first 6 of 9 weeks. Patients underwent serial technetium 99m sestamibi single emission computed tomography/CT imaging with correlative tumour biopsy samples to assess markers of drug efflux pump expression as a function of resistance to chemotherapy; this was followed by modified radical mastectomy. Patient toxicity included grade 3 radiation pneumonitis and grade 3 dermatitis in 6 patients, 1 treatment-related death from acute respiratory distress syndrome and 1 disease progression resulting in discontinuation of protocol.

Overall, almost 30% of patients achieved a pCR, which is double the historical rate of 15% in this patient population over the past 5 years in Ontario. This study is the first to use a full chemotherapy regimen with radiation in the neoadjuvant setting. Although this regimen was not without its toxicities, concurrent chemo/radiation appears to significantly improve the surrogate measure for survival in this high-risk group.

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Impact of positron emission tomography on clinical staging of newly diagnosed rectal cancer: a specialized single centre

retrospective study. ***R. Boissonneault, R. Loungnarath, É. DeBroux, S. Lavertu, D. Donath, J.-P. Ayoub, M. Tehfé, C. Richard.*** **From the University of Montréal, Montréal, Que.**

Positron emission tomography–computed tomography (PET-CT) may be useful in the staging of primary rectal cancer (RC) patients. Its true value remains uncertain in the initial work-up. It is currently not part of staging guidelines. The goal of this study was to evaluate the impact of selective use of PET-CT on initial staging and management of primary RC in our institution.

The files of patients who underwent PET-CT for initial RC staging from 2006 to 2009 were reviewed. The PET-CT was performed based on the clinical judgment of the treating surgeon. Pre–PET-CT stage and treatment plan were compared with post–PET-CT findings. Proportions of up- and down-staging of disease were assessed.

In total, PET-CT was performed in 116 patients. In 53.4% of these patients, there was an indeterminate finding upon pre–PET-CT staging. Pretreatment staging was as follows: T3/T4 in 88.8% and 56.0% node positive. Imaging led to a stage modification in 40.5% of patients (95% CI 32.0%–49.6%) when considering M1a and M1b separately. The PET-CT was deemed accurate in at least 76.6% of cases (95% CI 68.9%–84.3%), whereas 14.7% of patients (95% CI 8.2%–21.1%) had a change of surgery plan. A change in treatment intention occurred in 14.7% of the patients (95% CI 9.4%–22.2%). The PET-CT imaging provided new or helpful information in 65.6% of patients (95% CI 57.0%–74.2%).

Based on our study, PET-CT lead to significant changes in staging and management in a high proportion of locally advanced rectal cancer patients. The test is especially of value in patients with indeterminate findings. Considering morbidity issues in the treatment of patients with locally advanced RC, accurate staging is crucial, and PET-CT may be of benefit.

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An evaluation of intraoperative Faxitron microradiography versus conventional specimen radiography for the excision of nonpalpable breast lesions. ***S.H.H. Kim, S.D. Cornacchi, B. Heller, F. Farrokhyar, M. Babra, P.J. Lovrics.*** **From McMaster University, Hamilton, Ont.**

This study examines the impact of Faxitron (FT) microradiography in comparison to conventional specimen radiography (CSR) for nonpalpable breast cancers undergoing breast-conserving surgery (BCS).

This is a retrospective, cohort analysis of consecutive image-detected nonpalpable breast lesions that underwent BCS with preoperative localization. We reviewed 105 cases using CSR performed before July 2009 and 96 cases using FT after July 2009. Data on patient, tumour and surgical factors were collected. Univariate and multivariable regression were performed to determine the independent predictors of operative time and positive margins.

Of the 216 cases identified, 201 underwent BCS with specimen radiography for malignancy. Patient and tumour characteristics were similar in both groups (e.g., BMI, tumour size, lesion type). The rate of cavity margin resection was the same for the FT and CSR groups (13.3% v. 20.8%, $p = 0.157$). Using univariate analysis, CSR resulted in more positive margins in primary specimens than FT (26.6% v. 12.7%, $p = 0.023$). After cavity margins were resected, CSR also resulted in more positive (19% v. 6.2%, $p = 0.012$) or positive/close margins (< 1 mm) (28.6% v. 15.6%, $p = 0.028$). Total operative time and reoperation rates were not affected by CSR or FT. With multivariable analyses, predictors of longer operative time were type of surgery performed (i.e., breast plus nodes), total specimen volume and number of additional cavity margins excised (all $p < 0.001$). Independent predictors of positive margin status were CSR (OR 3.0, 95% CI 1.01–8.4), microcalcifications on mammogram (OR 4.1, 95% CI 1.2–13.7), need for bracketing for localization (OR 3.3, 95% CI 1.2–8.8) and no cavity margin excision (OR 2.9, 95% CI 1.0–8.0).

In this study, utilization of intraoperative FT resulted in fewer positive and close margins after BCS in both univariate and multivariable analyses, though operative times were similar.

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Comparison of breast cancer treatment wait-times in the Southern Interior of British Columbia in 2006 and 2010. ***C. Baliski, C. Liberto.*** **From the BC Cancer Agency, Kelowna, BC**

Breast cancer is the most common malignancy in Canadian women. Because of the continued competition for resources and increased complexity of care, wait times for breast cancer treatment are an important issue. We sought to study the wait times for breast cancer care at our regional cancer centre.

Women with early diagnosed breast cancer, treated with surgery and referred to the BC Cancer Agency (BCCA) Centre for the Southern Interior (CSI) for adjuvant treatment were retrospectively analyzed via chart review.

We look at 2 separate time periods. For cohort 1, women with oncological consultations in 2006 were included ($n = 353$). For cohort 2, women with oncological consultations in 2010 were included ($n = 433$). Various factors, such as immediate reconstructive surgery, treatment types, age, use of MRI and number of biopsies performed were analyzed for their effect on wait times.

The median elapsed times from first diagnostic imaging test to first definitive oncologic procedure were 50 and 53 days in 2006 and 2010, respectively. Meanwhile, the median elapsed time from first diagnostic imaging test to first oncological consultation was 93 and 95.5 days in 2006 and 2010, respectively. Factors that were observed to influence wait times include immediate breast reconstruction, location of surgery, stage of disease, patient age and number of biopsies performed.

There was no observable difference between cohorts in wait times from first diagnostic imaging test to first oncologic procedure or to first oncologic consultation. There were differences from cohort 1 to cohort 2 in the time intervals between appointments/treatments, but these changes did not have an effect on the comprehensive wait times. Breast reconstruction, location of surgery, stage of disease, young age and number of biopsies impacted wait times.

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Factors affecting lymph nodes harvest in colorectal carcinoma. ***S. Gazala, S. Ghosh, R. McLean, D. Schiller.*** **From the University of Alberta and the Cross Cancer Institute, Edmonton, Alta.**

Colorectal cancer (CRC) is the second most common cause of cancer death. Lymph node (LN) involvement is the most important

prognostic factor in CRC staging. A minimum harvest of 12 LNs is recommended by several guidelines, but LN harvest can still be quite variable in Edmonton. This study was designed to determine the factors affecting LN harvest of 12 or more as we divided them to surgical, pathological and tumour-related factors.

Between July 2007 and July 2009, data on 220 patients who underwent surgical resection for CRC at 2 tertiary care hospitals were retrospectively collected. Factors examined were related to the surgery, pathologic examination, patient and the tumour. Univariate and multivariate analyses were performed to identify factors associated with LN harvest of 12 or more.

The mean age of patients was 68.5 (SD 13.5) years, the ratio of male:female patients was 135:85, and the ratio of colon:rectal cancer was 159:61. On univariate analysis, factors associated with LN harvest of 12 or more were: advanced T-stage ($p < 0.05$), tumour site ($p < 0.05$), institution ($p < 0.05$), procedure urgency ($p < 0.1$) and use of neoadjuvent therapy ($p < 0.5$). On the multivariate analysis, only the T-stage, tumour site and the institution were significantly associated with LN harvest of 12 or more ($p < 0.05$).

The number of LNs harvested was highly inconsistent in patients who underwent CRC resection in the 2 institutions in Edmonton. As others have observed previously, tumour-related factors, specifically T-stage and tumour site, were the most important factors associated with LN harvest of 12 or more. We also found a significant difference on LN harvest depending on the institution where the procedure was performed.

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Laparoscopic adrenalectomy for metastases. ***U. Hameed, T.D. Jackson, A. Okrainec, T.P. Penner, D.R. Urbach.*** **From the University Health Network and University of Toronto, Toronto, Ont.**

Adrenalectomy has been shown to increase survival for isolated metastases to the adrenal gland. Here we show our experience in managing metastases laparoscopically.

A retrospective review was performed of 13 laparoscopic adrenalectomies performed for adrenal metastases out of a total 174 laparoscopic adrenalectomies performed between November 2003 and October 2011. Of the metastases, 11 were resected using the transperitoneal approach and 1 using the retroperitoneal approach. The primary tumour was lung in 54% (7 of 13) of the patients, hepatocellular carcinoma in 2 patients, sarcoma in 2 patients and either renal cell carcinoma or melanoma in the 2 remaining patients. Demographic data collected included age, blood loss, tumour size, operating time, complications and length of hospital stay. We used the Kaplan–Meier estimator to assess survival.

The median tumour size of resected metastases was 3 (range 1–11.4) cm, operating time was 135 (range 90–305) minutes, and estimated blood loss was 50 mL (range 0–5.3 L). The median length of stay was 2 (1–16) days. There was 1 conversion to open owing to bleeding, and 1 patient had an intraoperative splenic injury, which was managed conservatively. Median survival was 35 months, and 46% of patients were alive 1 year postoperatively.

Laparoscopic adrenalectomy is a safe option in managing adrenal metastases in selected patients.

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You have a message! Social networking as a motivator for fundamentals of laparoscopic surgery (FLS) training. ***M. Sudarshan, S. Dumitra, J. Duplisea, S. Wexler.*** **From the McGill University Health Centre, Montréal, Que**

Wiggio is an online social networking tool that allows learners to work in groups. The purpose of this study was to assess whether using Wiggio impacts practice patterns and performance of Fundamentals of Laparoscopic Surgery (FLS) manual skills.

After baseline testing, R1 and R2 general surgery residents were randomized into control (C) and Wiggio (W) groups. Online tutorials and log sheets were distributed, and each group practised without proctoring. Residents in the Wiggio group interacted with each other via the Wiggio website. The website moderator sent motivational messages, calendar reminders and FLS-related articles. Best times and progress graphs were posted online. After 4 weeks, all residents underwent FLS testing.

In all, 14 residents were enrolled in the study. Twice as many residents in the Wiggio group practised compared with the control group (W 4 v. C 2); they had more practise events (W 14 v. C 4) and spent more time practising in the laboratory (1035 v. 480 min), although results were not statistically significant. During practise sessions, proficiency scores were achieved for 40% of the tasks in the Wiggio group compared with 8.6% in the control group (NS). The FLS scores were similar at baseline (C 56.9 v. W 57.6, $p = 0.93$). Final scores in both groups improved scores in the Wiggio group, but were not better than the control group (C 76.5 v. W 73.3, $p = 0.73$).

Participation in Wiggio seems to increase practice events and time spent in the laboratory for FLS training. Social networking can play a role in surgical education and learner motivation. The optimal use of Internet technologies in resident education remains to be explored.

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The evaluation and validation of a rapid diagnostic and support clinic for women assessment for breast cancer. ***A. Arnaout, J. Seely, J. Smylie, K. Knight, S. Robertson, J. Watters.*** **From The Ottawa Hospital, Ottawa, Ont.**

The diagnostic phase of care is an extremely anxiety-provoking and stressful experience for the potential breast cancer patient and her family.

A multidisciplinary team of breast cancer specialists in a regional referral centre embarked on a new initiative to set up a rapid diagnosis and support (RADS) program to coordinate the diagnostic imaging work-up, needle biopsy and pathological diagnosis for women with suspicious findings on their initial diagnostic mammogram. A prospective study was performed to evaluate the effectiveness this service delivery model aimed at reducing wait times, decreasing the fragmentation of care and enhancing a patient's overall experience.

Consecutive patients with initial diagnostic mammograms who received a Breast Imaging Reporting and Data System (BIRADS) score of 5 were invited to participate in the study. Interventions included prioritizing biopsy appointments, initiating follow-up diagnostic imaging, providing support and coordination of care by a nurse navigator. Wait times were evaluated at 3 different intervals: from diagnostic imaging to biopsy, from biopsy to pathology report verification and from diagnostic imaging to MRI. Patient satisfaction surveys were completed. All data postintervention were compared with historical data at our breast centre.

A total of 88 patients with a BIRADS score of 5 consented to the study between March and September 2011; 82 (93%) patients had either invasive carcinoma or ductal carcinoma in situ that necessitated surgery. All wait times significantly improved after initiation of the RADS clinic. Biopsy wait times improved from a mean of 6 to 2 days ($p < 0.0001$), pathology verification from 4 to 3 days ($p = 0.03$) and MRI wait times from 9 to 7 days ($p = 0.017$). In all, 85 (97%) patients rated the care and support they received from RADS clinic as "excellent" or "very good," and 97% of patients felt completely satisfied that they were cared for in a timely manner.

The RADS clinic significantly improved diagnostic wait times and overall experience for patients with a highly probable diagnosis of breast cancer.

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Oncoplastic breast surgery: oncologic benefits and limitations. ***D. Wedman, T. Zhang, A. Arneout.*** **From The Ottawa Hospital, Ottawa, Ont.**

Breast-conserving surgery (BCS) is a valuable part of breast cancer treatment, with a survival outcome equivalent to that of mastectomy. Recently, oncoplastic surgery (OPS) has been popularized as a method to improve margins and yield better aesthetic outcomes when traditional lumpectomy either anticipates poor results or is not possible. This study was undertaken to examine the oncologic benefits and limitations of this technique.

This was a retrospective review of the surgical outcomes of all patients offered BCS at a tertiary care hospital from 2008 to 2011. Patients were divided into 3 groups: the traditional lumpectomy group (no attempt was made to close the defect), OPS level 1 group (less than 20% of breast tissue excised; general undermining to close the defect) and OPS level 2 group (skin resection, greater than 20% of breast tissue excised), which included batwing resection, Binelli mastopexy, reduction and J/raquet mammoplasties. A survey was performed to assess patient satisfaction.

A total of 310 patients had BCS: 106 patients in the traditional, 156 patients in OPS 1 and 45 patients in the OPS 2 group. There was no significant difference in the proportion of ductal carcinoma in situ (DCIS), invasive disease histology, estrogen receptor, progesterone receptor, Her 2 status or postoperative complication rate between all 3 groups. Patients in the OPS II group were significantly younger than ($p = 0.036$) and had negative margins with significantly larger tumours ($p = 0.013$) and greater multifocality ($p = 0.018$) than the traditional group. Among DCIS patients, those in the OPS II group had significantly wider margins ($p = 0.022$). Both OPS groups achieved adequate resection of tumours in cosmetically difficult areas, such as the lower inner/outer quadrants ($p = 0.01$), and a high level of patient satisfaction was noted despite larger weights of excision ($p = 0.007$).

Oncoplastic surgery extends the scope of BCS, allowing for resection of larger, multifocal tumours in traditionally cosmetically difficult quadrants of the breast, without greater postoperative complication rates.

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A qualitative study on rectal cancer patients' preferences for location of surgical care. ***M. Nostedt, D. Hochman, D. Wirtzfeld, A. McKay, B. Yip, C.S. Yaffe, R. Silverman, J. Park.*** **From the University of Manitoba, Winnipeg, Man.**

Multiples authors argue for the regionalization of health care services based on studies showing an association between hospital volume and outcomes for major cancer surgeries, but few studies have examined patients' preferences in these contexts. This study qualitatively assessed rectal cancer patients' preferences and the factors they consider when deciding on location of surgical care.

We conducted semistructured telephone interviews with patients with stage I–III rectal cancer ($n = 18$) from rural Manitoba who were about to undergo surgery at a tertiary care centre. We asked open-ended questions on factors they considered when deciding on treatment location and their satisfaction with their decision. Two researchers analyzed the transcribed interview data for emergent themes using a grounded theory approach.

Participants' reasons for undergoing surgery at a tertiary care centre reflected 3 major themes: the point of referral, treatment factors and personal factors. At the point of referral, the referring physician often did not present an option to have surgery elsewhere, or participants asked for a tertiary care centre referral because of treatment-related factors. Treatment factors described how the hospital or surgeon might influence treatment or outcome. Personal factors, including travel, supports, accommodations and finances, were not necessarily primary considerations but still affected the treatment experience and often required participants' acquiescence.

Patterns of treatment location may only partly reflect patients' actual preferences. Patients are not always presented with options for treatment location, and the resulting travel impacts them and their support systems. We plan further studies to include referring physicians as well as patients who choose to have surgery at their local hospital, in order to better understand referral patterns and to support the decision-making and treatment processes.

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The effect of surgery on local recurrence in young women with breast cancer. ***P. Hebbard, N. Baxter, L. Yun, E. Rakovitch, F. Wright, E. Warner, D. McCready, N. Hodgson, M.L. Quan.*** **From the Foothills Medical Centre, University of Calgary, Calgary, Alta., St. Michael's Hospital, the Institute for Clinical Evaluative Sciences, the Sunnybrook Health Sciences Centre, the University Health Network, University of Toronto, Toronto, Ont., and the Juravinski Cancer Centre, McMaster University, Hamilton, Ont.**

Very young women with breast cancer are an understudied population at higher risk for recurrence. We sought to study the influence of type of surgery on local recurrence (LR) in this cohort.

We undertook a retrospective population-based cohort study including all women ages 18–35 with a diagnosis of stage I–III invasive breast cancer in Ontario from 1994 to 2003 identified through the Ontario Cancer Registry. Data were obtained through primary chart abstraction.

There were 1265 young women in our cohort: 560 (20%) had mastectomy (MX), 309 (24%) had mastectomy plus radiation (MX-RT), 79 (6%) had lumpectomy alone (L) and 626 (49%) had lumpectomy plus radiation (L-RT). Median follow-up was 12 years. Overall, LR was seen in 135 patients (11%). Median time to LR was 2.9 (IQR 1.4–5.9) years. Risk of LR was not different between MX and L-RT groups when controlling for known variables (Cox proportional HR 1.13, $p < 0.70$; see Table).

Local recurrence was higher than expected in this cohort,

Table, abstract 147. Multivariate analysis of the impact of various predictors of local recurrence

Variable	Overall local recurrence, hazard ratio (95% CI)		*p* value
Type of surgery			
Mastectomy	1.0		referent group
Mastectomy plus radiation	0.86	(0.47–1.6)	0.63
Lumpectomy alone	3.6	(1.9–6.7)	< 0.0001
Lumpectomy plus radiation	1.11	(0.67–1.8)	0.67
T stage			
T1	1.0		referent group
T2	1.4	(0.95–2.1)	0.086
T3	2.9	(1.5–5.4)	0.001
Lymphovascular invasion	1.4	(0.96–2.2)	0.073
Adjuvant chemotherapy	0.63	(0.40–1.0)	0.054

*Nonsignificant variables: socio-economic status, age, lymph node positivity, ER/PR/HER2 status, histology, grade, multicentricity, multifocality, neoadjuvant chemotherapy and hormonal therapy

regardless of surgery. Mastectomy offered no additional benefit over standard breast-conserving therapy in this high-risk patient population. Whereas the young patient population is at high risk of local recurrence, in well selected patients the use of standard breast conserving therapy does not worsen outcome.

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Elevated IL-6 and IL-8 levels in tumour microenvironment is not associated with increased serum levels in humans with Pseudomyxoma peritonei and peritoneal mesothelioma. ***S.J. Shetty, B. Natarajan, V. Govindarajan, P. Thomas, B.W. Loggie.*** **From the Creighton University Medical Center, Omaha, Nebr.**

Pseudomyxoma peritonei (PMP) and malignant peritoneal mesothelioma (MPM) are associated with inflammatory changes in the tumour microenvironment (peritoneal cavity). Elevated levels of cytokines IL-6 and IL-8 in ascites and in serum in patients with colorectal and ovarian cancers have been reported previously. We hypothesized a similar increase in these proinflammatory cytokines in ascites and serum of PMP and MPM patients.

Serum and ascitic fluid samples were collected pre- and intraoperatively from patients with PMP (n = 10) and MPM (n = 6) with ascites undergoing cytoreductive surgery with or without hyperthermic intraperitoneal chemotherapy. Serum samples were obtained from 6 healthy controls. Levels of IL-6 and IL-8 were measured in serum and ascitic fluid of these patients using Millipore's MILLIPLEX MAP Human Cytokine/Chemokine panel with Luminex technology. Data were analyzed using the Mann–Whitney U test for comparison between the groups.

High levels of IL-6 (median 1107.5, range 148–5322 pg/mL) and IL-8 (median 167, range 39.5–7201.5 pg/mL) were observed in ascitic fluid in PMP. Similar elevated levels of IL-6 (median 3703.5, range 17.7–42.7 pg/mL) and IL-8 (median 110, range 84.03–619 pg/mL) were observed in ascitic fluid in MPM. Serum IL-6 levels in PMP (median 3.18, range 1.41–4.41 pg/mL) and MPM (median 3.18, range 1.42–3.2 pg/mL) and serum IL-8 levels in PMP (median 1.59, range 1.52–33.31 pg/mL) and MPM (median 2.65, range 1.59–7.29 pg/mL) were not significantly greater than controls (p = 0.16). There was no significant difference between PMP and MPM in levels of ascitic fluid IL-6 (p = 0.96), ascitic fluid IL-8 (p = 0.74), serum IL-6 (p = 0.94) or serum IL-8 (p = 0.25).

IL-6 and IL-8 were markedly elevated in PMP and MPM ascitic fluid, and were 100- to 1000-fold higher than serum concentrations. Surprisingly, in contrast to colorectal cancers, serum levels of IL-6 and IL-8 were not elevated in MPM and PMP. Increase in levels of these cytokines in the ascites appear independent of their serum concentrations and likely reflect local inflammatory changes in the tumour microenvironment that allow for the growth and dissemination of these tumours within the peritoneal cavity. Future studies will be focused on understanding the relevance of these cytokines to PMP and MPM tumour biology and on analyses of a wider range of cytokines that can be used as inflammatory and/or tumour markers for PMP and MPM.

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Conversion from laparoscopic to open approach during gastrectomy: a population-based analysis. ***M. Dixon, S. Brar, A. Mahar, C. Law, N. Coburn.*** **From the Sunnybrook Research Institute, Toronto, Ont., the Department of Surgery, Maimonides Medical Center, Brooklyn, NY, the Department of Surgery, University of Toronto, Toronto, Ont., and the Department of Community Health and Epidemiology, Queen's University, Kingston, Ont.**

Many centres have adopted a laparoscopic approach to gastric cancer surgery. Little is known regarding conversion rates and reasons for converting from laparoscopic to open resections in these patients. The purpose of this study was to examine the rates and reasons why gastric resections were converted from a laparoscopic approach to open.

Using administrative data from the Ontario Cancer Registry, all patients between the ages of 18 and 99 years with a diagnosis of gastric adenocarcinoma between Apr. 1, 2005, and Mar. 31, 2008, were identified. All operative reports for these patients were reviewed for reasons for conversion.

A total of 1686 surgical procedures were performed on 1576 patients; 1090 procedures were gastrectomies, with 131 (12.0%) involving a laparoscopic or laparoscopic-assisted approach. Of the gastrectomies involving a laparoscopic approach, 12.2% were converted to an open approach. Common reasons for conversion from laparoscopic to an open approach were safety issues, technical issues (i.e., difficulty with dissection or difficulty identifying anatomic landmarks) and local invasion. Uncontrollable bleeding, adhesions and equipment issues were less common reasons.

The majority of laparoscopic resections for gastric cancer are successfully completed laparoscopically with a low conversion rate. Conversion rates may decrease with increasing experience with the laparoscopic approach.

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A scoping review of surgical process improvement tools (SPITs) in cancer surgery. ***A.C. Wei, K.S. Devitt, M. Wiebe, O.F. Bathe, R.S. McLeod, N.N. Baxter, A.R. Gagliardi, E.D. Kennedy, D.R. Urbach.*** **From the University Health Network, Toronto, Ont., the University of Calgary, Calgary,**

Alta., Mount Sinai Hospital, Toronto, Ont., and St. Michael's Hospital, Toronto, Ont

Surgical process improvement tools (SPITs) have been developed that focus on changing the processes of care as a means of quality improvement. This research project was designed to synthesize and integrate the current literature on SPITs.

A scoping review was conducted for instruments developed for quality improvement in surgery. The search was developed with input from key knowledge end users including the Canadian Association of General Surgeons, Cancer Care Ontario and the hospital-level surgical administrators. The search was executed on electronically indexed sources (MEDLINE, EMBASE and the Cochrane library) between January 1990 and March 2011. Quantitative and qualitative data extraction was performed for studies that met prespecified inclusion and exclusion criteria. Data were tabulated and reported thematically using a narrative synthesis approach. Results were used to develop a conceptual framework.

In total, 5635 abstracts were identified; 236 articles met inclusion criteria. The overall quality of the literature was poor. There were very few randomized controlled trials (12, 5%).The majority of these studies were designed as either an interventional (118, 50%) or observational (71, 30%) assessment of SPITs. Only 67 (28%) articles focused on cancer surgery. The most common SPITs were clinical pathways (133, 56%), enhanced recovery after surgery protocols (45, 19%) and fast-track protocols (45, 19%). Other SPITs included checklists (15, 6%), structured communication tools (24, 10%), patient care planning (15, 6), patient safety (5, 2%) and quality indicators (5, 2%). Reported outcomes included length of stay (178, 58%), morbidity (115, 49%), readmission rates (113, 48%), mortality (101, 43%) and cost (31, 13%).

Surgical process improvement tools are innovative knowledge instruments that can improve quality of care by optimizing care delivery. The results of this study will guide the design and development of new SPITs for use with patients undergoing cancer surgery.

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Splenectomy during gastric cancer surgery: a population-based study. *M. Dixon, S. Brar, A. Mahar, C. Law, N. Coburn.* From the Sunnybrook Research Institute, Toronto, Ont., the Department of Surgery, Maimonides Medical Center, Brooklyn, NY, the Department of Surgery, University of Toronto, Ont., and the Department of Community Health and Epidemiology, Queen's University, Kingston, Ont.

Splenectomy for patients undergoing gastrectomy with extended lymphadenectomy may be associated with worse outcomes and is no longer recommended in a D2 lymph node dissection. Splenectomy may be indicated, however, for locally advanced or adherent gastric cancer, and in cases of intraoperative complications including bleeding. The purpose of this study was to examine the indications for splenectomy in patients undergoing gastric cancer surgery.

Using administrative data from the Ontario Cancer Registry, all patients between the ages of 18 and 99 years with a diagnosis of gastric adenocarcinoma between Apr. 1, 2005, and Mar. 31, 2008, were identified. All operative reports for these patients were reviewed.

A total of 1686 surgical procedures were performed on 1576 patients. Of these procedures, 86 were splenectomies: 3 were not eligible for analysis, 74 splenectomies were performed in curative-intent gastric resections, and 9 were performed in noncurative and palliative-intent resections. Of 266 total gastrectomies, 21.8% required splenectomy: 6% were for bleeding and 15.8% for other reasons. Of 599 distal gastrectomies, 2.5% required splenectomy: 2.0% were for bleeding. Of 218 proximal gastrectomies/esophagogastrectomies, 4.6% required splenectomy: 2.8% were for bleeding and 4.6% for other reasons.

We found very low rates of splenectomy as part of a D2 lymphadenectomy. En bloc splenectomy for direct invasion and splenectomy for bleeding occurred most frequently in conjunction with total gastrectomy.

Table 1, abstract 151. Summary of the number of patients undergoing splenectomy, by surgical intent

Intent; type of gastric resection	No. undergoing splenectomy
Curative	
Total gastrectomy	53
Distal subtotal gastrectomy	12
Proximal subtotal gastrectomy/esophagogastrectomy	9
Noncurative and palliative	
All types of resection	9

Table 2, abstract 151. Indications for splenectomy, by type of resection

Type of gastric resection	No. (% overall)	For bleeding (% overall)	For other reasons (% overall)
Total gastrectomy	58 (21.8)	16 (6.0)	42 (15.8)
Distal subtotal gastrectomy	15 (2.5)	12 (2.0)	< 6
Proximal subtotal gastrectomy/esophagogastrectomy	10 (4.6)	6 (2.8)	10 (4.6)

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Defining the polo-like kinase 4 (Plk4) interactome in cancer cell protrusions. *K. Kazazian, F. Zih, C. Rosario, J. Dennis, A.-C. Gingras, C. Swallow.* From the Samuel Lunenfeld Research Institute, Mount Sinai Hospital, Division of General Surgery, University of Toronto, Toronto, Ont.

High expression of polo-like kinase 4 (Plk4), a serine/threonine kinase active from S through M phases of the cell cycle, is an indicator of poor prognosis in patients with breast and pancreas cancer. Whereas Plk4 is well known to have a specialized function in the centrosome cycle, recent work from our laboratory has shown a novel function for Plk4 in promoting cell movement. Our recent identification of Plk4 at the tips of protrusions in motile cells has prompted our interest in defining the interacting proteins that mediate Plk4 motility and activity in cell protrusions.

HeLa cells were used as a model system to study the effect of up- and downregulation of Plk4 on motility-related phenotypes. To isolate protrusions, cells were plated onto polycarbonate filters allowing for pseudopodial invasion through the filter pores in response to serum in a bottom chamber.

A distinctive spreading phenotype with increased number and length of filopodia was noted in Flag-Plk4 transfected HeLa cells,

whereas Plk4 siRNA caused impaired spreading and a rounded cell morphology. Protrusions were isolated from cell bodies with an optimal filter pore size of 1 μm, and the purity of the protrusion fraction was confirmed by probing for Hsp-70. Interaction proteomics has identified several known and unknown Plk4 interacting proteins in Plk4-transfected cells.

Plk4 promotes protrusion formation and spreading in cancer cells. Mass spectrometry has successfully identified Plk4 interacting proteins, and will be used to characterize the protrusional Plk4 interactome, providing specific pathways to target in patients with Plk4-driven cancer progression. A deeper understanding of the mechanisms through which Plk4 modulates cancer cell invasion will help guide rational design and application of Plk4 inhibitors in cancer patients.

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Neoadjuvant imatinib mesylate for locally advanced gastrointestinal stromal tumours. ***M. Lemke, Y.-J. Ko, C. Rowsell, C.H.L. Law.*** **From the Sunnybrook Health Sciences, Toronto, Ont.**

Gastrointestinal stromal tumours (GIST) represent a small but important subset of gastrointestinal malignancies. Imatinib mesylate is well established as an effective therapy in the adjuvant and palliative setting; however, data regarding its role in neoadjuvant setting are limited for patients whose disease is determined to be technically unresectable.

All patients undergoing neoadjuvant therapy with imatinib mesylate (coordinated at a single academic institution) for downstaging for the purpose of conversion to surgical resectability were reviewed retrospectively and stratified by site of origin of the GIST, resection status, length of time on neoadjuvant imatinib therapy and mutational status. Patients were treated with imatinib mesylate until they were deemed to be appropriate surgical candidates by multidisciplinary case conferences. All tumours were sent for molecular analysis following resection.

A total of 17 patients were identified for this study from 2007 to 2012. Gastric (n = 10), small bowel (n = 5) and rectal (n = 2) GISTS were included. The overall median size of GISTs preoperatively was 15.0 (range 2.0–26.0) cm, compared with a median size of 7.1 (range 1.0–16.0) cm following neoadjuvant therapy. Median reduction in maximum tumour diameter (MR-MTD) was 14.3% for gastric tumours, 16.3% small bowel and 5.1% rectal. An R0 resection was accomplished in 13 (76.5%) patients. Of gastric patients, 10 (100%) were graded R0 as compared with 2 (40%) R1 in patients with small bowel tumours and 2 (100%) R1 in rectal GISTs. When the study population was stratified by R status, R0 patients had an MR-MRTD of 15.6%, whereas in R1 patients this was only 7.8%. When the patients were grouped by length of time on neoadjuvant therapy, patients on imatinib mesylate for 6–12 months had an MR-MTD of 14.4%, for 12–18 months it was 13.9%, and for longer than 18 months it was 18.1%. Finally, when patients were stratified by their final molecular analysis, their MR-MTD was 14.4% for exon 11, 5.1% for exon 9 and 23.4% if there was no identified mutation.

Neoadjuvant imatinib mesylate can significantly downstage unresectable GISTs to surgery. Our early experience shows that final success was best achieved with gastric GISTs in terms of ability to achieve an R0 resection, whereas our experience with small bowel and rectal GISTs continues to show the challenges of tumours initially deemed unresectable. However, significant size downstaging was achieved, and there may be further survival benefit of ongoing adjuvant imatinib mesylate following this strategy. Further study is warranted, but our early results show promise for patients who present with initially unresectable GIST malignancies.

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Implementing results from ACOSOG Z0011: Practice-changing or practice-affirming? ***B. Wells, R. Saskin, M.-L. Quan.*** **From the Division of General Surgery, University of Toronto, Toronto, Ont., the Institute of Clinical and Evaluative Sciences, University of Toronto, Toronto, Ont., and the Department of Surgery, University of Calgary, Calgary, Alta.**

Completion axillary lymph node dissection (cALND) has routinely been recommended in the case of a positive sentinel node in the treatment of early-stage breast cancer. The American College of Surgeons Oncology Group Z0011 trial results suggest that cALND may be omitted because sentinel lymph node biopsy (SLNB) alone provides excellent locoregional control and long-term survival. We sought to determine if results from the Z0011 trial supported current clinical practice.

Evaluation of SLNB quality and practice patterns for all patients diagnosed with early-stage breast cancer in Ontario between Jan. 1, 2005, and Dec. 31, 2005, has been previously reported by our group. A subgroup analysis was conducted to evaluate predictors of cALND after positive SLNB.

We identified 629 breast cancer patients with a positive SLNB. Patient and tumour characteristics are shown in the Table. Completion ALND was less likely in elderly women with small

Table, abstract 154. Demographic and disease characteristics for patients with a positive SLNB who did or did not undergo completion ALND

	Completion ALND; no. (%)		
SLNB variables	No	Yes	*p* value
Patient age, yr			< 0.01
< 50	32 (27.1)	177 (34.6)	
50– 69	57 (48.3)	275 (53.8)	
> 70	29 (24.6)	59 (11.5)	
Breast operation			0.22
Lumpectomy	72 (61.0)	319 (62.4)	
Mastectomy	42 (35.6)	186 (36.4)	
Missing	4 (3.4)	6 (1.2)	
1° tumour size, cm			0.02
≤ 1	14 (11.9)	49 (9.6)	
1– 2	44 (37.3)	196 (38.4)	
> 2– 3cm	30 (25.4)	139 (27.2)	
> 3	14 (11.8)	102 (19.9)	
Missing	16 (13.6)	25 (4.9)	
SLN metastases size			< 0.01
ITC	26 (22.0)	15 (2.9)	
Micrometastasis	39 (33.1)	72 (14.1)	
Macrometastasis	22 (18.6)	195 (38.2)	
Missing	31 (26.3)	229 (44.8)	

ALND = axillary lymph node dissection; ITC = isolated tumour cells; SLN = sentinel lymph node; SLNB = sentinel lymph node biopsy.

sentinel lymph node metastases. There was a trend toward cALND in patients with larger tumours. These results broadly mirror those of Z0011.

Population-level data reflecting SLNB practice patterns 5 years before the publication of Z0011 suggest that surgeons were already omitting cALND in lower risk groups, supporting the Z0011 findings.

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Should lymph node retrieval be a surgical quality indicator in colon cancer? ***R.P. Musselman, M. Xie, K. McLaughlin, C. Marginean, T.N. Moyana, H. Moloo, R.P. Boushey, R.C. Auer.*** **From the University of Ottawa, Ottawa, Ont.**

Adequate lymph node harvest is an attractive measure of surgical quality for policy makers. However, achieving an adequate lymph node harvest requires a multidisciplinary effort. The purpose of this study was to determine if it is appropriate to use this measure as a surgical quality indicator for individual surgeons.

Charts of 1138 consecutive segmental colon cancer surgeries performed between 2002 and 2008 were retrospectively analyzed. The primary outcome was inadequate lymph node retrieval for colon cancer surgery defined by fewer than 12 lymph nodes on pathology. Predictor variables were based on patient-, surgeon-, pathology- and tumour-related factors. Univariate and multivariate analyses were performed on all potential predictor variables.

In all, 841 cases (69.0%) achieved adequate lymph node harvest, whereas 377 (31.0%) were inadequate. Factors on univariate analysis associated with inadequate lymph node harvest were specimen length ($p < 0.0001$), tumour location ($p < 0.0001$), T-stage ($p = 0.0015$) and year of surgery ($p < 0.0001$), all of which remained significant on multivariate logistic regression. The average specimen length differed by 3.6 cm between nonadequate and adequate specimens. Surgeon volume and subspecialty training were not predictive of improved lymph node harvest. When surgeons were ranked according to their success rate of more than 12 lymph nodes retrieved, there was no difference between surgeons in mean specimen length.

Tumour- and patient-related variables were the primary predictors of a successful lymph node harvest, and there was no association between surgeon-related factor and adequate lymph node retrieval. Caution should be used when considering lymph node harvest as a surgical quality indicator for individual surgeons.

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Long-term outcomes following resection of retroperitoneal recurrence of colorectal cancer. ***F. Si Wai Zih, R. Razik, E. Haase, A. Mathieson, A.J. Smith, C.J. Swallow.*** **From the Mount Sinai Hospital, the University of Toronto and the Sunnybrook Health Sciences Centre, Toronto, Ont.**

The role of curative-intent surgery for retroperitoneal recurrence (RPR) of colorectal cancer (CRC) remains controversial, since the durability of disease control is not well described. We previously showed 0% mortality and acceptable morbidity in patients who underwent resection of RPR at our centre. Here we examine the overall (OS) and disease-free survival (DFS) and associated prognostic factors.

We identified patients who underwent resection for RPR of CRC between January 1999 and June 2011 from 2 prospective CRC databases, and a retrospective chart review was performed.

The study cohort was composed of 49 patients (26 women) whose median age was 59 (36–80) years: 11 patients had undergone resection of a different focus of disease recurrence before diagnosis of RPR, and 8 patients had additional site(s) of distant metastatic disease at the time of RPR resection. Following surgery for RPR, 5 patients were left with gross residual disease at 1 or more sites, and 6 had microscopically positive margins.

Median follow-up time from RPR surgery was 32.6 (2.9–126.9) months. At last follow-up, 13 patients had died of cancer and 1 of other causes. For the entire cohort, OS at 5 years was 70% (median OS 80 mo). In univariate analysis, OS was reduced in younger patients ($p = 0.003$) and in those with gross residual disease (HR 4.3, $p = 0.033$). Overall survival was not measurably inferior in patients who had undergone prior resection of recurrence, or with other sites of distant disease. After total gross resection of RPR, 22 of 44 patients re-recurred. Disease-free survival at 5 years was 48% (median DFS 38 mo). Predictors of DFS on multivariate analysis were young age and non-R0 resection.

This is the largest reported series of resection of RPR of CRC; OS and DFS were favourable in well selected patients treated in the modern era. The presence of other limited distant disease, or previous surgery for recurrence at another site, should not preclude patients from being considered for curative intent surgery.

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Clinical research in surgical oncology: an analysis of clinicaltrials.gov. ***A.S. Menezes, A. Barnes, A.S. Scheer, H. Moloo, R.P. Boushey, E. Sabri, R.A.C. Auer.*** **From the Division of General Surgery, Department of Surgery, University of Ottawa, and The Ottawa Hospital Research Institute, Ottawa, Ont.**

The conduction of randomized clinical trials has expanded in medical specialties, but to a far lesser degree in surgery. The objective of this study was to assess the current landscape of clinical trials in surgical oncology registered at clinicaltrials.gov.

Data were extracted from clinicaltrials.gov using the following search engine criteria: "cancer" as condition, "surgery or operation or resection" as intervention, and non–industry sponsored. The search was limited to Canada and the United States and included trials registered from Jan. 1, 2001, to Jan. 1, 2011. The total number of oncology trials was also obtained.

Of 9961 oncology trials, 1049 (10.5%) included any type of surgical intervention. Of these trials, 125 (11.9%; 1.3% of all oncology trials) manipulated a surgical variable, 773 (73.7%) assessed adjuvant/neoadjuvant therapies, and 151 (14.4%) were observational studies. Of the trials assessing adjuvant therapies, systemic treatment (362 trials, 46.8%) and multimodal therapy (129 trials, 16.7%) comprised a large focus. Of the 125 trials where surgery was the manipulated variable, 59 trials (47.2%) focused on surgical techniques (including minimally invasive) or devices, 45 trials (36.0%) studied invasive diagnostic methods, and 21 trials (16.8%) evaluated surgery versus no surgery. The majority of the 125 trials was nonrandomized (72, 57.6%), and phase III trials accounted for less than one-quarter (29, 23.2%).

The number of registered surgical oncology trials is small in comparison to oncology trials as a whole. Clinical trials specifically designed to assess surgical interventions are vastly

outnumbered by trials focusing on adjuvant therapies, and are frequently nonrandomized. Randomized surgical oncology trials account for less than 1% of all registered cancer trials. Barriers to the design and implementation of randomized trials in surgical oncology need to be clarified in order to facilitate higher-level evidence in surgical decision-making.

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Radiation therapy after breast conserving surgery: When are we missing the mark? *M. Nassif, K. Reidel, N. Trabulsi, S. Meterissian, R. Tamblyn, N. Mayo, A.N. Meguerditchian.* From McGill University, Montréal, Que.

Postoperative radiotherapy (RT) after breast-conserving surgery (BCS) represents the standard of care for local control of breast cancer. Despite wide dissemination of clinical guidelines, variations in practice persist.

Our goal was to identify patient, disease and physician characteristics that predict lack of consideration for RT after BCS.

Cancer registry data and administrative claims for all BCs diagnosed in Quebec from 1998 to 2005 were collected. Receipt of a consultation for RT in women with nonmetastatic breast cancer treated with BCS was measured. Multivariate logistic regression was used to assess the association between patient, disease and physician characteristics and having an RT consult.

In total, 27 483 women were included. Mean age was 59 years, 76.5% had no comorbidities, and 27.6% had stage III breast cancer. Overall, 90.1% of women were considered for RT within 1 year of diagnosis. Patients at age extremes were less likely to be considered as compared with women aged 50–69 years: those 30–49, 70–79 and 80+ had odds ratios (OR) of 0.82 (CI 0.73–0.93), 0.54 (CI 0.48–0.61) and 0.11 (CI 0.09–0.12), respectively. Women with any emergency room visit and women with a hospitalization (unrelated to breast cancer) had 15% and 17% lower odds of having an RT consult, respectively. In patients with advanced disease, receiving a consultation for chemotherapy within 4 months of BCS increased the likelihood of also being considered for RT within 1 year (OR 1.54, CI 1.19–2.00). Increases in physician BCS volume in the year before patient diagnosis increased the chance of their patient receiving an RT consult by 7% for every additional 10 BCSs performed.

Patient age, use of non–breast cancer related health services and physician volume of BCS predicts use of RT. Guideline deviations in chemotherapy administration also predicts variation in RT use.

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The accuracy of endorectal ultrasound in staging rectal lesions in patients undergoing transanal endoscopic microsurgery. *M. Leon-Carlyle, J.A. Brown, J. Hamm, P.T. Phang, M.J. Raval, C.J. Brown.* From the Departments of General Surgery and Radiology, St. Paul's Hospital, and the Surgical Oncology Network, British Columbia Cancer Agency, Vancouver, BC

Transanal endoscopic microsurgery (TEM) is a minimally invasive procedure that can be used to resect adenomas and highly select T1 adenocarcinoma. Endorectal ultrasound (ERUS) is used to preoperatively assess T stage. In this study, we evaluate the accuracy of ERUS in determining the T stage of rectal neoplasms in patients treated by TEM.

Between January 2007 and July 2011, 145 patients treated with TEM were identified. Inclusion criteria were histopathology confirmed adenoma or adenocarcinoma, complete excision of the lesion and preoperative ERUS performed. Patients were excluded if they had been treated with neoadjuvant therapy. An experienced radiologist performed ERUS with a 7.5 MHz probe. Ultrasound results were compared with gold-standard postoperative histopathology reports. Sensitivity analysis was performed to determine accuracy of tumour staging based on T stage and tumour height (> 9 cm, < 9 cm). Finally, tumour height from anal verge as measured by ERUS and by rigid sigmoidoscopy was compared.

In all, 55 patients were eligible to participate in the study. A Friedman test demonstrated significant difference in the T stage ranking between ERUS and the histopathology reports ($p < 0.001$), regardless of the height of the neoplasm (height > 9 cm, $p < 0.05$; height < 9 cm, $p < 0.001$). For uT2, 77.8% (14 of 18) neoplasms were overstaged. The height of the tumour measured by ERUS is significantly higher than the height measured by other modalities ($p < 0.05$).

This study confirms that ERUS often overstages rectal neoplasms. Moreover, it suggests ERUS is not an accurate measure of preoperative T stage as it frequently under- and overstages neoplasms. A discrepancy was also found between the height as measured by ERUS and that determined by other clinical measures. Overall, this study suggests that preoperative ERUS should not definitively influence the decision to proceed with TEM and needs to be considered in the context of the clinical scenario.

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Quality improvement in gastrointestinal cancer surgery: expert panel recommendations for priority research areas. *A.C. Wei, K.S. Devitt, M. Wiebe, O.F. Bathe, R.S. McLeod, B. Taylor, D.R. Urbach.* From the University Health Network, Toronto, Ont., the University of Calgary, Calgary, Alta., Mount Sinai Hospital and the University Health Network, Toronto, Ont.

Surgical process improvement tools (SPITs) are quality improvement tools that improve quality by changing the processes of care at the point of care. We report on the recommendations of an expert panel that was assembled to prioritize research areas for future research for SPITs in the area of gastrointestinal (GI) cancer surgery.

An expert panel was convened representing Canadian stakeholders in the area of GI cancer, surgery and/or quality improvement. Using nominal group methodology, the panel deliberated on the evidence for various SPITs and ranked priority areas for future research. Criteria of relevance, feasibility and impact were assessed. Preferred settings, outcomes and instruments for future research areas were collected quantitatively before, during and after the workshop. Quantitative and qualitative data were obtained. Rank order of expert panel recommendations was tabulated. Qualitative results were assembled thematically to summarize deliberations.

In total, 22 content experts participated: 16 (73%) surgeons, 3 (14%) nurses, 1 (5%) administrator, 1 (5%) research coordinator and 1 (5%) surgical trainee. Stakeholders represented health care systems from Ontario (17, 77%), Alberta (1, 5%), British Columbia (1, 5%), Nova Scotia (1, 5%) and Quebec (2, 9%). Panelists

ranked clinical pathways and related tools (e.g., enhanced recovery programs and/or fast tract protocols) as the preferred SPIT. The preferred settings and outcomes were of preoperative care evaluation and cancer-related health outcomes, respectively. The least preferred instrument was a checklist. Participants were least interested in resource utilization as an outcome and transfer points as a setting for quality improvement.

The expert panel identified clinical pathways and related tools as the highest priority SPIT to focus on for future research. We have used feedback from the expert panel to set research priorities for SPITs development.

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Factors influencing the quality of local management of ductal carcinoma in situ: a cohort study. ***S. Krotneva, K. Reidel, N. Mayo, R. Tamblyn, A. Meguerditchian.*** **From the McGill University Health Centre (MUHC) and McGill University, Montréal, Que.**

Improved screening practices have led to a dramatic increase in the detection of ductal carcinoma in situ (DCIS) over the past 40 years. Current treatment guidelines recommend radiotherapy (RT) after breast-conserving surgery (BCS) for optimal local management. However, deviations exist, leaving some DCIS patients with unnecessarily high risk of recurrence and potential for disease progression. The aim of this study was to identify factors influencing RT receipt among a retrospective cohort of women with DCIS who underwent a BCS between 1998 and 2005 in Quebec, Canada.

The provincial cancer registry and administrative claims data were used to obtain demographic and clinical information for patients and physicians. Using consultation for RT as the RT consideration indicator, odds ratios (ORs) and 95% confidence intervals (CIs) were estimated by using a generalized estimating equations regression model. Of the 4139 women (mean age 58 yr) selected, 83% received a consultation for RT, and 89% of those who received a consultation chose to use the service. Relative to the largest age group (50–69 yr), ORs for age groups 18–50, 70–79 and over 80 years were 0.86 (CI 0.69–1.07), 0.71 (CI 0.55–0.92) and 0.21 (CI 0.14–0.32), respectively. Women with a rural postal code, comorbidities, emergency department visits or hospitalizations unrelated to breast cancer had ORs of receiving a consultation of 0.92 (CI 0.71–1.21), 1.17 (CI 0.91–1.51), 0.94 (CI 0.87–1.03) and 0.85 (CI 0.66–1.1), respectively. For every 10 km increase from the nearest centre of excellence for breast care, ORs were 0.98 (CI 0.97–1.00) and for every 10 more BCSs performed by the physician, they were 1.07 (CI 1.04–1.11).

In the present study, older age and distance were associated with not receiving RT, whereas having a physician with a higher number BCSs performed was positively associated with providing RT.

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Papillary thyroid microcarcinoma: Does size matter? ***N.L. Bradley, J.D. Hamm, S.M. Wiseman.*** **From the Department of General Surgery, St. Paul's Hospital, University of British Columbia, and the BC Cancer Agency, Vancouver, BC**

The current guidelines for surgical management of papillary thyroid microcarcinoma (PMTC) are controversial. Some reports suggest tumours smaller than 5 mm are less aggressive than those 5 mm and larger and may be managed conservatively. Our objective was to compare the clinical and histological characteristics of small (< 5 mm) to large PTMCs (≥ 5 mm).

From 2002 to 2011, data were collected prospectively from 1459 sequential patients undergoing thyroid surgery at a single institution. Among these patients, 132 (9%) were found to have PTMC of 1 cm or smaller without the presence of a macrocarcinoma (> 1 cm). We performed a retrospective analysis of these PTMC cases. The Fisher exact test was used. Statistical significance was set at $p < 0.05$ a priori.

Overall, 75 patients (57%) revealed small PTMCs, 84 (64%) were older than 45 years and 84 (64%) were female. Older patients had small PTMCs more frequently than large PTMCs (71% v. 54%) and were more often female (85% v. 71%), but this did not reach significance ($p = 0.07$ and 0.09, respectively). Total thyroidectomy occurred in 57 patients (43%), and surgical indication was known/suspected malignancy in 99 patients (75%). Size of PTMC had no relationship to surgery performed or surgical indication. Markers of severity were assessed, including multifocality in 38 cases (29%), bilaterality in 8 cases (6%), extrathyroidal cancer extension (ETE) in 6 cases (5%), lymph node metastases in 9 cases (7%) and distant metastases in 1 case (< 1%). A relationship between larger cancers and severity was seen only with ETE: 6 of 57 large PTMCs (11%) but none of 75 small PTMCs (0%) had ETE ($p < 0.01$). Lymph node metastases were present in both small PTMCs (5 of 9 cases) and large PTMCs (4 of 9 cases). The single case of distant metastases was diagnosed in a 3 mm PTMC.

Diagnosis of PTMC is common after thyroid surgery. However, cancer size smaller than 5 mm does not preclude the possibility of locally advanced or distant disease. Management decisions for individuals with PTMC should not be based solely upon cancer size.

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Hyperthermic isolated limb perfusion for extremity soft tissue sarcomas: systematic review of clinical efficacy and quality assessment of reported trials. ***N. Trabulsi, L. Patakfalvi, M. Nassif, R. Turcotte, A. Nichols, A. Meguerditchian.*** **From the Departments of Surgery and Orthopedic Surgery, McGill University, Montréal, Que., and the Urban Institute, Washington, DC**

Extremity soft tissue sarcomas (STS) are managed with radiotherapy and limb-sparing surgery; however, aggressive or recurrent disease requires amputation. The understanding that amputation does not enhance survival in patients with large (> 5 cm) high-grade sarcomas has driven the search for less invasive alternatives. Hyperthermic isolated limb perfusion (HILP) has been proposed as an alternative. Our aim was to systematically review phase II HILP trials to assess tumour response, limb salvage and the quality of scientific publications on this technique.

We conducted a literature search of electronic databases (MEDLINE, EMBASE, Scopus, Cochrane Library) and clinical trial registries for phase II HILP trials on nonresectable extremity STS. Outcomes of interest were complete response (CR), partial response (PR) and limb salvage (LS) rates. Quality of published trials was assessed using a quality checklist with a priori defined ideal and essential elements.

Of 518 patients across 12 studies, 408 had some response (CR

or PR), and 428 had the limb spared. Median CR, PR and LS rates were 31%, 53.5% and 82.5%, respectively. Median Wieberdink locoregional toxicity rates were 3.8%, 45.5%, 17%, 1% and 0% for levels 1–5, respectively. No trial fulfilled either all ideal or essential quality criteria; only 2 satisfied more than 75% of essential elements, and 7 trials did not include statistical methodology.

Hyperthermic isolated limb perfusion seems effective in treating advanced extremity STS. However, poor publication quality, the absolute loss of uniformity in terms of defining potential candidates, technique, dosages and response outcome, as well as who will assess the response and how and when it will be assessed, hinder results validity. Communication and interaction of centres through a structured, organized network will help with effective decision-making and standardization of methodological consensus in the treatment of advanced extremity STS.

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Adherence to antiestrogen therapy in seniors with breast cancer: How well are we doing? ***N. Trabulsi, K.E. Riedel, N.E. Winslade, J.-P. Grégoire, S. Meterissian, M. Abrahamovicz, A. Megueerditchian.*** **From the Departments of Surgery and of Clinical Epidemiology and Biostatistics, McGill University, the Department of Medicine, School of Physical and Occupational Therapy, McGill University, the Clinical and Health Informatics Research Group, McGill University, Montréal, Que., and the Faculty of Pharmacy, Laval University, Québec, Que.**

Nearly a third of breast cancers occur in women 65 years and older. Antiestrogen therapy (AET) significantly reduces breast cancer recurrence and death in these patients, as they often have hormone receptor–positive tumours. However, studies suggest that adherence to AET in older women is a challenge.

Cancer registry data and administrative claims for all nonmetastatic breast cancers diagnosed in Quebec between 1998 and 2005 were accessed from the provincial health insurance program. Patients 65 years or older who started AET and had 5 years of follow-up were studied. The 5 year medication possession ratio (MPR) was calculated, and multivariate linear regression was used to assess the association between independent factors and MPR.

In total, 4715 women were included. Mean age was 72.9 years. Stage distribution was 6.43% in situ, 74.13% localized and 19.45% regional disease. Mean MPR was 83.5%; 5 year MPR decreased with increasing age and non–breast cancer related hospitalizations ($p < 0.05$). Compared with women with regional disease, those with in situ disease had on average an MPR that was lower by 6.5% ($p < 0.01$). Having more active prescriptions at baseline increased the MPR; however, adding further medications after AET start decreased the MPR ($p < 0.01$). Women known to take antidepressants at baseline had a decrease in their MPR by 4.7% ($p = 0.003$). Women on tamoxifen, compared with those on anastrozole, had on average an MPR that was lower by 6% ($p = 0.002$). Compared with those who never switched their AET type, those who switched during the first year had a lower MPR by 5.3%; however, those who switched later had an increased MPR by 7.4% ($p < 0.01$).

Most seniors with breast cancer had good adherence to AET. Nevertheless, we noticed that certain factors collectively might critically reduce the MPR. This type of patient-specific information provided in real time and at the point of care could help physicians understand challenges in optimizing the benefits of AET, target high-risk patients and direct resources toward supporting them.

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Parathyroid carcinoma: Challenging the surgical dogma? ***L. Chin-Lenn, J. Pasieka.*** **From the University of Calgary, Calgary, Alta.**

Parathyroid carcinoma (PCa) is rare. Surgical dogma has been to perform an en bloc resection at the initial operation if PCa is suspected, to avoid high recurrence rates and mortality. The question is how well these preoperative and intraoperative criteria correlate with the histological diagnosis of PCa, which itself is a challenging diagnosis. How one should follow the patient with clinical features of carcinoma yet benign histology makes PCa a challenging disease for the endocrine surgeon.

We conducted a retrospective chart review of all parathyroidectomies performed by an endocrine surgeon at a tertiary cancer centre between 1992 and 2011. Patients with either preoperative suspicion (hypercalcemic crisis, palpable mass, recurrent laryngeal nerve paralysis, high calcium, parathyroid hormone [PTH] more than 4 times normal, nephrocalcinosis and osteitis fibrosa cystica) or intraoperative suspicion of PCa were included. Demographic details, histopathology and follow-up were recorded.

Of 1241 parathyroidectomies performed, 35 had either preoperative or intraoperative suspicion of PCa. Overall only 5 of 35 (14%) patients had PCa on final histology; 28 patients had preoperative suspicion of PCa. Final histology was PCa (4), atypical adenoma (4), adenoma (17), hyperplasia (1) and parathyromatosis (2). Calcium, PTH and palpability were poor predictors of PCa. Median preoperative calcium levels for adenomas were 3.5 mmol/L, atypical adenoma 3.87 mmol/L and PCa 3.04 mmol/L. Median PTH for adenomas were 522 ng/L, atypical adenomas 621 ng/L and PCa 386 ng/L (normal 13–54 ng/L). Masses were palpable in 63% of adenomas, 33% of atypical adenomas and 75% of PCa patients. Osteitis fibrosa cystica was equally distributed (25% each). Only 1 of 7 patients with intraoperative suspicion of PCa was proven on histology. There were no recurrences in any patients (median follow-up 44 [1–192] mo).

It would appear that the clinical criteria suggestive of PCa do not correlate well with standard histopathology. Is it time to revisit the surgical dogma of en bloc resection for these patients?

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A qualitative assessment of the journey to delayed breast reconstruction. ***H. Cheng, C. McMillan, J. Lipa, L. Snell.*** **From the Division of Plastic and Reconstructive Surgery, University of Toronto, and the Sunnybrook Health Sciences Centre, Toronto, Ont.**

Canada has low immediate breast reconstruction (IBR) rates compared with the United States and Europe. Breast cancer survivors may live with their mastectomy defects for years while waiting for delayed breast reconstruction (DBR). This preventable loss in quality of life represents an area for improvement in breast cancer care. This study qualitatively assessed the information provided about breast reconstruction at the time of cancer diagnosis and inefficiencies in referral practices that may contribute to consultation wait times.

In all, 51 consecutive patients seen in consultation for DBR at a tertiary care centre completed a questionnaire examining their experience of pursuing breasts reconstruction; 7 semistructured interviews were conducted to further explore patient knowledge and decision-making. Questionnaire responses were tabulated. Interviews were recorded and transcribed. Data were analyzed for recurring ideas and themes using standard qualitative techniques.

Questionnaires revealed that IBR is infrequently discussed, or barriers to timely access are often cited to discourage patients from pursuing IBR. Patients stated that more information about reconstructive options is needed at diagnosis, and this information could be provided by general surgeons, oncologists or cancer nurses. Overall, 49% of patients had seen another plastic surgeon for DBR before attending consultation at our institution.

Misinformation or lack of information about IBR options and access are contributing factors to underutilization in Canada. Changes can be instituted by providing accurate information to the multidisciplinary cancer care team and patients at diagnosis. Systematic inefficiencies exist in DBR referral practices. By minimizing the number of consultations per patient and appropriately matching surgeon referrals to an individual's specific needs would allow more women timely access to breast reconstruction.

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The role of yoga therapy in breast cancer patients. ***A.M. Petrucci, M. Sudarshan, S. Dumitra, J. Duplisea, S. Wexler, S. Meterissian.*** **From the McGill University Health Centre, Royal Victoria Hospital, Montréal, Que.**

Complementary and alternative medicine (CAM) is rapidly growing as an adjunct to the management of oncology patients. The field of yoga therapy holds promise as a CAM; however, there is a paucity of literature on this topic. We sought to study the impact of yoga therapy on anxiety, depression and physical health in women undergoing breast cancer treatment.

Patients with stage I to III breast cancer who underwent surgical treatment were recruited from the McGill University Health Centre (MUHC) in Montréal, Québec. A module of 12 one hour weekly yoga sessions with an experienced yoga instructor was completed. Before and after each module, each study participant filled out questionnaires, including the Hospital Anxiety and Depression Scale (HADS), the Distress Thermometer and the Dallas Pain Questionnaire (divided into daily activities, work, leisure and social activities subcategories). In addition, measurements for shoulder flexibility were obtained to track improvement in physical status. Data are presented as means (confidence intervals) and compared using the Wilcoxon matched pair signed rank nonparametric test.

In all, 14 patients completed the entire yoga session, with 42.8% having a total mastectomy and 15.4% having breast reconstruction. Both right and left shoulder abduction flexibility improved significantly ($p = 0.004$ and $p = 0.015$, respectively), as well as left glenohumeral flexion ($p = 0.046$). As for quality of life, although there were no statistically significant findings for the HADS and Dallas questionnaires pre- and postintervention, the trend in scores showed improvement in the domains of anxiety, depression and pain.

Our data indicate an improvement in physical function in addition to a consistent amelioration in anxiety, depression and pain symptoms. Further larger scale trials are required to explore these promising results. Our study also holds widespread applicability to oncology programs that wish to offer such sessions to address the important concept of whole person care and wellness.

Table, abstract 195. Mean scores and measurements

	Time; mean (CI)		
Measure; subtype	Pretreatment	Post-treatment	*p* value
HADS score (max 21 = worse)			
Anxiety	6.69 (3.94–9.44)	5.54 (2.64–8.28)	0.439
Depression	6.77 (4.49–9.05)	5.08 (2.44–7.71)	0.148
Dallas pain questionnaire, % (max score 100% = worse)			
Daily activity	28 (20–35)	21 (12–30)	0.208
Work and leisure	24 (9–38)	19 (2–37)	0.521
Anxiety and depression	28 (13–44)	25 (9–40)	0.814
Social	16 (7–25)	12 (2–21)	0.176
Flexibility, ° (out of 180° of motion)			
Right shoulder abduction	141 (121–161)	175 (167–180)	0.004
Right shoulder flexion	162 (147–178)	176 (168–180)	0.106
Left shoulder abduction	155 (136–173)	174 (166–180)	0.015
Left shoulder flexion	164 (147–180)	180 (179–181)	0.046

CI = confidence interval; HADS = Hospital Anxiety and Depression Scale.

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Outcomes reported in comparative studies of surgical interventions. ***L. Sandhu, G. Tomlinson, E.D. Kennedy, A. Wei, N.N. Baxter, D.R. Urbach.*** **From the University of Toronto, Toronto, Ont.**

It is not clear how study outcomes are selected in studies comparing surgical procedures. The aim of this study was to empirically assess which outcomes are routinely reported across nonrandomized studies (NRS) and randomized controlled trials (RCTs).

MEDLINE (1950–2010) and EMBASE (1980–2010) searches were conducted to identify all studies comparing laparoscopy with conventional surgery for colon cancer. All reported outcomes were abstracted and tabulated. Differences between NRS and RCTs were compared by calculating the Pearson χ^2 statistic.

Of 7832 abstracts reviewed, 187 studies met the inclusion criteria. Once overlapping reports were combined, 139 NRS and 27 RCTs remained. A total of 89 unique outcomes were reported. Operative characteristics were consistently reported in a majority of studies (53.9% NRS, 56.0% RCTs, $p = 0.88$), as were mortality (56.8% NRS, 66.6% RCTs, $p = 0.34$) and postoperative complications (57.6% NRS and 85.1% RCTs, $p = 0.007$). Pathological outcomes, including number of lymph nodes harvested, distance to the closest margin and R0 resection rates, were far less commonly mentioned (see Table). Only 3.6% of NRS and 11.1% of RCTs provided quality of life data ($p = 0.12$). Long-term outcomes were reported in 7.9% of NRS and 22.2% of RCTs (delta = –14.3%, 95% CI –33.2 to –1.4, $p < 0.001$).

Outcomes necessary to determine the oncologic adequacy of laparoscopy for colon cancer were seldom reported, and NRS were less likely to report such outcomes as compared with RCTs.

Table, abstract 167.

Outcome	Intervention; %: NRS, $n = 139$	Intervention; %: RCTs, $n = 27$	% difference, NRS–RCTs (95% CI)	p value
Operative characteristics				
Duration of surgery	53.9	55.6	–1.7 (–20.4 to 18.3)	0.88
Blood loss	47.5	48.1	–0.6 (–20.3 to 18.6)	1.00
Postoperative mortality	56.8	66.7	–9.9 (–26.7 to 10.6)	0.34
Postoperative complications	57.6	85.2	–27.6 (–39.8 to –8.3)	0.007
Pathological				
No. lymph nodes harvested	38.8	29.6	9.2 (–11.1 to 25.3)	0.37
Distance to closest margin	13.0	29.6	–16.6 (–36.1 to –1.4)	0.029
Margin involvement	5.7	14.8	–9.1 (–27.0 to 1.2)	0.10
Quality of life	3.6	11.1	–7.5 (–24.6 to 1.0)	0.12
Long-term outcomes				
3 yr/5 yr OS	7.9	22.2	–14.3 (–33.2 to –1.4)	0.025
3 yr/5 yr DFS	6.5	18.5	–12.0 (–30.5 to –0.4)	0.039

CI = confidence interval; DFS = disease-free survival; NRS = nonrandomized studies; OS = overall survival; RCT = randomized controlled trial.

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Enhanced recovery pathways decrease length of stay following colorectal surgery, but how quickly do patients actually recover? ***A. Neville, A.S. Liberman, P. Charlebois, B. Stein, A. Ncuti, M.C. Vassiliou, G.M. Fried, L.S. Feldman.*** **From the McGill University Health Centre, Montréal, Que.**

Enhanced recovery pathways (ERPs) are associated with decreased complications and shorter hospital stay after colorectal surgery. Whereas many studies evaluating recovery report length of stay as the primary outcome, duration of hospitalization does not reflect the patients' process of recovery to their baseline level of function. The purpose of this study was to evaluate recovery within an ERP using a physical activity questionnaire (the Community Health Activities Model Program for Seniors [CHAMPS]).

CHAMPS, a validated measure of recovery, asks patients to report time spent doing physical activity over the course of a week. Responses are converted into caloric expenditure (kcal/kg/wk). This questionnaire was administered preoperatively and 6 weeks postoperatively to patients undergoing elective colorectal surgery within the framework of an ERP between September 2009 and February 2011. Data are presented as mean (SD) or median (25th–75th percentile).

In all, 54 patients with complete follow-up data were analyzed. Of these patients, 54.0% were male, the mean age was 59.0 (17.9) years and the mean BMI was 26.2 (5.7) kg/m^2. Most patients underwent surgery for neoplastic disease (79.6%), and 76% of procedures were laparoscopic. The median length of stay was 4 (3–7) days. On average, patients had not recovered to baseline physical activity at 6 weeks ($p = 0.11$); 54% of patients were at or above baseline at 6 weeks. Baseline physical activity correlated with change from baseline at 6 weeks (Spearman correlation coefficient 0.45, $p < 0.01$). Patients who were discharged by postoperative day 4 were more likely to have recovered to baseline physical activity compared with those with longer hospital stays (68% v. 35%, $p = 0.03$).

This study highlights the challenges in estimating postdischarge functional recovery, a complex outcome. However, within an enhanced recovery pathway, patients discharged on target were also more likely to have recovered to baseline by 6 weeks postoperatively.

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The impact of complications on bed utilization after elective colorectal resection. ***L. Lee, G. Capretti, A. Power, A.S. Liberman, P. Charlebois, B. Stein, P. Kaneva, F. Carli,***

G.M. Fried, L.S. Feldman. **From the McGill University Health Centre, Montréal, Que.**

Despite advances in surgical care, the incidence of postoperative morbidity after colorectal surgery remains high. We estimated the impact of postoperative morbidity on bed utilization after elective colorectal resection to develop targets for quality improvement.

The records of all elective colorectal resections from 2003 to 2010 at a single university-based institution were reviewed. Multiple linear regressions determined the adjusted effect of postoperative complications on length of stay (LOS). The total bed days used by patients affected by postoperative morbidity were calculated. Data are median (and IQR).

In total, 1131 consecutive patients were reviewed. The median age was 64 years, 18.4% had a BMI greater than 30, 63% had a malignancy and 47% underwent a rectal resection. Laparoscopy increased from 7% in 2003 to 75% in 2010. A fast-track pathway began in 2005 and was used in 83% of patients by 2010. Hospital stay decreased over time, from 7 (6) to 4 (4) days. The Table

Table , abstract 169. Impact of morbidity on length of stay in hospital after colorectal resection

Morbidity	Days	*p* value
Anastomotic leak, *n* = 65	+21.7	< 0.001
Intra-abdominal bleeding, *n* = 10	+11.7	< 0.001
Pneumonia, *n* = 24	+11.3	< 0.001
Acute myocardial infarction, *n* = 12	+8.2	< 0.001
Primary ileus, *n* = 204	+6.5	< 0.001
Urinary tract infection, *n* = 81	+4.1	< 0.001
Wound infection, *n* = 139	+3.9	< 0.001
Gastrointestinal bleed, *n* = 40	+3.3	0.001
Confusion/delirium, *n* = 53	+2.0	0.006

shows the results of a multivariate analysis of the impact of complications on LOS adjusted for patient- and procedure-specific factors and the use of an enhanced recovery program. A total of 11 299 hospital days were used: 2973 (26%) by the 52% of patients without complications (LOS 4 [3] d), 2473 (22%) by the 6% who had an anastomotic leak (LOS 26 [30] d) and 2541 (23%) by the 18% that had a primary ileus (LOS 10 [6] d).

Despite the increasing use of laparoscopy and a fast-track pathway, postoperative complications still have a significant impact on bed utilization. Postoperative primary ileus had as great an impact on bed utilization as anastomotic leak.

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Impact of trimodal prehabilitation program on functional recovery after colorectal cancer surgery: a pilot study. ***C. Li, F. Carli, P. Charlebois, B. Stein, A.S. Liberman, P. Kaneva, B. Augustin, A. Gamsa, D.-J. Kim, M. Vassiliou, L. Feldman.*** **From McGill University, Montréal, Que.**

Patients undergoing colorectal cancer resections are at risk for delayed recovery. Prehabilitation aims to enhance functional capacity preoperatively, in order for patients to better tolerate surgery and to facilitate recovery. We previously demonstrated the limited impact of a prehabilitation program based on exercise alone. We therefore propose an expanded trimodal prehabilitation program that adds nutritional counselling, whey-protein supplementation and anxiety reduction strategies to a moderate aerobic and resistance exercise program. The purpose of this study was to estimate the impact of this trimodal program on recovery of functional exercise capacity compared with standard surgical care.

Patients were enrolled in this pre-/postintervention study over a 23 month period. Postoperative recovery in 42 consecutive patients enrolled in the trimodal prehabilitation program was compared with a cohort of 45 patients assessed before the intervention began. The primary outcome was functional walking capacity (6 minute walk test) at 8 weeks after surgery. Secondary outcomes included self-reported physical activity (CHAMPS questionnaire) and health-related quality of life (SF-36). Patients in both groups followed an enhanced recovery program after surgery. Data are expressed as mean (SD) or median (IQR), and are analyzed using χ^2, Student t and Wilcoxon rank-sum tests; $p < 0.05$ was considered significant.

The prehabilitation and control groups were comparable in age, sex, BMI and ASA class. Complication rates and length of stay were similar. During the prehabilitation period lasting 37 (21) days, functional walking capacity improved by 40 (40) m. There was no difference in the first 6 minute walk test results obtained in the 2 groups (422 [87] m v. 402 [57] m). Postoperatively, patients in the prehabilitation program had better functional walking capacity both at 4 weeks (mean difference 51.9 [93] m, $p = 0.01$) and 8 weeks (89.9 [83] m, $p < 0.01$). At 8 weeks, 81% of prehabilitated patients were recovered or above baseline compared with 40% in the control group ($p < 0.01$). The prehabilitation group also reported higher levels of physical activity preoperatively (CHAMPS questionnaire, kcal/kg/wk: 32 [19–75] v. 20 [9–32], $p < 0.01$), at 4 weeks (20 [7–57] v. 3 [0–7], $p < 0.01$) and at 8 weeks (23 [9–51] v. 7 [0–17], $p < 0.01$).

In this pilot study, a 1 month trimodal prehabilitation program improved postoperative functional recovery. A randomized trial is ongoing (NCT01356264).

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Complex fistula-in-ano: Should the plug be abandoned in favour of the LIFT or BioLIFT? ***I. Yang, R. Boushey, H. Moloo.*** **From the Division of General Surgery, The Ottawa Hospital, Ottawa, Ont.**

This study aimed to determine the outcomes of the ligation of the intersphincteric fistula tract alone (LIFT), LIFT reinforced with a bioprosthetic graft (BioLIFT) and the anal fistula plug (AFP) in the treatment of complex fistulas.

A retrospective review using electronic patient charts was completed of all LIFT, BioLIFT and AFP procedures performed between June 2007 and December 2011 by 2 colorectal surgeons at a single institution. All cases involved complex fistulas that were not amenable to fistulotomy owing to significant sphincter involvement or preexisting compromised anal tone. Patients with inflammatory bowel disease were excluded. Patient and fistula characteristics, clinical healing, postoperative fecal incontinence and operative times were examined.

In total, 12 LIFTs (6 men, 6 women, mean age 48 yr), 5 BioLIFTs (3 men, 2 women, mean age 42 yr) and 29 AFPs (20 men, 9 women, mean age 51 yr) were performed. There had been previous attempts at repair for 6 fistulas in the LIFT group, none in the BioLIFT group and 10 in the AFP group. All of the fistulas

managed with the LIFT and BioLIFT were transsphincteric, whereas all except 3 fistulas (1 intersphincteric, 2 extrasphincteric) treated with the AFP were transsphincteric. The median follow-up intervals were 182 (range 24–651) days for the LIFT, 101 (range 44–191) days for the BioLIFT and 183 (range 24–880) days for the AFP. Clinical healing was observed following 10 of 12 LIFT (83%), 4 of 5 BioLIFT (80%) and 4 of 29 AFP (14%) procedures. There was no occurrence of fecal incontinence following any of the procedures. The mean operative times were 54 minutes for the LIFT, 51 minutes for the BioLIFT and 30 minutes for the AFP procedure.

Both LIFT and BioLIFT have produced encouraging rates of healing, and should be favoured over the plug for fistulas that are not amenable to fistulotomy.

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Prognostic utility of cyclooxygenase-2 expression by colon and rectal cancer. ***K. Lobo Prabhu, L. Vu, S. Chan, P.T. Phang, A. Gown, S. Jones, S. Wiseman.*** **From St. Paul's Hospital, University of British Columbia, British Columbia Cancer Agency, Michael Smith Genome Sciences Centre, Vancouver, BC**

Our goal was to evaluate the utility of cyclooxygenase-2 (COX-2) as a molecular prognosticator for colon and rectal cancer.

Tissue microarrays were constructed using 118 colon cancer and 85 rectal cancer specimens. As well, 44 synchronous metastatic colon cancer lymph nodes and 22 synchronous rectal cancer metastatic lymph nodes were also evaluated. COX-2 expression was evaluated by immunohistochemistry. Univariate analysis was used to determine the prognostic significance of clinicopathologic variables.

COX-2 was found to be expressed in 93.2% of colon cancers and 87.1% of rectal cancers. Decreased COX-2 expression was related to decreased disease-specific survival (p = 0.016) and decreased disease-free survival (p = 0.019) in the rectal cancer cohort, and this was not observed in the colon cancer cohort. There was no differential expression of COX-2 when comparing primary tumours and their synchronous lymph node metastases.

COX-2 expression has prognostic utility in rectal but not colon cancer.

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Laparoscopic right hemicolectomy with complete mesocolic excision provides acceptable perioperative outcomes but is complex and time-consuming: analysis of learning curves for a novice minimally invasive surgeon. ***G. Melich, D. Hyoun Jeong, H. Hur, S. Hyuk Baik, N. Kyu Kim, J. Faria, B. Soh Min.*** **From the Jewish General Hospital, McGill University, Montréal, Que. and the Department of Surgery, Yonsei University College of Medicine, Seoul, South Korea**

Laparoscopic colon surgery has been shown to offer clear evidence of benefit when compared with open surgery. Furthermore, complete mesocolic excision (CME) has been demonstrated to provide superior nodal yield and further offers prospects of better long-term oncological outcomes. Involving 81 consecutive cases, the purpose of this retrospective study is to analyze laparoscopic right hemicolectomy with CME with respect to perioperative outcomes and operative times for a novice colorectal surgeon primarily trained in open CME.

Outcome results feature a major complication rate of 3.6% (± 4.2%) and an average nodal yield of 31.3 (± 4.1). Cumulative sum plots indicate that acceptable complication rates and nodal yields can be achieved from the beginning of a surgeon's laparoscopic career. However, operative time might be an obstacle for adopting laparoscopic CME. The operative time curve reveals initial times of about 250 minutes. These times are nearly triple the times reported for conventional laparoscopic right hemicolectomy performed by experienced laparoscopic surgeons. The times decrease to just below 200 minutes at the end of the study. The operative time learning curve reveals a rather slow, linear, inverse relationship between operating room time and successive cases ($y = –0.58x + 248$), reflecting complex anatomy and the need for careful dissection around critical anatomic structures. This relationship continues to be linear, without reaching a plateau even at the end of the study, indicating potential for further operative time improvement beyond the initial 81 cases.

Despite the lack of randomized control trials, should one wish to adopt this strategy, either based on the limited evidence of superiority or with intention to participate in research, one should change one's view of right hemicolectomy as a rather simple procedure to being a complex lengthy laparoscopic surgery. Another issue remains for a non-CME trained surgeon: Should one first adopt open CME, or is it feasible to learn laparoscopic CME directly?

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Intraoperative quality assessment following double stapled circular colorectal anastomosis. ***S. Knowles, K. Lumb, P. Colquhoun.*** **From the Division of General Surgery, Schulich School of Medicine, University of Western Ontario, London, Ont.**

Double stapled circular (DSC) anastomosis is the most common approach for restoration of intestinal continuity post–distal large bowel resection. A prior survey of surgeons suggested variable practice for assessment of anastomotic integrity during surgery and interventions when surgical operators called this into question. The utility of intraoperative quality assurance manoeuvres (IOQAM) is not well studied. We hypothesize that IOQAMs and interventions to address problems vary in surgical practice.

From January 2009 to December 2010, a retrospective review of patient records was done to determine current surgical practice. Only cases where a DSC anastomosis was done were included.

A total of 813 charts were reviewed, and 310 cases were identified. The IOQAM included inspection of tissue excised by the stapler in 177 cases (57%), endoscopic assessment in 65 cases (21%), "insufflation test" in 274 cases (88%) and no assessments in 16 cases (5%). There were 29 cases that reported concerns over anastomotic integrity: 26 positive "insufflation tests," 2 incomplete tissue doughnuts and 1 defect seen on visual inspection. The underlying cause of the failure was only reported in 1 case. Anastomotic leak rates varied: 8% (24 of 294) in cases where assessments were reported, 14% (4 of 29) in cases where integrity was called into question and 13% (2 of 16) in cases with no assessment. In response to stapler failure, 6 different surgeon actions were taken.

This study reflects the inconsistency among surgeons with respect to IOQAM performed following a DSC anastomosis and the variability in the actions taken by the surgeon after a failure is identified. The anastomotic leak rate may be higher when IOQAM suggest concern with anastomotic integrity. Further research is needed to determine the clinical significance of detecting a failure and what the appropriate course of action is when a failure is identified.

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Improving patient outcomes through quality assessment of rectal cancer care. ***D. Richardson, G. Porter, P. Johnson.*** **From Dalhousie University, Halifax, NS**

Quality indicators for rectal cancer care have been proposed; however, their relationship with oncologic outcomes has not been well established. Furthermore, the extent to which these indicators are being achieved in clinical practice is unclear. The purpose of this study was to determine if proposed quality indicators are associated with local recurrence (LR), disease-specific survival (DSS) and overall survival (OS) and to examine rates of achievement of quality indicators among hospitals providing rectal cancer care.

A retrospective review of all newly diagnosed rectal cancer patients from July 1, 2002, to June 30, 2006, in Nova Scotia was performed. Data were collected from hospital inpatient and outpatient medical records. The association between 13 quality indicators of colorectal cancer care proposed by Cancer Care Ontario and LR, DSS and OS was examined using multivariate Cox proportional hazards regression controlling for patient and tumour factors.

During the study period, 466 patients underwent potentially curative surgery (median follow-up 4.2 yr) in 10 hospitals. Of the quality indicators examined, nonreceipt of a total mesorectal excision (TME) was associated with increased LR ($p < 0.01$), and a negative radial margin was associated with decreased LR ($p < 0.01$). Nonreferral of patients with stage II and III disease for adjuvant therapy was associated with reduced DSS ($p = 0.01$) and OS ($p < 0.01$). Among hospitals, the rate of TME was 18%–93%, the positive radial margin rate was 0%–20%, and the referral rate for patients with stage II/III disease for adjuvant therapy was 50%–100%.

There was wide variation in the rates of achievement of the quality indicators that were associated with oncologic outcomes. Quality improvement initiatives directed to these areas may provide the most benefit to rectal cancer patients.

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Are physicians willing to accept a decrease in treatment effectiveness for improved functional outcomes for low rectal cancer? ***A.M. Borowiec, N.N. Baxter, S. Schmocker, H. Huang, J.C. Victor, M. K. Krzyzanowska, J. Brierley, R.S. McLeod, E.D. Kennedy.*** **From the University of Toronto, Toronto, Ont.**

Treatment decisions for low rectal cancer are challenging due to the inherent tradeoffs between effectiveness and functional outcomes. The objective of this study was to determine if physicians would recommend treatment options to their patients that are less effective but have better functional outcomes relative to abdominal perineal resection (APR) in the setting of low rectal cancer.

A survey was mailed to radiation oncologists and colorectal and surgical oncology surgeons across Canada. The survey was a modified threshold task comparing: (scenario 1) transanal excision followed by chemoradiation (TAE) for a T2N0 rectal cancer relative to APR and (scenario 2) observation following complete clinical response to neoadjuvant chemoradiation (OB) for T3N0 rectal cancer relative to APR. For each scenario, respondents were asked to indicate the treatment option they would recommend to their patient when survival and local recurrence (LR) were initially set to be equivalent for TAE and for OB and APR. The respondents who chose TAE and OB were then asked to indicate the minimum survival and maximum LR they would consider acceptable to recommend TAE and OB instead of APR.

The overall response rate to the survey was 67% (127 of 189): 75% and 66% of the respondents indicated they would recommend TAE and OB, respectively, to their patient when the chance of survival was 80% (equivalent to APR). For both scenarios, the respondents indicated they would consider TAE and OB acceptable options even if the survival was as low as 75% (5% absolute decrease in survival relative to APR). For scenario 1, 85% indicated they would recommend TAE when the risk of LR was set at 6% for both TAE and APR, and they would consider TAE an acceptable option even if the risk of LR was as high as 10% (4% absolute increase in LR risk relative to APR). For scenario 2, 83% indicated they would recommend OB when the risk of LR was set at 1% for both OB and APR, and they would consider OB an acceptable option even if the risk of LR was as high as 5% (4% absolute increase in risk of LR relative to APR). Multivariable logistic regression analysis did not reveal any physician demographic factors to be predictive of willingness to accept either a decrease in survival or increase in local recurrence for TAE or OB relative to APR.

Overall most physicians (but not all) were willing to offer patients TAE and OB when effectiveness was equivalent to APR. These physicians considered both TAE and OB acceptable treatment options even when associated with up to a 5% absolute decrease in survival and 4% absolute increase in risk of LR relative to APR. These results indicate that physicians consider functional outcomes important when recommending treatment options for low rectal cancer to their patients.

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Turnbull-Cutait delayed coloanal anastomosis for the treatment of distal rectal cancer: a prospective cohort study. ***J. Hallet, H. Milot, E. Desrosiers, A. Lebrun, S. Drolet, A. Bouchard, R.C. Grégoire.*** **From the Department of Surgery, Université Laval, and the Department of Surgery, Centre hospitalier universitaire de Québec, Québec, Que.**

Coloanal anastomosis for distal rectal cancer is associated with a high risk of anastomotic leak. Fecal diversion with a loop ileostomy has been shown to reduce the impact of anastomotic leak but doesn't reduce its incidence and requires an additional procedure to close the stoma. The Turnbull-Cutait delayed coloanal anastomosis (TC) has been used to treat complex anorectal conditions. The aim of this study was to evaluate the feasibility and outcomes of TC as a primary procedure after elective resection for rectal cancer.

From October 2010 to December 2011, all patients undergoing TC used for elective rectal cancer were prospectively followed. Patients had transanal colonic pull-through of proximal colon with fixation to the thigh followed a week later by a hand-sewn anastomosis. No fecal diversion was used. Perioperative morbidity and mortality data were recorded. Functional results were measured using Wexner fecal continence score and the Fecal Incontinence Quality of Life Scale (FIQoLS).

In all, 20 TCs were performed for 18 (90%) distal and 2 (10%) midrectal cancers; 17 (85%) patients received neoadjuvant radiochemotherapy. No 30 day mortality occurred, and the major morbidity rate was 15.8%. Anastomotic leaks occurred in 2 patients (10.5%): 1 treated with a diverting ileostomy, and 1 by transanastomotic drainage. Short-term follow-up (median 263 d) revealed a mean Wexner score of 16 (14–18). The FIQoLS revealed the following mean (95% CI) scores on a scale of 0–4: lifestyle 3.1 (2.8–3.5), comportment 2.7 (2.3–3.1), depression 3.6 (3.3–3.8) and embarrassment 3.2 (2.9–3.5).

In our early experience, TC-delayed anastomosis appears to be a feasible and safe option for the elective treatment of distal rectal cancer. Short-term functional results appear satisfying. It may offer an opportunity to decrease the risk of anastomotic leak without using a diverting stoma. Further studies are needed to define long-term functional and oncologic outcomes.

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Preoperative high-dose rate brachytherapy in preparation for sphincter preservation surgery for patients with advanced cancer of the lower rectum. ***R. Boissonneault, T. Vuong, R. Loungnarath, E. DeBroux, A.S. Liberman, P. Charlebois, B. Stein, C. Richard.*** **From the University of Montréal and McGill University, Montréal, Que.**

Neoadjuvant external beam radiation therapy is recommended to decrease local recurrence in locally advanced rectal cancer (LARC), but may impair negatively on sphincter function and quality of life. High-dose rate endorectal brachytherapy (HDREBT) represents an alternative with potentially less morbidity. This study aimed to assess sphincter preservation rates and quality of life of patients with distal third LARC treated with neoadjuvant HDREBT.

A phase II study was undertaken. Eligible criteria were patients with nonmetastatic distal third LARC without invasion of the sphincter. With a high-dose rate delivery system, 26 Gy were given. Surgery was scheduled 4–8 weeks later. All surgeons involved were colorectal trained. Overall survival, local recurrence rate, quality of life and sphincter function (EORTC QLQ-CR30–CR38) were evaluated.

In total, 44 patients were entered. Tumours were graded T2 (n = 3), T3 (n = 40) and early T4 (n = 1), N0 (n = 24) and N1 (n = 20). Grade III toxicity occurred in 1 patient (2.3%). Sphincter preservation was performed in 33 patients (75%, group 1), with 6 radiological anastomotic leaks. Abdominoperineal resection was done in 11 (group 2). At 2 years, overall survival was 90.9% (95% CI 82.4%–99.4%), disease-free survival was 81.8% (95% CI 70.4%–93.2%), and the local recurrence rate was 4.5% (95% CI 0%–10.6%). Quality of life was good, with a mean score of 72.4 for group 1 and 73.5 for group 2 after 24 months (p = NS). In group 1, functional results were good (mean defecation problem score = 21.8).

High-dose rate endorectal brachytherapy allowed good local control with minimal toxicity. A high rate of sphincter preservation with good functional results was achieved, possibly related to minimal sphincter irradiation with this novel technique. A randomized-controlled trial comparing HDREBT to conventional radiation is warranted.

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Impact of an enhanced recovery program on short-term outcomes after scheduled laparoscopic colon resection. ***N.O. Kolozsvari, G. Capretti, P. Kaneva, A. Neville, F. Carli, S. Liberman, P. Charlebois, B. Stein, M.C. Vassiliou, G.M. Fried, L.S. Feldman.*** **From McGill University, Montréal, Que.**

Both enhanced recovery programs (ERP) and laparoscopy can reduce complications and length of stay (LOS) in colon surgery. We investigated whether ERP further improved the short-term outcomes of scheduled laparoscopic colectomies.

We performed an audit of all patients undergoing scheduled laparoscopic colon resection between January 2003 and August 2010 in our institution. An ERP including accelerated introduction of nutrition, mobilization, pain control and catheter management was introduced in 2005. Demographic data, intra- and postoperative details and 30 day emergency room (ER) visit and readmission rates were collected. We compared LOS and short-term outcomes for ERP patients with those receiving traditional postoperative care using χ^2 and regression models. Data are presented as median (25th–75th percentile). Statistical significance was defined as $p < 0.05$.

In total, 136 (46%) of 297 patients were enrolled in the ERP. At baseline, the 2 groups had similar demographic characteristics, but patients in the ERP were more likely to have their operation performed by a colorectal surgeon ($p = 0.01$). Patients in the ERP ate solids earlier ($p < 0.001$) and had earlier removal of their urinary catheter ($p < 0.001$). The LOS was 4 (3–6) days for both groups ($p < 0.01$), with more patients in the ERP discharged by postoperative day 3 ($p < 0.001$). After adjusting for other variables, ERP enrolment remained an independent predictor of LOS ($p < 0.01$), along with age ($p < 0.01$) and in-hospital complications ($p < 0.001$).

Complication rates were similar, with no increase in nausea/vomiting or nasogastric tube despite rapid diet advancement in the ERP and no difference in urinary retention despite earlier catheter removal. Patients in the ERP had significantly fewer ER visits ($p = 0.02$), but there were no differences in readmission rates.

In patients undergoing scheduled laparoscopic colectomy in a university-based clinical teaching unit, ERP can further reduce length of stay and postoperative ER visits without increasing readmission rates.

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The clinical results of the Turnbull-Cutait delayed coloanal anastomosis: a systematic review. ***J. Hallet, H. Milot, S. Drolet, A. Bouchard, R.C. Grégoire.*** **From the Québec Centre for Minimally Invasive Surgery—CHUQ, Department of Surgery, Québec, Que.**

Turnbull and Cutait described abdominoperineal pull-through followed by delayed coloanal anastomosis (DCA) in 1961.

Delayed coloanal anastomosis could reduce anastomotic leaks, pelvic morbidity and avoid permanent or temporary stomas; however, there is still a lack strong evidence on its clinical benefits. This systematic review examined the clinical outcomes of DCA for the treatment of malignant and benign colorectal conditions.

We systematically searched MEDLINE, EMBASE, Web of Science, Biosis, Cochrane Central and Scopus to identify relevant randomized controlled trials (RCTs) and observational studies (OSs) reporting on the clinical results of DCA. Two independent reviewers selected studies, extracted data using a standardized form and assessed risk of bias using the Newcastle-Ottawa Scale and a checklist of key methodological elements. The primary outcome was pelvic morbidity (anastomotic leak, pelvic abscess and sepsis, use of stoma). Secondary outcomes were fecal continence and oncologic follow-up.

From 1251 citations, 7 OSs were included (n = 1124). All studies were considered at high risk of bias. The 2 studies comparing DCA to immediate coloanal anastomosis each reported a significant decrease in anastomotic leak and pelvic abscess or sepsis. Pelvic morbidity was low in the other 5 studies: anastomotic leak 0%–7%, pelvic abscess 0%–11.8% and pelvic sepsis 6.8%–10%. A permanent stoma was required after 1%–6% of DCA, except for 1 study reporting a 25% rate. Fecal continence was satisfying in all studies, with no difference in comparative setting, and 4 studies reported an overall survival from 63.8% to 91% at 4–5 years. Clinical heterogeneity and methodological issues precluded meta-analysis.

Based on retrospective evidence, with high risk of bias, DCA produces a low rate of anastomotic leak, pelvic morbidity and permanent or temporary stoma, with reasonable fecal continence. Results are encouraging, but prospective OSs and RCTs are needed for comparison with the standard of care.

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Is a vertical rectus abdominus flap (VRAM) necessary? An analysis of perineal wound complications. ***P. Tuttle, R. Powell, A. Fowler, A. Mathieson.*** **From the Memorial University of Newfoundland, St. John's, Nfld.**

Rectal excision (abdominal perineal resection and total proctocolectomy) without reconstruction is associated with significant morbidity, including perineal wound complications ranging from 25% to 60%. It has been postulated that a vertical rectus abdominus flap (VRAM) may reduce the perineal complication rate. In our local experience, VRAM flaps have not been without complications. The purpose of this study was to determine the rate of perineal wound complications at our institution. A high rate of major complications would suggest potential benefit from VRAM flaps, which could be tested in a separate trial.

A retrospective chart review was performed on patients who underwent rectal excision for anorectal cancer or inflammatory bowel disease from January 2005 to February 2011 at our institution. Patients were identified from our prospectively maintained operating room database. Perineal wound complications defined as superficial skin infections, perineal abscesses, wound dehiscence, perineal sinuses and hernias were included. Data were analyzed using χ^2 tests and logistic regression.

In total, 209 patients were included in the study. The perineal wound complication rate was 45.9%. The majority were superficial infections (34.7%). The rates of perineal abscess, wound dehiscence and sinus were 9.7%, 6.3% and 10.5%, respectively. Two perineal hernias were identified. There was no difference in perineal complications between patients with inflammatory bowel disease and anorectal cancer. Neoadjuvant treatment for anorectal cancer did not significantly affect wound complications, but there was a trend toward significance in this group for perineal abscesses (p = 0.052).

A literature review indicates that our institute's wound infection rate appears similar to that of others. Despite the high complication rate, most are superficial infections. This minimal morbidity would likely not be helped by a VRAM flap.

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Fistula plug versus endorectal anal advancement flap for the treatment of high transsphincteric cryptoglandular anal fistulas: a systematic review and meta-analysis. ***L. VanHouwelingen, K. Martin, K. Vogt, M.C. Ott.*** **From the University of Western Ontario, London, Ont.**

The success rates of anal fistula plug (AFP) and endorectal anal advancement flap (ERAF) for the treatment of high transsphincteric anal fistulas vary widely in the literature and are associated with a significant morbidity (incontinence) and unacceptably high recurrence rates. This study was undertaken to determine if the use of AFP to treat high transsphincteric cryptoglandular anal fistulas, in comparison to ERAF, is associated with a better rate of healing, lower recurrence rate and improved continence and quality of life.

A systematic review of 3 bibliographic databases, reference lists and conference proceedings was conducted. Studies from January 2000 to January 2012 were included if comparisons were made between patients receiving treatment for high transsphincteric cryptoglandular anal fistulas using AFP or ERAF. Data were extracted by 2 independent reviewers on study design, healing rates, incontinence rates, quality of life scores and complications. Data were pooled using a random effects model, and heterogeneity was explored.

In all, 3 randomized control trials and 4 retrospective cohort studies met all eligibility criteria. Among 462 patients with high transsphincteric cryptoglandular anal fistulas requiring treatment, there was no significant difference found between AFP versus ERAF with respect to healing (RR 0.73, 95% CI 0.50–1.07). When only randomized control trials were assessed (n = 63), again, no statistical difference was found between AFP and ERAF (RR 0.64, 95% CI 0.26–1.56).

The use of AFP is not associated with a significant difference in healing compared with ERAF. Based on the available data, we cannot recommend one surgical technique over the other. Both methods seem to have decreased success rates, which suggests that the decision as to which procedure is best is likely related to individual patient characteristics and surgeon preference. A large, well conducted randomized control trial is necessary to determine the true efficacy of AFP.

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Maternal and neonatal outcomes following colorectal cancer surgery. ***F. Haggar, G. Pereira, K. Einarsdottir, H. Moloo, R. Boushey, J. Mamazza.*** **From the Division of General Surgery, The Ottawa Hospital, University of Ottawa, Ottawa, Ont., and the Institute of Child Health**

Research, the University of Western Australia, Perth, Australia

This study aims to investigate maternal and neonatal outcomes of pregnancies in women who have had previous colorectal cancer (CRC) surgery, including the effects of surgical technique.

A population-based linked data study, combining data from the Western Australia Midwives Notification System and Western Australia Cancer Registry, was performed to compare outcomes for all pregnancies of patients who underwent surgical treatment for CRC during the period 1982–2007. Logistic regression models were performed to investigate the association between CRC surgery and a range of maternal and neonatal outcomes.

Of the 627 762 births during the study period, 232 deliveries were to patients who had previously undergone surgery for CRC. Surgical treatment of colorectal cancer was associated with an increased risk of all reported adverse maternal outcomes, except induced and threatened abortions, compared with noncancer controls, with risks ranging from 11% to 4-fold (OR range 1.11–4.24). The increased risk of adverse outcomes was generally worse in women who had previous open surgery (n = 153) compared with those who had laparoscopic-assisted surgery (n = 79). The open CRC group had an increased risk of prelabour rupture of membranes (OR 2.14, CI 1.52–2.93), intrauterine growth restriction (OR 1.11, CI 1.00–1.23) and postpartum hospital stay shorter than 5 days (OR 4.24, CI 1.32–13.6). Risk of adverse neonatal outcomes was nearly 2-fold in the open group compared with the laparoscopic group.

Previous surgical treatment of CRC conferred a significantly increased likelihood of adverse maternal and neonatal outcomes in subsequent pregnancy; in particular, those who underwent the open technique had higher risks.

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Transanal drainage to treat anastomotic leaks after low anterior resection for rectal cancer: a valuable option. ***C. Boulanger-Gobeil, A. Bouchard, J.P. Gagné, R.C. Grégoire, C. Thibault, P. Bouchard.*** **From Université Laval and the Centre de chirurgie minimalement invasive de Québec, Québec, Que.**

Anastomotic leak after resection for low rectal cancer remains a major cause of morbidity and mortality. The aim of this study was to assess short- and long-term outcomes of patients with a symptomatic leak, depending on the initial management.

We underwent a retrospective review of all patients treated for an anastomotic leak after low anterior resection for rectal cancer at a single institution between January 2000 and March 2011.

A total of 37 patients (35 male, 2 female) developed a symptomatic leak. Initial leak management consisted of transanal/transanastomotic drainage (TD group, n = 16), abdominal reintervention (AR group, n = 12) or medical treatment (M group, n = 9). A diverting ileostomy had been performed before the leak occurred in 94% of patients in the TD group, 78% in the M group and only 33% in the AR group. Stoma closure rate was higher in the TD group (93%) when compared with the other groups (M = 67% and AR = 60%). Neither of the 2 Hartmann patients had their intestinal continuity restored. The only death attributed to a leak was observed in the AR group. In the TD group, 19% required an admission to the intensive care unit. Antibiotics were administered for a median length of 9 days, and the drain was left in place for a median length of 30 days. No patient required an abdominal procedure, but 38% needed a second transanal drainage. Complications observed in the TD group were anastomotic strictures in 33% and the creation of a new stoma owing to poor function in 13%.

For the management of low anastomotic leak, transanal drainage allows preservation of the anastomosis and control of the sepsis with a high rate of ileostomy closure. We consider this a valuable option in patients who already had a diverting ileostomy performed at the index procedure.

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Trends in colon cancer in Ontario: 2002–2009. ***B.P. Chan, T. Gomes, R.P. Musselman, R.C. Auer, H. Moloo, M. Mamdani, M. Al-Omran, R.P. Boushey, O. AlObeed.*** **From the University of Ottawa, Ottawa, Ont., the Institute of Clinical Evaluative Sciences, Toronto, Ont., and the King Saud University, Riyadh, Saudi Arabia**

The safety and efficacy of laparoscopic surgery for colon cancer is well established, and the uptake of this surgical technique had not been explored previously in the province. We therefore examined the temporal trends of open and laparoscopic surgery for colon cancer in Ontario, Canada.

A retrospective cross-sectional time series analysis examining population-based rates of elective surgeries for colon cancer among 10.5 million adults in Ontario was conducted from Apr. 1, 2002, to Mar. 31, 2009. Administrative claims databases were linked to assess quarterly elective procedure rates over time.

Over the study period, 3950 laparoscopic and 13 048 open elective colon cancer surgeries were performed in Ontario. The overall quarterly rate of colon cancer surgeries has remained relatively stable over time at an average of 5.8 per 100 000 population (p = 0.10). From the first and last quarter, the rates of laparoscopic surgeries conducted increased nearly 3-fold from 0.8 to 2.2 per 100 000 population, with a notable increase after 2005 (p < 0.01). Conversely, open surgery rates decreased over 30%, from 5.3 to 3.5 per 100 000 population (p < 0.01). If current trends continue, the projected proportion of laparoscopic colon surgeries is estimated to reach 41% by 2015. Patients receiving open surgery had significantly higher preoperative comorbidity (Charlson comorbidity score ≥ 3) than patients in the laparoscopic group (47.8% v. 39.1%, standardized difference = 0.26).

Temporal trends in Ontario for laparoscopic colon cancer surgery are increasing but remain lower than open surgeries. Patient selection remains an important consideration for the surgeon.

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Validation of electronically derived short-term outcomes in colorectal surgery. ***B.P. Chan, J.B.P. Armstrong, D.A. Fergusson, A.J. Forster, R.P. Boushey.*** **From the University of Ottawa and The Ottawa Hospital, Ottawa, Ont.**

The purpose of this study was to validate electronically derived short-term outcomes of colorectal surgery with a gold standard chart review.

From Apr. 1, 2003, to Dec. 31, 2009, 30 day outcomes of colorectal surgeries performed at The Ottawa Hospital were studied using the Ottawa Hospital Data Warehouse (OHDW).

Thirty day outcomes were derived from the modified Clavien–Dindo classification: grade 2 complications were blood transfusions or total parenteral nutrition (TPN), grade 3 were return to the operating room, endoscopic or radiologic intervention, grade 4 were intensive care unit or step-down unit admissions, and grade 5 was in-hospital mortality. Electronic algorithms were assessed with a 300 sample size chart review. Analysis was done by calculating sensitivity and specificity.

Over the study period, 4988 colorectal surgeries were identified. Of these, 3269 (65.5%) were elective surgeries, 2312 (46.3%) patients were female, mean age was 62.1 (SD 16.5) years and 2676 (53.6%) surgeries were cancer cases. In total, 1259 (25.2%) cases had a complication. For cases with a complication, 234 (4.7%) were grade 5, 386 (7.7%) were grade 4, 249 (5.0%) were grade 3, and 390 (7.8%) were grade 2 as their highest complication. Compared with the chart review, sensitivities and specificities were both 100% for in-hospital mortality, 98.5% and 99.1% for grade 4 complications, and 91.4% and 94.4% for grade 3 complications. Sensitivity and specificity for TPN were 96.1% and 99.1%, and blood transfusions were 87.0% and 97.0%.

Electronic algorithms used to derive short-term outcomes from colorectal surgeries using the OHDW were highly sensitive and specific when compared with a gold standard chart review.

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A population-based assessment of transanal and endoscopic resection for adenocarcinoma of the rectum. ***D. Richardson, G. Porter, P. Johnson.*** **From the Dalhousie University, Halifax, NS**

Controversy exists regarding the use of local excision techniques in the treatment of early rectal cancer and malignant rectal polyps. The purpose of this study was to describe the outcomes associated with these procedures using population-based data from a Canadian province.

All patients with a new diagnosis of rectal adenocarcinoma from July 1, 2002, to June 30, 2006, in Nova Scotia, who underwent transanal excision (TAE) or endoscopic resection with curative intent were identified. Data were collected through a comprehensive, standardized review of hospital inpatient and outpatient medical records. Recurrence was defined as the presence of local and/or distant disease.

Of 533 patients with rectal cancer who were treated with curative intent, 30 patients (5.6%) underwent TAE. Tumour stage was T1 in 47%, T2 in 47% and T3 in 6%. Among patients with T1 tumours, 12 of 14 underwent TAE alone, with a 5 year recurrence rate of 26% compared with 0% for the 2 of 14 patients who underwent TAE followed by radical excision. Of the 10 of 14 patients with T2 tumours who underwent TAE alone, the 5 year recurrence rate was 27% compared with 50% in the 4 of 14 patients who underwent TAE followed by radical excision. Of the patients who underwent TAE, 2 had T3 lesions: 1 had a radical excision and no recurrence and 1 had TAE alone with recurrence. Endoscopic resection was performed in 37 of 533 patients (7%). Polyp morphology was sessile in 54%, pedunculated in 38% and unknown in 8%. Following endoscopic resection, 11 of 37 (30%) patients underwent radical resection. Residual disease was present 73% of specimens, and the 5 year recurrence rate was 0%. Of the 26 of 37 patients (70%) who underwent endoscopic resection alone, the 5 year recurrence rate was 12%.

Local excision techniques were used infrequently for treating rectal malignancy. Transanal excision alone for T1 and T2 tumours is associated with high recurrence rates, and further research is needed to identify which patients can safely receive these procedures.

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Laparoscopic colorectal surgery in the emergency setting: trends in the province of Ontario from 2002 to 2009. ***R.P. Musselman, Tara Gomes, B.P. Chan, R.C. Auer, H. Moloo, M. Mamdani, M. Al-Omran, O. Al-Obaid, R.P. Boushey.*** **From the University of Ottawa, Ottawa, Ont., the Institute of Clinical Evaluative Sciences, Toronto, Ont., and the King Saud University, Riyadh, Saudi Arabia**

The purpose of this study was to examine the adoption trends of emergency laparoscopic colorectal surgery in the province of Ontario from 2002 to 2009.

We conducted a retrospective time-series analysis examining rates of emergency colorectal surgery among 10.5 million adults in Ontario, Canada, from Apr. 1, 2002, to Dec. 31, 2009. We linked administrative claims databases and the Ontario Cancer Registry to assess procedure rates over time. Procedure trends were assessed using time-series analysis.

Over the 8 year period, 29 676 emergency colorectal procedures were identified: 2582 (8.7%) were performed laparoscopically and 27 094 (91.3%) were open. Open and laparoscopic patients were similar with respect age, sex and Charlson comorbidity index. The proportion of surgery for benign (63.8% of open cases v. 65.6% laparoscopic, standardized difference = 0.04) and malignant disease (36.2% open v. 34.4% laparoscopic, standardized difference = 0.04) was equal between groups. The percentage of emergency colorectal surgery performed laparoscopically increased from 5.7% in 2002 to 12.0% in 2009 ($p < 0.01$). The use of laparoscopy increased for both benign and malignant disease. Statistically significant upward trends in laparoscopic surgery were seen for inflammatory bowel disease ($p < 0.01$), obstruction ($p < 0.01$) and colon cancer ($p < 0.01$). From 2002 to 2009, annual procedure rates increased at a greater rate in nonacademic centres ($p < 0.01$).

Laparoscopic emergency colorectal surgery has increased significantly between 2002 and 2009 for both benign and malignant disease and for a wide range of diagnoses. This was driven in part by steadily rising usage of laparoscopy in nonacademic centres.

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Prevention of perineal hernia after laparoscopic and robotic abdominoperineal resection: review with case series of internal hernia through pelvic mesh which was placed in attempt to prevent perineal hernia. ***G. Melich, D. Ro Lim, B. Soh Min, S. Hyuk Baik, P.H. Gordon, N. Kyu Kim.*** **From the Jewish General Hospital, McGill University, Montréal, Que., and the Department of Surgery, Yonsei University College of Medicine, Seoul, South Korea**

This review with case series is intended to raise awareness of a previously unpublished phenomenon of placing a pelvic mesh to prevent perineal hernias in cases of laparoscopic and robotic abdominoperineal resections (APR) and in doing so actually

causing internal hernias through the mesh.

Perineal hernia is a rare complication of major pelvic surgery such as APR. In most cases, the perineal hernias are asymptomatic, but often enough, a dragging feeling and discomfort in the perineum, urinary symptoms and bowel compromise can occur. Despite the lack of evidence in the literature, some surgeons therefore feel compelled to reinforce the surgically weakened pelvic floor after APR with mesh to prevent these complications.

Presented is an illustrative series of 4 consecutive cases of early internal hernia through a pelvic mesh defect after laparoscopic and robotic APR. All cases were successfully managed using the following 4 laparoscopic options depending on the patient's specific conditions: 1) hernia reduction with removal of original mesh without any further intervention if the pelvic floor appeared well healed and intact; 2) hernia reduction with mesh removal followed by technically improved placement and fixation of new mesh in the noncontaminated pelvis with a weak pelvic floor; and 3) hernia reduction, resection of compromised bowel and removal of original mesh followed by suture of the bladder; or 4) vagina to presacral fascia in cases with possible contamination.

Is reinforcing really necessary, and in which cases? It might just be that in patients with a shallow, somewhat supported pelvic floor, the benefits of not performing any additional reinforcement could outweigh possible complications such as internal hernias and infection. What are some of the technical issues, and what is the best way to address them? These are some of the topics to be discussed and should be further scientifically scrutinized.

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Effect of rectal cancer treatments on quality of life. ***P.T. Phang, A. Lo, I. Pinsk, C. Brown, M. Raval.*** **From St. Paul's Hospital, Vancouver, BC**

Preoperative radiation and total mesorectal excision (TME) result in the lowest local recurrence for rectal cancer. Both treatments are associated with decreased quality of life (QOL). We aim to determine the longitudinal effects of these treatments on QOL.

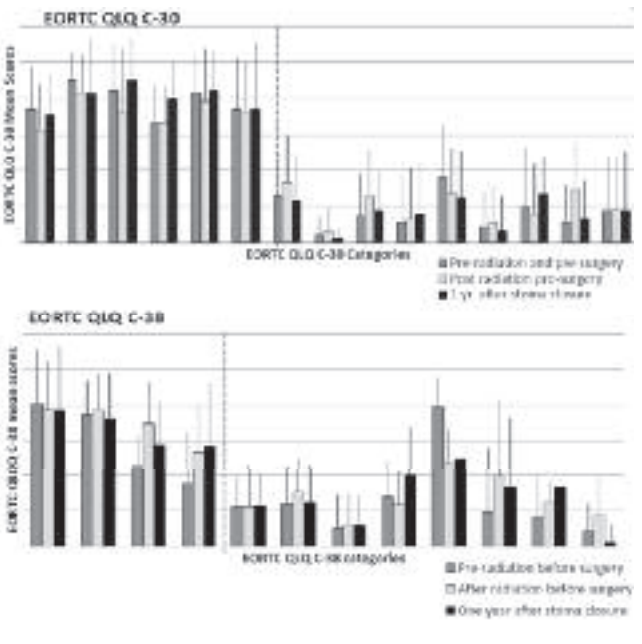

Fig., abstract 190. Comparison of EORTC QLQ C-30 and C-38 function and symptoms scores.

Rectal cancer patients treated with long-course preoperative radiation then surgery (n = 15) completed validated questionnaires for cancer-specific QOL (EORTC QLQ-C30) and site-specific (colorectal) QOL (EORTC QLQ C-38). The questionnaires were completed prospectively at 3 times: before radiation and surgery, after radiation before surgery, and 1 year after stoma closure.

The mean age was 62 years. The male to female ratio was 4:1. Average distance from the anal verge was 6.5 cm. Subscales of emotional functioning, sexual enjoyment and future perspective increased at 1 year after treatment (*p < 0.04, 0.03, 0.01, respectively). Emotional functioning also improved from postradiation presurgery to 1 year after stoma closure (†p < 0.02). All other subscales of global and site-specific QOL did not change significantly after radiation or surgery.

Quality of life in rectal cancer patients did not decrease as a result of radiation or combination of radiotherapy and surgery. Emotional functioning, sexual enjoyment and future perspective scores increased at 1 year after treatment. Curative rectal cancer treatments result in maintained or improved quality of life.

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The use of antibacterial sutures as an adjunctive preventative strategy for surgical site infection in Canada: an economic analysis. ***L.J. Goldstein, H. Cheng.*** **From the Johnson and Johnson Medical Companies, Markham, Ont.**

Colorectal surgery is associated with one of the highest incidence rates of surgical site infection (SSI) when compared with other surgical procedures. Canadian hospitals employ many different strategies in an effort to combat SSI, including sterilization, antibiotic prophylaxis and normothermia. This study was conducted to determine whether incorporating antibacterial, triclosan-coated sutures as an adjunctive strategy to reduce SSIs in Canadian hospitals would be cost-effective.

Clinical and economic data were obtained from peer-reviewed literature and through case-costing data from a large Canadian hospital. The efficacy data used to demonstrate a reduction in SSIs from the use of antibacterial sutures were obtained through a large prospective trial. One- and 2-way sensitivity analyses were conducted on economic and clinical parameters to ensure robustness.

Incorporating antibacterial suture use for colorectal procedures has been found to reduce the incidence of SSI from 14.3% to 6.5%. Based on model calculations, a hypothetical hospital that completes a total of 250 colorectal procedures per year would experience 36 SSIs using standard SSI prevention strategies. Incorporating antibacterial suture use into the hospital's SSI preventative strategy would reduce the number of SSIs experienced to 16, for a total reduction of 20 SSIs. Patients who develop SSIs after colorectal surgery spend an average of 13 additional days in hospital. By adopting antibacterial sutures for all of their colorectal procedures, the hospital would reduce inpatient hospital stays by 257 days per year. The model establishes that the use of antibacterial sutures has the potential to provide the hospital with a yearly net cost savings. Taking into account the price premium associated with antibacterial sutures, the hospital would still

achieve a cost savings of $229 016.26 per year.

Antibacterial sutures are a cost-effective adjunctive strategy that can be used to prevent SSIs after colorectal surgery in Canadian hospitals.

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Impact of socioeconomic status on colorectal cancer screening and stage at presentation: preliminary results of a population-based study from an urban Canadian centre. ***C. Wen, C. Wong, N. Johnston, F. Farrokhyar, W. Stephen, S. Kelly, L. Lindsay, S. Forbes.*** **From McMaster University, Hamilton, Ont.**

Previous studies using large administrative data sets have suggested that lower household income is associated with a lower likelihood of receiving screening investigations for colorectal cancer (CRC) and, possibly, a higher likelihood of being diagnosed with more advanced disease. In this study, we test these hypotheses by conducting a population-based retrospective cohort study drawing from chart-level data.

All patients with a diagnosis of CRC living in a defined geographic area in an urban Canadian centre were identified. Key outcome variables extracted were method of diagnosis (asymptomatic screening v. symptomatic work-up) and stage at presentation. Median household income was imputed by linking patients' postal codes with census tract data. Multivariable logistic regression was used to assess the association between income quintile and method of diagnosis, and stage at presentation.

There were 985 residents treated for CRC at local hospitals between 2003 and 2011. Asymptomatic screening diagnosed CRC in 29.6% of patients. There was no association between income quintile and method of diagnosis (OR 0.9, 95% CI 0.6–1.4 for highest income quintile compared with lowest). Colorectal cancer was more likely to be found via symptomatic work-up for patients aged younger than 50 years (OR 2.3, 95% CI 1.1–4.5) and older than 75 years (OR 1.4, 95% CI 1.0–1.9) compared with patients aged 50–75 years. Stage I, II, III and IV disease was found in 16.6%, 38.1%, 29.4% and 15.9% of patients, respectively. There was no association between income quintile and stage at presentation (OR 1.2, 95% CI 0.7–2.1 for highest income quintile compared with lowest). Patients older than 75 years were less likely to present with stage III/IV disease (OR 0.6, 95% CI 0.4–0.9). Colorectal cancer found via symptomatic work-up was more likely to present with stage III/IV disease (OR 1.5, 95% CI 1.01–2.0).

Contrary to previous studies, our results suggest that household income is not associated with access to CRC screening or stage at presentation.

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Initial perioperative results of the first transanal endoscopic microsurgery (TEM) program in the province of Quebec. ***A. Lebrun, A. Bouchard.*** **From the Saint-François d'Assise Hospital—CHUQ, Québec, Que.**

The aim of this study is to assess the quality of the first transanal endoscopic microsurgery (TEM) program in the province of Quebec. Transanal endoscopic microsurgery is the resection of a rectal tumour using special laparoscopic instruments after transanal introduction of an operative proctoscope and creation of a pneumorectum. One benefit of TEM is that it offers a minimally invasive procedure to patients who could otherwise need transabdominal radical surgery for the removal of a rectal tumour.

All 33 patients who underwent a TEM in our hospital from the beginning of the program in April 2011 to March 2012 by a single surgeon were prospectively followed. Indications, perioperative data, final pathological analysis and functional results were collected. Primary outcome is 30 day morbidity, and secondary outcomes are margin status and anorectal function.

Operative indications were endoscopically unresectable villous tumour or transformed polyp (n = 21); T1 rectal adenocarcinoma with favourable criterias or T2 in patients with important comorbidities, making them ineligible for a radical resection (n = 9); or positive margin after endoscopic excision of a neuroendocrine tumour (n = 3). Most of patients (64%) had midrectal tumours (6–10 cm). The procedure was done as an ambulatory surgery in 31% of the first 13 patients and in 90% of the remaining patients. Median operative time was 59 (11–204) minutes, and mean blood loss was minimal (17 mL). There were 4 postoperative complications: 2 minor urinary complications, 1 recto-vaginal fistula managed with a vaginal advancement flap and 1 rectal stenosis that was treated endoscopically (dilations and temporary stent). Final pathological analysis reported positive margins for 2 patients (benign tumours).

The introduction of the first TEM program in the province of Quebec has been safely executed. Once the program is running, most patients can safely undergo surgery in an ambulatory setting. Long-term follow-up will be necessary to assess the recurrence rate, even with a high rate of negative margins.

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Use of negative pressure wound therapy decreases perineal wound infections following abdominal perineal resection. ***S.A. Chadi, N.G. Parry, K. Leslie, M.C. Ott.*** **From the University of Western Ontario, London, Ont.**

There has been an increased use of negative pressure wound therapy (NPWT) in high-risk surgical incisions such as traumatic, open extremity fractures and high-risk sternotomies. Perineal incisions postabdominoperineal resection (APR) are associated with a 20%–30% risk of infection in normal-risk patients. Our objective was to investigate the effect of NPWT on the perineal incisions of high-risk patients.

A prospective series of high-risk patients receiving APR was used. Demographic information was collected as well as all risk factors of wound infection. Negative pressure wound therapy (KCI) was applied continuously to the perineal incision for 5 days postoperatively. After discontinuation, patients were followed with daily assessments of their incisions. All other postoperative care was carried out in the standard fashion, including antibiotic prophylaxis, progression to oral intake and ambulation. Patients were subsequently followed-up at 30 days postoperatively.

Over a 9 month period, 10 patients were accrued with a mean age of 63 years (40% female) and a median length of stay of 10 days. Of these, 8 patients had a low-lying rectal malignancy, with 88% requiring neoadjuvant therapy and 20% having pelvic exenterations. The remaining patients received an APR for ulcerative colitis; both patients were receiving chronic doses of steroids. Of all patients, 2 were found to have perineal wound infections, the largest of which was 1 cm in length presenting on postoperative day 5 and resolving with 1 week of regular wound

packing. A patient who had received a pelvic exenteration was found to have a pelvic abscess with no associated perineal wound concerns; this was treated successfully with percutaneous drainage.

In a previous assessment of our institutional data, perineal infections were detected in 28.6% of normal-risk patients and in 54% of high-risk patients. Our study demonstrates a decreased risk of perineal wound infections in these high-risk patients.