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Canadian Association of General Surgeons

Canadian Association of Thoracic Surgeons

Canadian Hepato-Pancreato-Biliary Society

Canadian Society of Surgical Oncology

Canadian Society of Colon and Rectal Surgeons

Québec City, Que.
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Forum canadien de chirurgie

Résumés des communications présentées aux congrès annuels de

l'Association canadienne des médecins et chirurgiens spécialistes de l'obésité

l'Association canadienne des chirurgiens généraux

l'Association canadienne des chirurgiens thoraciques

la *Canadian Hepato-Pancreato-Biliary Society*

la Société canadienne d'oncologie chirurgicale

la Société canadienne des chirurgiens du côlon et du rectum

Québec, Que.
du 2 au 5 sept., 2010

Abstracts • Résumés

Canadian Association of Bariatric Physicians and Surgeons
Association canadienne des médecins et chirurgiens spécialistes de l'obésité

1

Laparoscopic sleeve gastrectomy: superobese patients (BMI > 50 kg/m^2) may require a second stage procedure. ***H. Atlas, N. Safa, R. Denis, P. Garneau.*** **From the Department of Surgery, Hôpital du Sacré-Cœur de Montréal, Montréal University, Montréal, Que.**

Laparoscopic sleeve gastrectomy (LSG) has been designed as a first-stage procedure for high-risk or superobese patients (BMI > 50 kg/m^2) to decrease perioperative complications following laparoscopic Roux-en-Y gastric bypass (LRYGB) or duodenal switch (DS). Its short- and midterm weight loss results are reportedly similar to those of LRYGB, stimulating surgeons to perform LSG as a primary procedure. The aim of this study was to evaluate its safety, efficacy with short- and midterm results of excess weight loss (%EWL) and to identify variables for reinterventions.

We retrospectively evaluated 242 patients who underwent LSG between March 2007 and March 2010. Their mean preoperative weight was 138.6 kg, with a mean BMI of 49.0 kg/m^2; 38% were superobese (n = 93). The major morbidity encountered was staple line leaks in 15 of 242 patients (6.2%), with 6 following revisional procedures. The perioperative mortality rate was 1.6% (4 patients). In terms of weight loss, %EWL for patients at 6 months was 46%, 60% at 12 months, 61% at 18 months and 62% at 24 months. Eighty-seven patients were evaluated at 12 months: 44 were morbidly obese (BMI < 50 kg/m^2) and 43 were superobese (BMI > 50 kg/m^2). Failures were assessed as %EWL less than 50 or BMI greater than 35 kg/m^2. The failure rate was 4.5% (2/44 patients) for morbidly obese patients (p < 0.05) and 32.6% (14/43 patients) for superobese patients; these were scheduled for a second stage procedure. In all, 76.4% of superobese patients had an %EWL greater than 50%.

Given our encouraging results with LSG, we believe that LSG gives similar midterm weight loss results as LRYGB, especially in patients with a BMI less than 50 kg/m^2, and that it could be proposed routinely in our healthcare system. Revisional procedures and superobesity have been identified as variables that increase the likelihood of reinterventions after LSG.

2

Weight loss after duodenal switch without gastrectomy for the treatment of severe obesity: review of a single-institution case series of duodeno-ileal intestinal bypass. ***F. Moustarah, S. Marceau, S. Lebel, L. Biertho, F. Hould, P. Marceau, S. Biron.*** **From the Bariatric and Metabolic Institute, Cleveland Clinic Foundation, Cleveland, Ohio, Département de chirurgie, Institut universitaire de cardiologie et de pneumologie de Québec, Université Laval, Québec City, Que.**

We describe the weight loss effect of the duodeno-ileal switch (DIS) component of a duodenal switch (DS) operation in a series of severely obese patients who had a DIS without gastrectomy as their sole bariatric procedure.

Our prospectively maintained database of DS patients was surveyed to identify those who had a duodenal switch without the vertical gastrectomy component. Weight and BMI are reported as mean ± standard error of the mean. The t test was used to compare continuous variables.

Between January 2001 and April 2009, 49 consecutive patients had a stand-alone duodeno-ileal switch without gastrectomy procedure. Our sample consists of 22 female and 27 male patients with a mean age of 58 (range 36–70) years at the time of surgery. Initial weight and BMI were 143.9 ± 3.6 kg and 52.5 ± 1.2 kg/m^2, respectively. There was 1 perioperative mortality (< 30 d). Nadir weight and BMI were reached at an average of 1.8 ± 0.2 years postoperatively and were 103.7 ± 3.2 kg and 38.0 ± 1.2 kg/m^2 (n = 48), respectively. The drop in BMI of 14.5 ± 0.8 kg/m^2 was significant (p < 0.001). The mean excess weight loss (%EWL) at nadir weight was 50.6% ± 2.8%. Sleeve gastrectomy was then performed in 6 patients to complete the DS procedure at a mean of 22 months from the time of initial surgery. Follow-up for the duodeno-ileal switch–only group ranged from 6 months to 8.3 years, and this group's weight-related parameters over time were as follows: at 3 years, BMI = 37.4 ± 1.3 kg/m^2 and %EWL = 48.8 ± 3.7% (n = 22); at 5 years, BMI = 39.2 ± 2.5 kg/m^2 and %EWL = 43.8 ± 7.0% (n = 9).

Duodeno-ileal switch alone is rarely performed as a sole weight loss procedure; but in patients whose clinical indications warrant foregoing the sleeve gastrectomy component, DIS can be safely performed with good weight loss results. In this series, weight loss at 2 years and beyond compares well with other commonly performed bariatric operations.

3

Laparoscopic bariatric surgery for treatment of complicated type 2 diabetes in obese patients: a prospective randomized controlled: a pilot study. ***M. Anvari, A. Sharma, C.H. Goldsmith, G. Lacobellis, M. Cadeddu, M. Misra, V. Taylor, J. Tarride, E. Hubert, M. Tiboni, D. Hong.*** **From the Departments of Surgery, Clinical Epidemiology and Biostatistics, Medicine, Psychiatry and Behavioural Neurosciences, and Anaesthesia, McMaster University, Hamilton, Ont., University of Alberta, Edmonton, Alta.**

This randomized controlled trial compares laparoscopic gastric bypass (LGB) to intensive medical management (IMM) for the treatment of complicated type 2 diabetes mellitus in obese individuals (BMI 30–40 kg/m^2).

Following extensive screening, 12 patients (9 female, 3 male; mean BMI 37.5) were randomized (6 LGB, 6 IMM). Diabetic control was assessed using HbA1c at baseline, 3 months, 6 months and 1 year. A decrease in HbA1c of 1.0% represented a clinically important improvement in glycemic control, and resolution of diabetes was defined as complete normalization of glucose and HbA1c levels to 6% or lower without need for antidiabetes medication.

At the time of interim analysis, 6-month data were available for 11 patients (5 LGB, 6 IMM) and 12-month data for 9 patients (4 LGB, 5 IMM). The mean baseline BMI for LGB and IMM patients was 36.9 and 38.0, respectively. The mean BMI at 3 months, 6 months and 12 months was 29.0, 28.0 and 28.2 (p = 0.0312) in the LGB group. There was no significant change in BMI in the IMM group. The mean baseline HbA1c was 7.4% for the LGB group and 7.8% for the IMM group. In the LGB group, the mean HbA1c level decreased to 6.4% at 3 months, 6.2% at 6 months and 6.1% at 12 months (p = 0.0312). In this group, HbA1c levels for 4 of 5 patients decreased by more than 1% at 6 months; 5 of 6 discontinued antidiabetes medication use postoperatively and 2 of 4 had HbA1c levels 6% or lower at 12 months. In the IMM group, there was no significant improvement in HbA1c at 12 months, nor was there was any significant change in use of antidiabetes medications.

Laparoscopic gastric bypass is associated with near cure of type 2 diabetes in most obese patients who normally do not qualify for bariatric surgery. This surgical option should be considered in obese and nonobese patients with complicated type 2 diabetes.

4

Laparoscopic sleeve gastrectomy in type II diabetic bariatric patients: promising early results. ***S. Wiebe, D. Klassen, J. Bonjer, D. Lawlor, J. Plowman, T. Ransom, M. Vallis, J. Ellsmere.*** **From the Departments of Medicine and Surgery, Dalhousie University, Queen Elizabeth II Health Sciences Centre, Halifax, NS**

A retrospective analysis was conducted to determine whether diabetic patients undergoing laparoscopic sleeve gastrectomy as part of a multidisciplinary bariatric program would not only lose weight but also demonstrate improved glucose control with decreased medication requirements.

Patients undergoing laparoscopic sleeve gastrectomy between December 2007 and December 2009 were reviewed. Patient parameters and perioperative data were collected. Postoperative follow-up data were obtained at 1, 3, 6, 12 and 18 months and included weight, antiglycemic medications and fasting glucose and hemoglobin A1c levels.

Thirty-five diabetic patients underwent laparoscopic sleeve gastrectomy; mean age was 46 years. The mean preoperative BMI was 51.6 (range 38.2–75.1) kg/m^2. The mean operative time was 117 minutes; a single procedure was converted to open due to inability to reach the fascia with a 15-cm trocar. One patient returned to the operating room for bleeding within a few hours of surgery; hemostasis was achieved laparoscopically. Weight loss outcomes are as demonstrated below and are comparable to our nondiabetic patients.

Table 1, abstract 4. Absolute and excess weight loss after laparoscopic sleeve gastrectomy in diabetic patients

Length of follow-up, mo	Absolute weight loss, kg	Excess weight loss, %
1	12.4	19.7
3	20.3	31.4
6	27.8	40.7
12	38.1	59.2
18	32.8	56.7

Postoperatively, at an average follow-up of 6.4 (range 2–20) months, of 13 patients managed preoperatively with insulin, 7 had stopped this medication completely, and the remainder had decreased their dose. Of 26 patients managed preoperatively with oral hypoglycemics, 8 had decreased their dose, 6 were off all oral hypoglycemics, 10 remained at the same dose, and 1 patient had increased her dose.

The percentage of patients with normalized glucose before eating and HbA1c is demonstrated below.

Laparoscopic sleeve gastrectomy in diabetic patients is not only a safe and effective primary weight loss procedure but also leads to decreases in medication requirements and improved glucose control.

Table 2, abstract 4. Percentage of normal fasting glucose and HbA1c in diabetic bariatric patients

Length of follow-up, mo	Normal glucose before eating, %	Normal HbA1c, %
1	50	59
3	50	70
6	46	70
12	66	100
18	100	100

5

Early experience with Roux-en-Y gastric bypass surgery for obesity in Saskatchewan. ***P.J. Graham, G.K. Kaban.*** **From the Department of Surgery, Regina General Hospital, Regina, University of Saskatchewan, Saskatoon, Sask.**

Obesity is fast reaching epidemic proportions in Canada. According to Statistics Canada, in 2004, 23.1% of Canadians were obese, up from 13.8% in 1978. Laparoscopic Roux-en-Y gastric bypass (LRYGB) is a safe and effective method of introducing loss of excess body weight and a reduction in comorbidities in the morbidly obese. Saskatchewan saw the introduction of an RYGB program in June 2008.

The objectives of this study are to review the early experience with LRYGB surgery in Saskatchewan. This retrospective chart analysis examines patient demographics, effectiveness of the preoperative program in instituting weight loss, evaluation of length of operating room time and hospital stay with respect to patient variables, identification and stratification of operative complications and evaluation of postoperative weight loss.

From June 2008 through December 2009, the program saw 60 patients receive LRYGB including 46 (76%) female and 14 male patients with an average age of 45.8 ± 8.4 years and BMI of 51.5 ± 6.5 kg/m^2. Patients spent 341 ± 169 days in the preoperative program and lost an average of 2.28 BMI points (95% CI 1.52–3.02). Longer time spent in the preoperative program did not increase weight loss (p = 0.63). Operating room time was 154 ± 35 minutes and was not dependent on patient sex, age, amount of preoperative weight loss or absolute preoperative BMI. The

most common complication encountered was postoperative bleeding (11/60) requiring intervention in 6 of 60, including 2 returns to the operating room and 5 transfusions. This is above the rate of 5% experienced at other centres. There were no mortalities. Postoperative weight loss was significant, with patients losing 24.8%, 31.7%, 56.1% and 65.8% of excess body weight at 2, 6, 26 and 52 weeks after surgery, respectively.

This review demonstrates that the preoperative program is successful in producing weight loss, and that surgery is safe but with increased incidence of postoperative bleeding. Excellent postoperative weight loss is achieved.

6

Low complication rate with staple line reinforcement in laparoscopic sleeve gastrectomy. ***A. Vizhul, D.W. Birch, A.C. Menezes, X. Shi, S. Karmali.*** **From the Centre for the Advancement of Minimally Invasive Surgery (CAMIS), Department of Surgery, University of Alberta, Edmonton, Alta.**

Laparoscopic sleeve gastrectomy (LSG) has demonstrated satisfactory medium-term weight loss and comorbidity resolution in patients with severe obesity. One important variation in technique is the utilization of staple line reinforcement to reduce the incidence of hemorrhage and leak. The objective of this study was to analyze the complications of a prospective cohort of morbidly obese patients who underwent LSG using a staple line buttress.

Thirty-six consecutive patients underwent LSG with staple line reinforcement between October 2008 and December 2009. The Duet TRS (Covidien) (20 cases), Seamguard (Gore) (3 cases) and Peri-Strip (Synovis) (13 cases) buttress were trialed. Perioperative complications, length of stay (LOS), operative time, early weight loss and costs were analyzed.

There were 0 deaths, open conversions or staple line leaks. One case of bleeding from the staple line (Peri-Strip) required staple line oversewing. Nonsurgical perioperative complications included 1 case of supraventricular tachycardia and 1 case of acute coronary syndrome. The mean operative time was 114 ± 35 minutes (Peri-Strip: 121 ± 39 min, Duet TRS: 109 ± 36 min; p = 0.37). Mean LOS was 2.5 ± 1.2 days (Peri-Strip: 2.6 ± 1.6 d, Duet TRS: 2.4 ± 0.9 d; p = 0.62). Mean percent excessive weight loss at 3 and 6 months was 18.3% ± 6.5% and 29.5% ± 16.3%, respectively. Average BMI (kg/m^2) dropped from 50.6 preoperatively to 46.2 at 3 months and 44.3 at 6 months. At 12 months (7 patients), the average BMI was 43.6. Mean weight loss at 6 and 12 months was 20.26 ± 11.63 kg and 32.4 ± 20.5 kg, respectively. There was no difference in weight loss related to buttress type. The average cost per case was Can$4622.71 for Peri-Strip and Can$2703 for Duet TRS.

This study suggests that staple line reinforcement may reduce the rate of postoperative staple line hemorrhage and leak. There were no differences in surgical outcomes between absorbable (Duet TRS) versus nonabsorbable matrices (Peri-Strip); however, costs favoured the absorbable product.

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7 (CAGS Basic Science Award)
Surgical stress promotes the development of cancer metastases by a coagulation-dependent mechanism. ***R. Seth, L. MacKenzie, A. Kus, J. Bell, M. Carrier, H. Atkins, R. Boushey, R. Auer.*** **From the Centre for Cancer Therapeutics, The Ottawa Hospital Research Institute, Ottawa, Ont.**

Surgery precipitates a hypercoagulable state and has been shown to increase development of metastases in animal models. Coagulation facilitates the formation of microthrombi around tumour cell emboli (TCE) in the microvasculature, thereby inhibiting natural killer (NK) cell–mediated destruction. We hypothesized that the prometastatic effect of surgery may be secondary to the postoperative hypercoagulable state.

Our aim was to determine if surgical stress promotes development of metastases by increased formation of TCE-associated microthrombi resulting in decreased NK cell–mediated destruction and to evaluate the ability of low molecular weight heparin (LMWH) to inhibit the prometastatic effect of surgery.

Surgical stress was induced in BalbC mice by partial hepatectomy followed by tail vein injection of colon cancer (CT26) cells to establish pulmonary metastases with or without perioperative anticoagulation with subcutaneous tinzaparin. Mice were euthanized at various time points and TCE were quantified. Fibrinogen and platelets were fluorescently labelled before surgical stress to evaluate TCE-associated fibrin and platelet clots. Involvement of NK cells in tumour clearance was examined.

Surgery resulted in a significant increase in metastases, whereas anticoagulation with LMWH completely abrogated this effect. A significant difference in metastatic foci were seen at 12 hours and at 3 days after surgery but not at earlier time points (10 min and 4 h). Fibrin and platelet clots were associated with TCE significantly more frequently in mice that underwent surgery, as compared with mice with no surgery or pretreatment with LMWH. Platelet depletion led to attenuation of metastatic deposits in surgically stressed mice. Natural killer cell depletion increased metastases in control animals but had a diminished effect in surgically stressed mice, as NK cells cannot clear TCE coated with clots.

Surgery promotes the formation of fibrin and platelet clots around TCE, and this appears to be the mechanism for the increase in metastases seen following surgery. Anticoagulation with LMWH appears to completely abrogate this prometastatic effect.

8 (CAGS Clinical Research Award)
Updated meta-analysis of laparoscopic versus open hepatectomy for benign and malignant tumours. ***K.P. Croome, M. Yamashita.*** **From the Division of General Surgery, University of Western Ontario, London, Ont., and the School of Public Health, Harvard University, Boston, Mass.**

Laparoscopic hepatic resections (LHR) for both benign and malignant tumours have been compared with open hepatic resections (OHR) in previous studies; however, the number of patients and follow-up have been limited. An updated meta-analysis on the role of laparoscopic liver resection for benign and malignant tumours, including an analysis of long-term outcomes, was needed.

Studies from January 1998 to May 2009 comparing laparoscopic to open approaches in patients undergoing liver resection for benign and malignant neoplasms were analyzed by meta-analysis. Operative, postoperative, resection margin, complication and survival outcomes were evaluated. Weighted mean differences and relative risks (RR) were calculated. As well, hazard ratios (HR) up to the longest available follow-up time (2, 3 or 5 yr) for all-cause mortality and recurrence were evaluated. A random effects model was used.

A total of 26 studies were included in the meta-analysis. The hazard ratio of death was significantly lower in the LHR group compared with the OHR group (HR 0.629, $p = 0.043$). The hazard ratio of recurrence was not significantly different between the 2 groups (HR 0.816, $p = 0.379$). The LHR group had a lower operative blood loss (–161 mL, $p < 0.001$) and relative risk of total postoperative complications (RR 0.41, $p < 0.001$). Furthermore, duration of hospital stay, days of narcotic use and days until oral intake were all significantly lower in the LHR group compared with the OHR group. The operative time between LHR and OHR was not significantly different. Significant heterogeneity was observed in some of the operative parameters, likely owing to surgeon differences and different surgical techniques.

Laparoscopic hepatic resection has a long-term survival that is at least comparable, if not superior, to open hepatic resection. For both benign and malignant tumours, LHR is a viable alternative to OHR, with many potential operative and postoperative benefits. Despite concerns by some, there does not appear to be any difference in disease recurrence between LHR and OHR. If used by specially trained hepatic surgeons who have extensive experience with laparoscopic techniques, laparoscopic hepatic resection is an effective means of dealing with benign and malignant tumours.

9
Uptake of enhanced recovery after surgery (ERAS) strategies is variable at academic teaching hospitals. ***M.-A. Aarts, A. Okrainec, A. Glicksman, E. Pearsall, K. Pitzul, H. Huang, R.S. McLeod.*** **From the University of Toronto, Toronto, Ont.**

There is evidence that an enhanced recovery after surgery (ERAS) program will result in overall decreased length of hospital stay while being safe. However, there are often barriers to implementation. The objective of this study was to identify the current practice at 7 adult teaching hospitals in the University of Toronto system.

A retrospective chart review of 50 consecutive patients having elective colorectal resection at each hospital was performed. Demographic, length of stay and complication data were collected. As well, data on 18 ERAS components identified from a systematic review of the literature were collected.

In total 336 charts were reviewed: 55% of patients were male

(mean age 63 yr), 55.6% had an ASA score of III or IV, 76.5% had cancer, 28.0% had low rectal procedures and 43.5% of surgeries were performed open. The median length of stay was 6.5 (mean 8.6) days. Of the 18 strategies identified, only omission of nasogastric tubes was routinely implemented (93%). There was variable use of preoperative counselling regarding early discharge (41.1%), avoidance of oral bowel preparation (67%), epidurals 21.6%), routine postoperative nonsteroidal anti-inflammatory drugs (34.8%), clear liquids on the day of surgery (41.7%) and early removal of Foley cathethers (54.7%). Probiotics, carbohydrate loading, elimination of preoperative fast, ambulation on the day of surgery, prescription of motility drugs and liquid supplements postoperatively were rarely ordered. Counselling regarding early discharge (63.1% v. 29.5%), omission of nasogastric tubes (21% v. 10%), clear liquids on the night of surgery (51.5% v. 34.8%) and early discontinuation of urinary catheters (66.9% v. 34.8%) were all significantly associated with discharge before 5 days versus 5 days or more ($p < 0.01$).

This study suggests that there is variable uptake of ERAS strategies. Further research assessing the value of each strategy is required, and then identification of barriers and active implementation by a multidisciplinary team is required.

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Improved outcomes in pediatric intestinal failure with aggressive intestinal rehabilitation. ***K. Sarkhosh, M. Robertson, D. Boctor, V. Lam, D. Sigalet.*** **From the Alberta Children's Hospital, University of Calgary, Calgary, Alta.**

Intestinal failure (IF) is a challenging problem in the pediatric population. In an effort to improve outcomes in these patients, a multidisciplinary team has been developed in the Alberta Children's Hospital to care for patients with intestinal failure.

Infants referred for surgical and nutritional care to the Alberta Children's Hospital from 2006 to 2009 were compared with our previous cohort of patients (1998–2006). The protocol for gathering data was approved by the conjoined Regional Health Ethics Board.

Children with intestinal failure (residual small bowel length of < 40 cm or requirement for parenteral nutrition [PN] for > 60 d) cared for in the Alberta Children's Hospital from 1998 to 2009 were studied.

A protocol-driven care algorithm was initiated in 2006 to prevent parenteral nutrition–associated cholestasis (PNAC). This included aggressive introduction of enteral feeds, use of prophylactic antibiotics to prevent bacterial over growth, lipid reduction and use of fish oil–based preparation (Omegaven) for cholestasis.

Data collected included patients' demographics, gestational age, birth weight and their original pathology. Data relating to patients' clinical status including tolerance of feeds, biochemical values, weight and use of medications (promotility agents or rotating antibiotics) were collected on a weekly basis.

Data were analyzed using Prism statistical software.

In the era from 1998 to 2006, 33 patients were identified with a 73% survival rate; the direct bilirubin averaged 112 ± 34 μM/L after 3 months of PN. Eight out of 33 (27%) patients received prophylactic antibiotics, and none received fish oil–based lipids. The most common causes of IF were gastroschisis (30%) and atresia (21%). The average time to intestinal rehabilitation was 4.5 ± 2.1 months. All deaths were related to liver failure. In the era from 2006 to 2009, 19 patients have followed, with a 100% survival rate.* The average bilirubin after 3 months of PN was 8 ± 2.2 μM/L,* 17 of 19 (89%)* patients received prophylactic antibiotics, and 6 of 19 (32%)* received fish oil–based lipid PN. The common causes of IF were gastroschisis (57%) and atresia (32%). Fifteen out of 19 patients were weaned from PN, and the average time to intestinal rehabilitation was 3.2 ± 1.4 months (*$p < 0.05$ by Fischer exact test, data show mean ± SD).

The institution of an aggressive protocol of advancing enteric feeds, oral antibiotics and fish oil–based lipid use has resulted in an increase in survival and a remarkable improvement in liver function in the pediatric IF population.

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Planned ilio-inguinal excision for prevention of chronic pain after inguinal hernia repair: a meta-analysis. ***A. Johner, J. Faulds, S.M. Wiseman.*** **From the Department of Surgery, St. Paul's Hospital, University of British Columbia, Vancouver, BC**

Inguinal hernia repair is an extremely common surgical procedure, and the development of chronic postoperative pain is a dreaded potential complication of the operation. The role of neurectomy in reducing the incidence of chronic pain following inguinal hernia repair is currently unknown. Our objective was to determine whether planned ilio-inguinal nerve excision results in a reduction in the development of chronic pain experienced after inguinal hernia repair. A systematic literature review was carried out to identify studies investigating the influence of ilio-inguinal nerve excision on the development of chronic postoperative pain. Quantitative analysis of the pooled data was carried out. Of 6023 abstracts reviewed, 4 high-quality randomized controlled trials were identified. The pooled mean difference in degree of pain at 6 months after surgery on a 10-point scale was –0.29 (95% CI –0.48 to –0.11), favouring neurectomy to reduce the chances of developing chronic pain. Those patients undergoing neurectomy were also more likely to develop altered sensation at the same time (OR 3.70, 95% CI 2.61–5.25).

Planned resection of the ilio-inguinal nerve at the time of inguinal hernia repair is associated with a reduction in the incidence of chronic postoperative pain, and thus this simple manoeuvre at the time of surgery may reduce a major source of patient morbidity.

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Evaluating the long-term impact of the trauma team training program in Guyana: a mixed methods approach. ***J. Pemberton, M.L. Gordon, C. Prashad, M. Rambaran, B. Cameron.*** **From the Georgetown Public Hospital Corporation, Georgetown, Guyana, and the Department of Surgery, McMaster University, Hamilton, Ont.**

The Trauma Team Training (TTT) program is a unique, interprofessional course developed by the Canadian Network for International Surgery and is the national trauma training standard in Guyana. Using multiple choice tests, trauma management scores and interviews, we evaluated the TTT program participants to determine the short- and long-term effectiveness of the course.

A prospective, cohort, mixed-methods design was used to

investigate 47 participants across 3 domains: clinical knowledge, skills and team trauma management. Participants included physicians, nurses and orthopedic technicians from across Guyana. We administered a validated multiple choice test immediately before, immediately after and 4 months after TTT participation. Participant teams were evaluated on their management of simulated trauma scenarios and their performance of 7 trauma-related skills immediately after and 4 months after TTT. Semistructured interviews were used to explore external effects on training retention and course experience.

Interview results revealed overwhelmingly positive feedback with improved confidence, enjoyment of trauma care and enthusiasm for the structured TTT approach to trauma management. Quantitatively, we saw overall improvement in clinical knowledge, skills and trauma scenario management immediately following the TTT. Statistically significant improvements were seen in clinical knowledge ($p < 0.0001$) across all professions, with the largest knowledge increase seen among nursing staff (20.8% increase), followed by orthopedic technicians (18.5% increase). The evaluation revealed considerable knowledge retention, especially among general medical officers (97.7%) and nursing staff (95.1%) at 4 months after TTT participation.

Clinical knowledge, skills and trauma scenario management all showed sustained improvement 4 months after the TTT course. We feel this interprofessional trauma team training approach is effective and applicable anywhere.

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Selecting patients for watchful waiting. *A. Neville, G.A. Sarosi Jr., Y. Wei, J.O. Gibbs, D.J. Reda, M. McCarthy Jr., R.J. Fitzgibbons Jr., J.S.T. Barkun.* From McGill University, Montréal, Que.

Roughly a quarter of patients with minimally symptomatic hernias who are managed with watchful waiting will elect repair in the first 2 years, suggesting that not all patients are good candidates for watchful waiting. This study aims to assist surgeons managing patients with minimally symptomatic inguinal hernia by identifying characteristics that predict crossover to surgery or worsening of hernia symptoms.

The 336 patients randomized to watchful waiting in the American College of Surgeons watchful waiting hernia trial constituted the study population. Preoperative patient characteristics were used to predict 2 outcomes, either crossover to surgery or the development of hernia pain limiting activities and/or crossover to surgery.

At 2 years, 72 patients crossed over to surgery, with pain with strenuous activities (OR 1.3 per 10-mm visual analog scale [VAS], pain), chronic constipation (OR 4.9), prostatism (OR 2.9), being married (OR 2.3) and good health (OR 3.0, ASA 1 v. 2) predicting crossover. An additional 28 patients developed pain limiting their activities with pain during strenuous activities (OR 1.3 per 10-mm VAS) and chronic constipation (OR 4.5) predicting the combined outcome of pain limiting activities or crossover to surgery. Higher levels of activity reduced the risk (OR 0.95) of this combined outcome.

Readily identifiable patient characteristics can predict patients with minimally symptomatic inguinal hernia who are likely to "fail" watchful waiting hernia management. Consideration of these factors will allow surgeons to optimally tailor hernia management.

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Knowledge transfer strategy is effective in improving surgical site infection prevention. *D.S. Fenech, S. Forbes, E. Pearsall, J. Chung, A. Glickman, J.C. Victor, A. Nathens, R.S. McLeod.* From the University of Toronto, Toronto, Ont

Active knowledge transfer (KT) strategies are required to change physician behaviour. Best Practice in General Surgery aims to standardize care at 7 adult teaching hospitals in Toronto based on best evidence. Our aim is to report the results of a KT strategy to implement surgical site infection prevention interventions.

The KT strategy included the following steps: audit practice, develop a guideline, survey general surgeons and residents to understand their beliefs and practices, interview stakeholders to understand implementation barriers, host a multidisciplinary workshop to develop consensus and discuss implementation, present results of the audit and guideline at grand rounds at all hospitals and resident teaching sessions. The audit was a review of 50 charts per site of patients having colorectal surgery before (2007) and after (2009) implementation of the guideline.

The use of preoperative oral antibiotics decreased from 20.5% to 1.7% ($p < 0.001$). The use of preoperative intravenous antibiotics were significantly improved from 79% to 90.8% ($p < 0.001$). The use of postoperative antibiotics decreased to 2% from 25.2% ($p < 0.001$). The proportion of patients who were normothermic throughout the operation was unchanged.

A multifaceted KT strategy is effective in increasing prophylactic antibiotics compliance. However, there was no statistically significant change in temperature control. Therefore, a KT strategy aimed at anesthesiologists may be necessary.

Table, abstract 14. Surgical site infection prevention interventions in patients having colorectal surgery before and after implementation of guideline recommendations

Recommendation	2007, %	2009, %	*p* value
Antibiotics administered			
Oral antibiotics	20.5	1.72	< 0.001
Preoperative antibiotics	79	90.8	< 0.001
Use of specific antibiotics			
Metronidazole	93.4	88.7	0.020
Gentamycin	64.7	19.6	< 0.001
Cefazolin	67.5	77.3	0.003
Postoperative antibiotics	25.2	2	< 0.001
Hair removal			
Documented in the chart	27.1	72.2	< 0.001
Of those documented			
% shaved	3.1	1	0.410
% clipped	45.3	70	0.005
% no removal	51.6	38.2	0.248
Temperature			
Documented in the chart	80.6	87.1	0.016
Bair hugger used	82	91	< 0.001
Minimum temperature > 36°C	30.2	24.7	0.088

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Single-centre experience of radiation exposure in acute surgical patients: assessment of therapeutic impact and future recommendations. *G.J. Fitzmaurice, F. Mone, R. Brown, B. Cranley, E.F. Conlon, R.A.J. Todd,*

M.E. O'Donnell. **From the Departments of General Surgery and Radiology, Daisy Hill Hospital, Newry, Northern Ireland**

The study objectives were to examine the use of radiological investigations in the management of acute surgical patients and to assess whether a guideline-based radiation-exposure risk/benefit analysis can aid in the choice of radiological investigation used.

A prospective observational study was completed over a 12-week period from April to July 2008 for all acute surgical admissions. The use of radiological investigative modalities as an adjunct to clinical assessment was then evaluated against The Royal College of Radiologists (RCR) guidelines.

A total of 380 acute surgical admissions (174 men, 185 women, 21 children) were assessed during the study period. In all, 734 radiological investigations were performed, with a mean of 1.93 investigations per patient. Based on the RCR guidelines, 680 (92.6%) radiological investigations were warranted, which included 142 CT scans (19.3%), 129 chest radiographs (17.6%) and 85 abdominal radiographs (11.6%). Clinically, radiological imaging complemented surgical management in 326 patients (85.8%). This accounted for an average radiation dose of 4.18 millisieverts (mSv) per patient, or 626 days of background radiation exposure. Computed tomography imaging was responsible for the majority of the radiation exposure, with a total of 1310 mSv (82.6%) of the total radiation exposure being attributed to CT imaging in 20.8% of acute admissions. Subgroup analysis demonstrated that 92.8% of the CT scans performed were appropriate.

Radiation exposure was generally low for the majority of acute surgical admissions. However, it is recommended to carefully evaluate CT imaging requests, particularly in patients with clinically confirmed pathologies and in younger women.

16

Development of a novel measure of surgical recovery. ***T.T. Tran, P.A. Kaneva, L.E. Finch, G.M. Fried, N.E. Mayo, L.S. Feldman*. From the Departments of Surgery and of Clinical Epidemiology, McGill University, Montréal, Que.**

Innovations in surgery are advocated on the basis of "enhanced recovery" currently measured using a mix of narrowly focused administrative indicators or patient-reported multiple-item questionnaires. Questionnaire length and the difficulty of integrating these different view points limit accurate measurement. The objective of our study was to develop a harmonized single linear measure that would be sensitive to expected differences in surgical recovery.

The measure was developed and validated using data from 50 patients undergoing laparoscopic cholecystectomy. Patients were assessed preoperatively, 1 week and 1 month postoperatively by the following measures: health-related quality of life (generic using the SF-36 and disease-specific using the Gastrointestinal Quality of Life Index), symptoms (visual analog scales for pain and fatigue) and physical activity (questionnaire) and function (6-min walk test). Rasch analysis combined items across domains of the various instruments to develop the new measure on a logit scale which was transformed to a score from 0 to 100 (SD). Reliability and validity were assessed. *$p < 0.05$.

A 34-item measure met all model requirements and included items from all domains. Reliability was excellent (0.96). The mean score (SD) decreased from 60 (18) preoperatively to 55 (15) at 1 week* and increased above baseline to 68 (18) at 1 month.* Construct validity was assessed by comparing patients with or without complications. Groups were similar preoperatively (54 v. 62), but patients with complications had lower scores at 1 week (48 v. 58*) and 1 month (57v. 73*). The measure had moderate correlations with all instruments at all time points ($r = 0.33–0.87$).

A novel measure of surgical recovery was developed encompassing a broad range of domains. Results are compatible with clinically observed postoperative recovery trajectories. This method illustrates that recovery can be quantified with mathematical units.

17

Blunt carotid and vertebral artery injuries after cervical spine fracture: 10-year experience at a Canadian lead trauma hospital. ***L. VanHouwellingen, K.N. Vogt, T.C. Stewart, J. Williamson, N. Parry, G. DeRose, D. Gray*. From the Department of Surgery, Trauma Program, Division of Critical Care, Schulich School of Medicine and Dentistry, University of Western Ontario, London, Ont.**

The impact of screening for blunt carotid and vertebral artery injuries (BCVI) after trauma in the Canadian population remains unclear. Patients with cervical (C)-spine fractures are at high risk of BCVI. We undertook this study to determine whether the implementation of CT angiography (CTA) in patients with C-spine fracture has changed the rate of detection of BCVI as well as whether it has improved patient outcome.

A retrospective cohort of all trauma patients sustaining C-spine fracture from 1999 to 2008 was identified from our trauma database. Data on injury and complication rates were compared before and after the availability of CTA.

Of the 5533 trauma patients admitted during the study period, 569 (10.3%) sustained C-spine fractures and 20 (3.5%) sustained BCVI; the latter was identified in 4 of 275 (1.4%) of patients before the use of CTA and in 16 of 294 (5.4%) of patients after its implementation ($p = 0.008$). After the introduction of CTA, 71 of 294 (24%) of patients underwent screening. A comparison of overall stroke rate revealed no difference between the before and after CTA groups (2.2% v. 2.4%, $p = 0.87$).

The availability of screening CTA has significantly increased the rate of detection of BCVI in patients sustaining C-spine fractures; however, this has not resulted in a decrease in stroke rate. Implementation of effective management strategies for patients with BCVI may be required to justify the use of screening in this population.

18

The C-reactive protein to prealbumin ratio as a predictor of fistula closure. ***S. Harriman, N. Rodych, P. Hayes, M. Moser*. From the Department of Surgery, Royal University Hospital, University of Saskatchewan, Saskatoon, Sask.**

The purpose of this study was to evaluate the predictability of closure of gastrointestinal fistulas after 2–3 weeks of nutritional support using the ratio of C-reactive protein to prealbumin (C:P ratio), a measure of both nutrition and inflammation, both important factors in fistula closure.

A retrospective database of 89 patients (39 female and 50 male) with gastrointestinal fistulas between 1993 and 2009 was created based on the records of the Nutrition Support Services (NSS)

Team at Royal University Hospital. All patients requiring total parenteral nutrition at our centre are assessed and followed by the NSS team, and all have weekly bloodwork including C-reactive protein, prealbumin, albumin and complete blood count. A total of 43 fistulas were managed without surgery for 6 weeks or more; of these, 29 fistulas closed.

For patients with a C:P ratio of 0.25 or less, spontaneous fistula closure occurred in 83.3% (95% CI 70.2–91.6), whereas closure was not seen in any patient with a ratio of greater than 1.0. A logistic regression analysis model incorporating fistula output and serum albumin showed that the C:P ratio is an independent predictor of fistula closure ($p = 0.01$).

Our results suggest that the C:P ratio is a good predictor of fistula closure and may be useful in planning surgical versus nonsurgical management in these complex patients.

19

Effect of the Accreditation Council of Graduate Medical Education work-hour restrictions on surgical patients: a meta-analysis. ***M.H. Jamal, S. Doi, M. Rousseau, L. Snell, S. Meterissian.*** **From the Centre for Medical Education, McGill University, Montréal, Que.**

In July 2003, the Accreditation Council of Graduate Medical Education (ACGME) restricted residents' work hours for all training programs. It was thought that this reduction in work hours would adversely affect surgical patients' outcome due to the lack of continuity of care.

We searched for articles studying the outcome of ACGME restrictions on surgical residents' work hours from 2000 to 2009 and included every paper looking at the effect of the work-hour limitations on surgical patient outcome. Criteria for inclusion in our meta-analysis were papers looking at the effect of the ACGME work-hour restrictions before and/or after their implementation, studies conducted in a surgical residency program in the United States and papers including morbidity and mortality outcomes. Out of 1048 potentially relevant manuscripts, 6 mortality and 7 morbidity trials met the inclusion criteria. We tabulated all occurrences of mortality and morbidity.

Heterogeneous subgroups were combined using a quality effects model, as we felt the random effects model was not suitable. All were case–control studies. The summary after to before AGCME restrictions OR was 0.94 (95% CI 0.91–0.97) for the mortality studies using the quality effects model. The pooled OR of 0.94 for the mortality studies indicates that after ACGME restrictions, there was a 6% decreased odds of mortality. There was no difference in morbidity in this meta-analysis.

This is the first meta-analysis addressing the effects of the ACGME work-hour limitations on surgical patient outcome. These limitations caused a reduction in surgical patient mortality, though morbidity was unchanged.

20

Are recent general surgery graduates prepared for practice? ***S. Zolfaghari, M.S. Friedlich.*** **From the Department of Surgery, The Ottawa Hospital — General Campus, University of Ottawa, Ottawa, Ont.**

There have been several changes in the past decade that may have negatively affected the delivery of surgical education to residents, especially as it pertains to the acquisition of technical skills. These changes have included an earlier examination date, the shift of low-intensity cases away from tertiary care centres, reduced work hours for residents and increased constraints on operating room time.

The purpose of this study was to determine whether as a result of these changes in education graduating Canadian general surgical residents feel less prepared technically to start practice now compared with previously.

A total of 215 practicing general surgeons who graduated from a Canadian general surgical residency program in the years 1990–1994 (#110) and 2000–2004 (#105) inclusive were surveyed. This survey asked the surgeons to rate their perceived preparedness to perform 10 types of surgeries (31 procedures) when they graduated from residency (part A). They were also asked to rate the importance of above-mentioned changes as they contributed to poor preparation for the list of procedures (part B). The numeric data from part A and B were compared across the years participating.

At the time of graduation, the 1990–1994 group (group 1) felt more prepared to perform open cholecystectomy, exploration of common bile duct, repair of bleeding or perforated duodenal ulcer, partial or total gastrectomy, drainage of pancreatic pseudocyst, femoral hernia repair, splenectomy and anal fistulotomy compared with the 2000–2004 group. On the other hand, the 2000–2004 group (group 2) felt more prepared to perform laparoscopic appendectomy, laparoscopic cholecystectomy and endoscopy. Group 1 did not rate any of the changes listed as important in their poor preparation for these tasks. Group 2 graduates rated, in order of importance, increased constraints on operating room time availability, the shift of low-intensity cases away from tertiary care centres, reduced work hours for residents and the earlier examination date (June v. September) as factors that they believed contributed to poor preparation for these tasks. We concluded that there is a direct correlation between preparedness of general surgery graduates and exposure to specific types of operations; this is affected by the prevalence of the disease related to the specific operation, advances in minimally invasive diagnostic and surgical interventions, increased constraints on operating room time and the shift of low-intensity cases away from tertiary care centres.

21

A tool for the training and evaluation of laparoscopic inguinal hernia. ***Y. Kurashima, S. Al-Sabah, P.A. Kaneva, L.S. Feldman, G.M. Fried, M.C. Vassiliou.*** **From the Steinberg-Bernstein Centre for Minimally Invasive Surgery and Innovation, McGill University, Montréal, Que.**

The purpose of this study was to develop and validate an intraoperative rating scale specific to laparoscopic inguinal hernia repair (LIHR) and to create a simulator for evaluation and training of this procedure.

The Global Operative Assessment of Laparoscopic Skills — Groin Hernia (GOALS-GH) was developed by surgeon educators. The GOALS-GH can be used to assess transabdominal preperitoneal or totally extraperitoneal hernia repairs. It consists of 5 items: trocar placement, creation of peritoneal flap (transabdominal preperitoneal hernia repair) or creation of preperitoneal space (totally extraperitoneal hernia repair), hernia sac reduction, mesh placement and flow of procedure. We also designed a laparoscopic inguinal hernia simulator (LIHS), which consists of readily avail-

able and low cost materials. It simulates accurate anatomic relations and allows the learner to perform each step of an LIHR. Fifteen novice (PGY 3–5) and 7 experienced (attendings and fellows) surgeons were assessed in the OR and/or on the LIHS using the GOALS-GH. Interrater reliability, internal consistency, construct, concurrent and predictive validity were evaluated.

The interrater reliability of the GOALS-GH was greater than 0.7 for all raters in the OR and during simulated LIHR. The internal consistency of GOALS-GH items was 0.97 in the OR and 0.96 in the simulator. The mean total GOALS-GH score for experts was significantly higher than novices in both environments. The correlation between GOALS-GH scores in the OR and the simulator was 0.74 ($p < 0.01$, $n = 12$). The cost of 1 simulated LIHR is $2 for disposables and $50 in tacks.

The GOALS-GH is reliable and valid for assessment of LIHR. The LIHS is affordable and models the skills required for safe and effective performance of this procedure. A curriculum incorporating both GOALS-GH and the LIHS could be used to teach, evaluate and demonstrate transfer of skills to the OR.

22

Short stay surgery: What really happens after discharge? ***T.T. Tran, P.A. Kaneva, N.E. Mayo, G.M. Fried, L.S. Feldman.*** **From the Steinberg-Bernstein Centre for Minimally Invasive Surgery, McGill University, Montréal, Que.**

Innovations in surgery and perioperative care enable rapid hospital discharge after a variety of procedures. Whereas length of hospital stay is commonly used as a surrogate outcome for surgical recovery, it is not applicable in the setting of short-stay surgery (< 24 h). The objective of our study was to describe the trajectory of recovery after short-stay abdominal surgery using measures of physical activity and health-related quality of life (HRQL).

Patients scheduled for short-stay abdominal surgery at a university medical centre were evaluated preoperatively and at 3 weeks and 2 months postoperatively. Physical activity was assessed using the 41-item Community Health Activities Model Program for Seniors (CHAMPS) questionnaire, where patients report physical activity over a range of intensities; responses are converted into caloric expenditure (kcal/kg/wk). The Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) was used to assess HRQL. Data are expressed as median and interquartile range.

In all, 135 patients, 71% male with a mean age of 53 (SD 15) years participated. Ninety-one percent were ambulatory and 9% were discharged the morning after surgery. The 3 most common ambulatory procedures were open inguinal hernia repair (38%), laparoscopic cholecystectomy (30%) and umbilical hernia repair (9%). Short-stay procedures included laparoscopic splenectomy, adrenalectomy and Heller myotomy. The CHAMPS estimated energy expenditure returned to baseline from 30 (18–58) preoperatively to 30 (15–50) 3 weeks postoperatively and increased above baseline levels to 44 (26–74) at 2 months ($p < 0.001$ v. baseline). At 3 weeks, 48% were at or above baseline, whereas 52% remained below. At 2 months, 33% remained below baseline. The physical function, vitality, pain and general health subscales of the SF-36 and CHAMPS estimated physical activity had low to moderate correlation ($r = 0.16$–0.54) at most postoperative time points.

Despite uniformly early discharge, a significant proportion of patients had suboptimal recovery 2 months after short-stay surgery. Measures of physical activity and HRQL provide complementary information and better reflect the variability in trajectories of recovery after surgery.

23

Patients admitted with acute abdominal conditions are at high risk for development of symptomatic venous thromboembolism (VTE) but often fail to receive adequate prophylaxis. ***E. Pearsall, U. Sheth, D. Fenech, M. McKenzie, J.C. Victor, R.S. McLeod.*** **From the University of Toronto, Toronto, Ont.**

There is level I evidence supporting the use of venous thromboembolism (VTE) prophylaxis in patients admitted with acute medical conditions. Best Practice in General Surgery was initiated to standardize care based on best evidence at 7 adult teaching hospitals in Toronto. The aim of this study was to determine the frequency with which VTE prophylaxis was administered appropriately as well as the frequency of symptomatic VTE in patients admitted with acute abdominal conditions.

Charts of 350 patients (50 from each hospital) admitted with acute abdominal conditions and who did not have surgery for at least 24 hours following admission were audited to identify whether they received VTE prophylaxis, timing, type and factors affecting prescription of VTE prophylaxis. As well, the rate of symptomatic VTE was recorded.

Of the 350 patients (174 male, 176 female, mean age 64.86), 195 (55.71%) were admitted for bowel obstruction, 14 (4%) for acute diverticulitis, 8 (2.29%) for pancreatitis, 113 (32.29%) for biliary conditions and 20 (5.71%) for other conditions. Eighty (22.9%) patients had cancer, 61 (17.4%) had a history of cancer and 14 (4%) had a history of VTE. In all, 142 (40.6%) patients had surgery following admission (mean time 5.44 d) and 247 (70.6%) received prophylaxis (174 unfractionated heparin, 73 low molecular weight heparin) at time of admission (96.8%) or before surgery (2.8%). Venous thromboembolism prophylaxis prescription varied according to hospital (range 46%–84%), disease (range 63%–75%) and surgery/no surgery (78.2 v. 64.2%). Overall, 12 patients (3.4%) developed symptomatic VTE: 2 (16.7%) had a prior history of VTE and 11 (91.7%) received prophylaxis.

Patients admitted with acute abdominal conditions are at high risk for the development of symptomatic VTE. There is variation in the rate of VTE, but a gap in care exists. Knowledge-transfer strategies are required to ensure all patients receive adequate prophylaxis.

24

Evaluation of surgical performance during laparoscopic incisional hernia repair: a multicentre study. ***I. Ghaderi, M. Vaillancourt, G. Sroka, P.A. Kaneva, M.C. Vassiliou, F.J. Seagull, E. Sutton, C. Godinez, I. George, A. Park, I. Choy, A. Okrainec, R. Brintzenhoff, A. Prabhu, B.T. Heniford, D. Stefanidis, G.M. Fried, L.S. Feldman.*** **From the Steinberg-Bernstein Centre for Minimally Invasive Surgery, McGill University, Montréal, Que., the University of Western Ontario, London, the University of Toronto, Toronto, Ont., the University of Maryland, Baltimore, Md., and the Carolinas Medical Center, Charlotte, NC**

Laparoscopic incisional hernia repair (LIHR) is a relatively

advanced procedure where a role for simulation has been suggested. The aim of this study was to develop a procedure-specific objective rating scale to assess performance during LIHR both in the OR and in a simulator and evaluate its reliability and validity.

The Global Operative Assessment of Laparoscopic Skills — Incisional Hernia module (GOALS-IH) includes 7 items evaluating the steps of LIHR (trocar placement, adhesiolysis, estimation of mesh size and shape, mesh positioning, mesh fixation, autonomy in the use of instruments and overall competence) each rated on a 5-point scale (maximum score = 35). In all, 32 participants (19 PGY 3–5 general surgery residents ["novice"] and 13 attending staff/minimally invasive surgery fellows ["experienced"]) in 4 university centres were evaluated in the OR by the attending, a trained observer and by self-assessment using the GOALS-IH. Fourteen participants (9 experienced and 5 novice) also performed LIHR in the surgical abdominal wall simulator. Interrater reliability was assessed by intraclass correlation. Known groups construct validity was assessed by t test and by correlating the number of self-reported LIHR cases with total score. The correlation between simulator and OR performance was assessed using the Pearson coefficient.

Interrater reliability for the total GOALS-IH score was 0.80 (0.56–0.92) between observer and attendings, 0.81 (0.58–0.92) between participants and attendings and 0.89 (0.76–0.96) between participants and observer. The mean (95% CI) scores for the experienced surgeons were significantly higher than novices (31 [28–34] v. 19 [17–22], $p < 0.01$). There was very good correlation between GOALS-IH and self-reported LIHR experience ($r = 0.82$, $p < 0.01$). The correlation between performance in the simulator and OR was 0.87 (95% CI 0.63–0.96) ($p < 0.01$).

Evidence is presented supporting the reliability and validity of GOAL-IH to measure performance of LIHR. Performance of simulated LIHR correlates with clinical performance. The GOALS-IH can be used for formative feedback to identify specific steps in the procedure where remediation can be directed.

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Radiation dose from computed tomography in trauma: effective dose during resuscitation, hospital stay and 6 months posttrauma. ***A. Igric, K.N Vogt, M. Girotti, N.G Parry, C. Vinden*. From the Department of General Surgery, University of Western Ontario, London, Ont.**

This study was undertaken to quantify the cumulative dose of ionizing radiation resulting from computed tomography (CT) in adult trauma patients.

A single-centre trauma database was queried for adults with an ISS greater than 12 admitted to the trauma service between January and July 2007. Patient medical records were reviewed to identify all CT scans performed during the initial trauma resuscitation, hospital stay and 6 months after trauma. Scan parameters and dose length product (DLP) were determined for each CT scan and were used in combination with published conversion factors to calculate the effective radiation dose. Data were also collected on the indication for the CT scan and actions taken based on the scan results.

A total of 165 patients were included. The majority ($n = 154$, 93%) incurred blunt trauma and 118 (71.5%) were male. Patients had a mean age of 48 (SD 20) years and a mean ISS of 26 (SD 9.6). Twenty-two patients had no CT scans at the London Healthy Sciences Centre. The mean number of CT scans for the remaining patients ($n = 143$) was 3.6. The mean radiation dose per patient was 28.36 (SD 23.7) mSv . Excluding the initial trauma scans, the indication for the CT scan was follow-up imaging in 140 (70.7%) and a change in clinical condition in 56 (28.3%). Scanning resulted in a procedure or operation in 11.6%, follow-up imaging in 21.7% and no identified action in 67.2%.

Computed tomography is an important imaging modality in trauma but is also a major source of radiation, equal to that of approximately 10 years of background radiation. Clinicians should be aware of the total dose of radiation received by a patient in the course of their resuscitation and posttrauma management. The role of alternate imaging modalities should be explored, and future directions should involve education about risk of malignancy.

26

General surgery: Who wants it? Addressing perceptions and misconceptions. ***S.H.H. Kim, N.N. Zhang, J.J. Russo, I.K. El-Salfiti, M. Kowalczuk, A.N. Rajaee, M. Bal, M.S. Gill, P.J. Lysecki, J. Hoogenes, D. Dath.* From the Department of Surgery, McMaster University, Hamilton, Ont.**

This quality improvement project explored medical student perceptions as possible contributing factors to declining applications for general surgery (GS) residency and compared these to resident and staff surgeon perspectives as a first step toward improving medical student interest in GS.

Informal, confidential interviews were conducted with a convenience sample of 20 medical students from all years with various career interests, 6 general surgery residents and 5 general surgeons at McMaster University. We asked interviewees about stereotypes about GS and issues related to workload, lifestyle and earning potential. Interviewees discussed the influence of these factors on career choice, current training and career satisfaction. Recommendations were formulated by consensus after discussion of the results.

Some medical students thought GS had great clinical variety and provided life-saving care. Others, especially in first-year medicine, held stereotypic perceptions of general surgeons as "brute," "arrogant," "egocentric" and having "God complexes," to name a few. Preclerkship students generally held negative perceptions regarding GS workload and lifestyle. Stereotypes were mainly propagated by medical students, most having had little-to-no formal exposure to GS. These stereotypes went undisputed until students were exposed to a more positive reality in clerkship. Residents stated that their workload was demanding but manageable and that they had lifestyle balance. Surgeons enjoyed flexibility of work and modified their practices to suit their lifestyle preferences. Earning potential was downplayed by students and was of no concern to residents and surgeons.

Students may benefit from a better balance of choices if surgeons institute preclerkship exposure to GS using lectures, mentorship programs and facilitated elective opportunities.

27

The influence of general surgery clerkship rotation on the attitude of McMaster medical students toward general surgery as a future career: preliminary findings. ***A.K. Nassar, S. Reid, K.N. Mohaisen, J. Winch, D. Omar.***

From the Department of General Surgery, Faculty of Health Sciences, McMaster University, Hamilton, Ont., and the Department of Psychology and Counseling, United Arab Emirates University, United Arab Emirates

This study investigated the effect of general surgery clerkship on the ranking of general surgery as a career compared with other specialties, whether general surgery clinical clerkship affected clerks' attitudes toward general surgery as a future career and areas related to general surgical clerkship rotation.

A pre–post design involving 63 McMaster clinical clerks (2008–2009) was used in preliminary analysis. Paired comparison (PC) was used to compare clerks' ranking of career choices before and after clerkship. Semantic differential (SD) was used to measure attitudes toward general surgery as well as toward variables that may impact those attitudes before and after clerkship. Analyses were done using SPSS 16.0.

Clinical clerks' ranked preferences for general surgery (as measured by PC) increased substantially after clerkship, moving from the 10th to the 5th ranked position in terms of preference. The SD result was consistent with PC, showing both significant and practical differences in attitudes after clerkship ($t = 3.81$, $p < 0.000$, effect size = 0.23). The rank of other surgical subspecialties were changed after clerkship, though general surgery demonstrated the largest improvement in ranking. Attitudes toward all areas related to general surgical clerkship improved significantly after the rotation except attitude toward technical skill, which did not improve significantly.

General surgery clerkship rotation at McMaster Medical School significantly improved clerks' attitudes toward general surgery as a career. Medical schools should foster positive interaction between clinical clerks and other staff (attending surgeons and nurses), ensure that teaching hospital staff provide a positive experience for clerks and, lastly, should provide opportunities for clerks to improve technical skills in general surgery during their clerkship.

28

Teaching management skills to surgical residents: a preliminary experience.

W.C. Hanna, D.S. Mulder, M.M. El-Hilali, K.A. Khwaja. **From the Montréal General Hospital, McGill University Health Centre, Montréal, Que.**

Management skills are not part of the present day surgical residency curriculum. We hypothesized that a yearly management seminar would provide residents with basic managerial skills that they could develop over the course of their careers.

Surgical residents from all disciplines were invited to participate in a 1-day management seminar. Information was collected through a precourse questionnaire. The seminar was then given by professionals in the form of interactive lectures and case-based discussions. A postcourse questionnaire was administered at the end. Pre- and postcourse data were compared using the Fisher exact test.

Forty-three senior residents participated in the seminar. Before the course, only 4.7% thought that managerial skills were sufficiently addressed in their program. The 9 skills that residents thought were important to learn during their training were: giving feedback, delegating duties, building teamwork, managing time, making rounds, effective learning, effective teaching, coping with stress and managing conflicts. Before the course, 49% of residents rated themselves as "good" or "excellent" on the ensemble of these skills. After the course, 60% of residents rated themselves as "good" or "excellent" ($p = 0.02$). Residents identified 4 major challenges that they would face as soon as they graduate: negotiating employment contracts, understanding and avoiding malpractice, managing personal finances and managing a private practice. Before the course, 88% of residents thought they were "not prepared" to face these challenges. After the course, only 52% of residents thought that they were still "not prepared" ($p = 0.007$).

A 1-day management seminar for residents serves to raise awareness and preparedness for management issues of surgical practice.

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Sentinel node frozen section: Should it be done?

M.H. Jamal, J. Rayment, S.A. Doi, A. Megueditchian, S. Meterissian. **From the McGill University Health Centre, Montréal, Que.**

The aims of this study were to identify preoperative factors associated with sentinel lymph node biopsy frozen section (SLNBFS) positivity, to verify the overall sensitivity and specificity of SLNBFS and to identify the risk of non–sentinel lymph node involvement in patients with micro- and macrometastasis using the Memorial Sloan-Kettering Cancer Center breast cancer nomogram, additional nodal metastasis (MSKCC BCN ANM).

We used our hospital record system to identify 176 sentinel lymph node biopsies done in 354 cases of stage T1–3N0 breast cancer managed at our institution from 2005 to 2007.

Preoperative factors associated with intraoperative SLNBFS sensitivity were lymphovascular invasion (OR 12.15, 95% CI 4.74–31.14) and increasing tumour size (OR 1.76, 95% CI 1.09–2.84). The overall sensitivity and specificity for the SLNBFS were 57.9% and 100%, respectively. Patients who had micrometastases had a very high rate of false negative SNLBFS. The MSKCC BCN ANM nomogram showed that these patients have a very low probability of non–sentinel lymph node spread of disease with a median probability at 10% (IQR 7%–14%) as opposed to patients with macrometastasis, who had a high rate of SLNBFS true positive with a median probability at 49% (IQR 36%–58%).

Factors suggestive of increased tumour aggressiveness increase the SLNBFS sensitivity. A false negative SLNBFS occurs owing to micrometastatic disease, which has a favourable prognosis anyway. The MSKCC BCN nomogram is a useful marker of disease bulk in this group, suggesting that only macrometastases predict non–sentinel lymph node spread, but more studies are required to define its role in planning strategies to deal more effectively with such patients.

30

Sharps handling practices among junior surgical residents: a video analysis.

D. Tso, M. Langer, G. Blair, S. Butterworth. **From the University of British Columbia, the Division of Pediatric Surgery, BC Children's Hospital, Vancouver, BC**

This study examines sharps handling practices of junior surgical residents and evaluates whether experience in performing a common surgical procedure correlates with a decrease in unsafe sharps behaviour.

Junior residents (second year general surgery and first year

plastic surgery) were videotaped performing indirect inguinal hernia repairs on pediatric patients as part of their technical surgical training during a 2-month rotation. For each procedure, the resident was the principal operator, with the attending surgeon assisting. Technical feedback was given by the attending surgeon to the resident by reviewing the videotape footage with them. A second video was taken of the resident performing the same procedure after the performance feedback session. Residents were not given specific feedback on their sharps handling technique. Assessment of safe and unsafe sharps handling was determined based on the Association of Perioperative Nurses and the American College of Surgeons guidelines. Resident safety performance was assessed in 3 areas: personal sharps tasks, passage of sharps and verbal notification regarding sharps. For residents with a second procedure videotaped, safety performance was compared between the 2 procedures. Descriptive statistics were employed.

Data were collected from 19 surgical residents' videos: 4 plastic surgery and 15 general surgery. Residents safely performed sharps tasks, passed sharps and verbally notified about sharps an average of 66.3%, 90.4% and 10.1% of the time, respectively. Eight residents had a second hernia repair videotaped. In comparing the second to the initial video, residents demonstrated a 10.5% increase in safe personal sharps tasks, a 5.9% increase in safe passing of sharps and a 6.4% decrease in verbal notification about sharps.

Junior surgical residents videotaped performing an indirect inguinal hernia repair most consistently passed sharps safely. Personal sharps tasks were less likely to be performed safely, and only a minority of residents verbally notified about sharps placement to the team. Review of the initial technical performance by video did not improve safety behaviour for all categories of sharps-related activities.

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Application of the goals rating scale to complex laparoscopic procedures: understanding the skill set. ***M. Vaillancourt, M.C. Vassiliou, S. Bergman, G.M. Fried, P.A. Kaneva, L.S. Feldman.*** **From the Steinberg-Bernstein Centre for Minimally Invasive Surgery and Innovation, McGill University, Montréal, Que.**

The Global Operative Assessment of Laparoscopic Skills (GOALS) is a 5-domain generic global rating scale evaluating fundamental laparoscopic skills. For basic laparoscopic procedures such as cholecystectomy and appendectomy, GOALS scores increase with surgical experience. The aim of this study was to compare performance during basic and advanced laparoscopic surgery using GOALS.

During an 8-month period, 10 general surgery trainees (PGY 3–5 and minimally invasive surgery fellows) were evaluated by attending surgeons after a variety of laparoscopic procedures using GOALS (maximum score = 25). For each participant, 3 assessments closest in time were selected: gallbladder resection from the liver bed (GBR), triangle of Calot dissection (TCD) and one more complex laparoscopic procedure. Repeated-measures ANOVA with Bonferroni post-hoc analysis was used to compare scores for the 3 case categories.

Mean (SD) total scores were 21.3 (3.5) for GBR, 20.2 (4.5) for TCD and 17.4 (3.2) for the complex procedure ($p < 0.05$). Post-hoc analysis demonstrated a significant decline in total scores between GBR and complex procedures ($p < 0.05$). There were significant differences with increasing case complexity in all GOALS domains except depth perception, with bimanual dexterity and autonomy being most discriminatory (Table).

As expected, GOALS scores decreased as case complexity increased. Although depth perception is developed early and is preserved as case complexity increases, strategic use of both hands and the flow of the operation decline as the complexity of the cases increase. This suggests that integrative skills should be targeted in advanced laparoscopic curricula.

Table, abstract 31. Global Assessment of Laparoscopic Skills (GOALS) scores across three surgical procedures

	Surgical procedure; mean (SD) score			
GOALS item	GBR	TCD	Complex	*p* value
Depth perception	4.3 (0.8)	4.3 (0.8)	4.0 (0.7)	0.342
Bimanual dexterity	4.1 (0.9)	4.1 (1.0)	3.5 (0.7)	0.005
Efficiency	4.1 (0.9)	3.9 (1.0)	3.3 (0.5)	0.046
Tissue handling	4.4 (0.7)	3.9 (1.0)	3.6 (0.8)	0.047
Autonomy	4.4 (0.7)	4.0 (0.9)	3.0 (1.2)	0.001
Total	21.3 (3.5)	20.2 (4.5)	17.4 (3.2)	0.004

GBR = gallbladder resection from the liver bed; SD = standard deviation; TCD = triangle of Calot dissection.

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Surgical approach and outcomes following paraesophageal hernia repair. ***E. Davenport, F. Haggar, D. Trottier, H. Huynh, C. Soto, F.M. Shamji, A. Seely, S. Sundaresan, G. Pagliarello, S. Tadros, J.D. Yelle, D. Maziak, H. Moloo, E.C. Poulin, J. Mamazza.*** **From the Department of Surgery, The Ottawa Hospital, Ottawa, Ont.**

Choice of surgical approach in the repair of paraesophageal hernia (PEH) is controversial, and outcomes are inadequately described. The objective of this study was to compare indications and outcomes according to surgical approach.

We analyzed demographics, choice of approach and outcomes (intra- and postoperative complications, mortality and clinical recurrence). The Kruskal–Wallis 1-way ANOVA and χ^2 and Fisher exact tests were used.

In all, 139 consecutive PEH repairs at a single institution (June 2004 to December 2008) were analyzed. The number and associated percentage follow-up for the 3 types of surgical approach were laparoscopy (n = 86, 88.5%), laparotomy (n = 26, 65.4%) and thoracotomy (n = 27, 84.6%). We found no difference in BMI, sex, ASA, type of hernia, prior abdominal surgery, intraoperative transfusion, intra- and postoperative complications, postoperative complications or mortality between the 3 groups (all p values > 0.5). However, median LOS was higher in the laparotomy (8 d) and thoracotomy (8 d) groups than in the laparoscopy group (3 d) ($p < 0.001$). Also, laparotomy patients were older ($p < 0.001$), more likely to be booked as emergencies ($p < 0.001$) than thoracotomy or laparoscopy patients, and operative time (160 min) was significantly shorter than that of laparoscopy (210 min) and thoracotomy (275 min) patients ($p < 0.001$). At a median follow-up of 188 days, there was no difference in symptomatic recurrence across the groups ($p = 0.527$).

Paraesophageal hernia repair when accomplished laparoscopic-

ally was associated with a shorter LOS than if performed by laparotomy or thoracotomy. Laparotomy was associated with older patients, emergency booking of cases and shorter operation time. Further large clinical trials are required to determine the role of laparoscopy in the elective and emergent repair of PEH.

33

Postearthquake Haiti: assessing patterns of injury and developing capacity for surgical response. ***L.M. Knowlton, S. Chackungal, K.A. MacQueen*****. From the Harvard School of Public Health, Harvard Humanitarian Initiative, Boston, Mass., the Department of Surgery, University of British Columbia, Vancouver, BC, the Division of General Surgery, University of Western Ontario, London, Ont.**

The burden of surgical disease in low-income developing countries is a pressing public health concern. Resource-poor countries such as Haiti have disparate, often inadequate, facilities and personnel to provide essential surgical care to their population. A detailed survey of infrastructure and resources in hospitals from all districts in Haiti has not been conducted. The objective was to develop a survey tool to elucidate such gaps in access to surgical care, one that will be relevant in the postearthquake setting. A pilot survey has been created based on the WHO Situational Analysis to Assess Emergency and Essential Surgical Care tool. The survey includes questions regarding surgical infrastructure, access to human resources (credentialed v. noncredentialed), surgical/anesthesia training programs access and availability, as well as outcomes. This survey differentiates between field hospitals that were established postearthquake and previously established university hospitals.

The pilot survey has been implemented in Indonesia and parts of Africa and is a feasible survey tool. Preliminary data have been compiled from an expert panel of 7 surgeons and anesthesiologists who were participants in surgical response teams postearthquake at 5 institutions (3 field hospitals, 2 university hospitals). The authors will be traveling to Haiti to implement the survey formally in the hospitals of 10 districts, and data will be reported.

This pilot survey will assess surgical capacity in postearthquake Haiti and will allow for comparison between predisaster Haiti and the current state of surgical care. We will need to then create more systematic methods for recording surgical response in order to best rebuild the nation.

34

Laparoscopic fundoplication is superior to proton pump inhibitor therapy in controlling gastroesophageal reflux disease–related cough: results of a randomized controlled trial. ***M. Anvari, C. Allen, C. Goldsmith and the ELVIS Research Group*****. From the Departments of Surgery, Medicine, Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, Ont.**

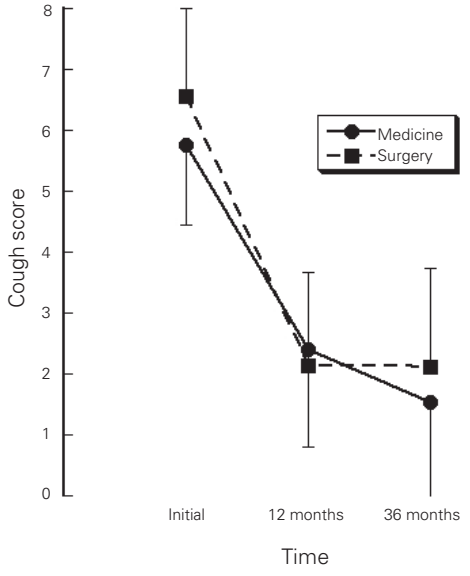
In patients with gastroesophageal reflux disease (GERD) who were stable and symptomatically controlled on long-term medical therapy, we performed an RCT to compare ongoing optimized medical therapy with laparoscopic Nissen fundoplication (LNF) for the control of chronic GERD symptoms including cough.

In all, 201 patients were eligible for randomization, 104 gave informed consent (mean age 42.9 [SD 11] yr; 55 male, 49 female) and 2 withdrew from the study immediately after randomization. Patients randomized to medical therapy received optimized treatment with proton pump inhibitors (PPI) using a standardized management protocol, and surgical patients underwent LNF. Patient symptoms were evaluated using the GERD symptom score (GSS), a published and validated instrument that includes cough. Individual cough scores varied from a low of 0 for no cough to a maximum of 12. Medical patients were evaluated on PPI, surgical patients off PPI.

Forty-nine (47%) of the 104 patients (24 male, 25 female) complained of cough at the time of randomization, and the follow-up mean (95% CI) cough scores in these 49 patients are shown 12 and 36 months after randomization (Figure). There were no significant differences between medically and surgically treated patients at any evaluation point. Both groups showed significant and clinically important improvement in cough scores.

In patients whose GERD symptoms are stable and controlled on PPI, surgery provides equal long-term control of cough for those who do not wish to remain on long-term PPI therapy.

Figure, abstract 34. Cough scores of patients with gastroesophageal disease whose symptoms were treated with proton pump inhibitors or laparoscopic fundoplication



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Canadian general surgeons' opinion about clinical practice audit: preliminary data. ***I. Ghaderi, A. Madani, C. de Gara, C.M. Schlachta*****. From the Division of General Surgery, Schulich School of Medicine and Dentistry, London, Ont., and the University of Alberta, Edmonton, Alta.**

The objective of this survey was to explore Canadian Association of General Surgeons (CAGS) members' opinion about the role and utility of clinical practice audit (CPA).

A 20-question electronic survey was sent to CAGS members that addressed demographics, knowledge about CPA, awareness

of available audit tools, experiences with CPA and opinions about value, implementation and barriers to CPA.

Forty-six surveys were completed: 70% of participants were male with mean age of 46 (SD 12) years; 70% of respondents practice in the public and 30% in the private sector; 63% had subspecialty training and 44% were in an academic centre as opposed to a community (25.5%) or a rural hospital (5.5%). Residents, fellows and retired surgeons comprised 18.2%, 3.7% and 3.7% of respondents, respectively. Familiarity with common auditing tools ranged from 3.1% to 28%, and 44.5% had previously performed CPA. One third believe that CPA should be mandatory (36.4%) and that CPA is best done by self (35%). Using a Likert scale, a majority of respondents felt that CPA is effective at changing both patient outcomes and clinical practice (median 4) and that barriers included time constraints (median 5), cost, resources and inadequate documentation (median 4). A majority of respondents would participate in CPA if the data were reviewed by themselves, their practice institute, provincial organizations, the Royal College or provincial government (median 4), as long as the data were not made public (median 2).

Preliminary survey data show that Canadian surgeons perceive the usefulness of clinical audit but have limited knowledge about available audit tools and resources.

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Surgical experiences in postearthquake Haiti. ***T.L. Zakrison.*** **From the Ryder Trauma Center, Jackson Memorial Hospital, University of Miami, Miami, Fla.**

A surgical team from the University of Miami arrived in Port-au-Prince, Haiti, within 24 hours of the earthquake on Jan. 12, 2010. Early mortality was secondary to injuries such as pelvic fractures leading to exsanguination and high spinal cord injuries. Within the next 72 hours, the priority shifted to control of open fractures and débridement of soft tissue infection and necrotic wounds. Intravenous fluid administration was important to avoid cases of acute kidney injury secondary to crush injury. Early emphasis on amputation was necessary to avoid death from septic shock. Amputations were carried out in extremely austere environments from a surgical and anesthetic perspective. Intubations were not possible, and ketamine in combination with midazolam were the main agents for dissociative anesthesia and sedation. Regional blocks were administered when possible, even for above-knee amputations. Surgically, Gigli saws were portable and easily used for amputations with suture ligation of bleeding vessels. Amputations were done in a definitive, nonguillotine manner, with all wounds left open for closure 24–48 hours later. Later surgical experience (1-mo after the earthquake) involved exploratory laparotomies for trauma or for gynecological and/or gastrointestinal concerns. In addition, surgeries were done for suprapubic catherter insertions, craniotomies for posttraumatic epidural hematomas or ongoing attention to wound care and débridement or skin grafting. Most operations were not related to earthquake-induced injuries except for ongoing wound débridements. Modest intensive care support for both adult and pediatric (including neonatal) patients carried intrinsic logistical and ethical challenges. The earthquake in Haiti was the largest disaster encountered in the western hemisphere in terms of morbidity and mortality. This led to novel and unique surgical experiences in an attempt to preserve life and function.

37

Noncontrast sestamibi computed tomography/single photon emission computed tomography for preoperative localization in primary hyperparathyroidism. ***M.C. Tee, S. Chan, V. Nguyen, J. Yang, D. Holmes, D. Levine, S. Bugis, S.M. Wiseman.*** **From the University of British Columbia, Department of Surgery, St. Paul's Hospital, Vancouver, BC**

A retrospective review of 207 patients at a tertiary care centre was conducted to compare preoperative imaging techniques for primary hyperparathyroidism. Noncontrast computed tomography/single photon emission computed tomography (CT/SPECT) was compared with planar sestamibi (MIBI) and neck sonography (US) for preoperative parathyroid adenoma localization. The sensitivity and positive predictive value of MIBI, US and CT/SPECT were calculated. Correct localization was defined as side of localization on imaging compared with operative findings. The congruency of noncontrast CT/SPECT with other imaging modalities was also evaluated. A separate subgroup analysis was conducted for cases of ectopic and double adenomas.

The sensitivities of MIBI, US and CT/SPECT were 0.540, 0.586 and 0.710, respectively. The positive predictive value of MIBI, US and CT/SPECT were 0.910, 0.919 and 0.981, respectively. There was only one true negative result, and thus insufficient data to calculate test specificity and negative predictive value. There was a trend toward increased sensitivity and positive predictive value for CT/SPECT, but this result did not reach statistical significance. Colocalization was determined by a χ^2 test. Parathyroid adenoma colocalization between US and noncontrast CT/SPECT was significantly better than US and MIBI (p = 0.03). A subset analysis of cases of ectopic and double adenoma disease did not reveal any significant results.

Noncontrast CT/SPECT is a more sensitive preoperative imaging test and has a greater positive predictive value compared with US and MIBI. Although this result was not statistically significant, it is clinically relevant, as SPECT/CT allows for a more focused surgical approach in approximately 15% more patients. Furthermore, the colocalization between noncontrast CT/SPECT and US may represent the most accurate combination of preoperative investigations for localizing parathyroid adenoma. Ongoing study is required to better elucidate the role of CT/SPECT in the preoperative evaluation of individuals diagnosed with parathyroid adenoma.

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Survey of current practice patterns in the management of colorectal cancer liver metastases in Ontario. ***L. Sandhu, J. Zhai, E.D. Kennedy, N.N. Baxter, A.R. Gagliardi, D.R. Urbach, A.C. Wei.*** **From the Division of General Surgery, University of Toronto, Toronto, Ont.**

Though the indications for hepatic resection for colorectal cancer (CRC) metastases have broadened considerably over the past decade, we hypothesize that hepatectomy remains underutilized. The aim of this study was to assess practice patterns among general surgeons (GS) and medical oncologists (MO) who refer patients with hepatic CRC metastases to hepatobiliary surgeons.

A postal survey was sent to all general surgeons (n = 628) and medical oncologists (n = 147) in Ontario. The questionnaire examined approaches to referral and perceived contraindications

to hepatectomy for CRC metastases. Physicians were asked to provide responses on a 5-point scale (1 = never, 2 = rarely, 3 = sometimes, 4 = very often and 5 = always).

The overall response rate was 52% (GS, n = 307, 51%; MO, n = 83, 56%). Physicians whose scope of practice did not include patients with CRC were excluded (n = 85, 21%). Seventy-four percent of physicians "very often" or "always" refer patients with hepatic CRC metastases to hepatobiliary surgeons but 24% "rarely" or "sometimes" do so (GS 23%, MO 25%). Ninety-seven percent of physicians reported referring patients with single liver lesions "very often" or "always." Only 28% would refer patients with bilateral, multiple CRC metastases (GS 29%, MO 25%). Whereas only 2% of MO (n = 1) "never" refer patients with bilateral, multiple lesions for surgical consideration, 17% of GS (n = 36) never do so (p = 0.01). Perceived contraindications to surgery were similar across both groups: 25% of physicians "very often" or "always" consider a previous liver resection a contraindication to hepatectomy, as compared with 41% for lung metastases and 63% for extrahepatic metastases.

Whereas patients with single CRC liver metastases are receiving appropriate hepatobiliary surgical consultations, the rate of referral declines as the burden of disease increases. Further research is necessary to identify the barriers to appropriate referral for patients with more extensive but potentially curable disease.

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Genicular collateral arterial circulation. ***M. Sabalbal, V.C. McAlister.*** **From the Canadian Forces Medical Service, University of Western Ontario, London, Ont.**

The superficial femoral artery (SFA) is frequently injured in combat-related penetrating trauma of the thigh. Genicular collateral arterial circulation allows for some perfusion of the lower leg if blood flow through the SFA becomes obstructed by trauma or disease. When describing the anatomy, textbooks only provide a schematic representation of the genicular collateral circulation and suggest that the descending branch of the lateral circumflex artery (DBLCFA) plays a critical role. The arterial anatomy of this anastomosis has not been well documented since the 18th century. The DBLCFA may be removed for bypass and reconstructive surgeries; therefore, a sound anatomic description of this artery is essential. This study combines dissection with 3-dimensional (3-D) reconstruction to describe the anatomy of the DBLCFA and to provide a morphological description of how this artery contributes to the genicular anastomosis. The arterial anatomy of 10 cadaveric lower limbs was dissected from the inguinal ligament to the level of the tibial tubercle. Thigh cryosections from the female visible human project were used in AMIRA to reconstruct a 3-D model of the arterial anatomy. Data from CT angiograms as well as contrast MRI were imported into OSIRIX to create a similar 3-D model. The DBLCFA is variable and should be renamed since it does not always originate from the lateral circumflex femoral artery. Collateral circulation at the knee is also variable: continuous communicating vessel (1/3); possible communication via capillaries (1/2): no evident communication (1/5). There is anatomic evidence that the DBLCFA contributes to a collateral pathway should the femoropopliteal segment become occluded; its removal is not recommended. The DBLCFA may provide a route for infusion of growth factors or placement of a stent in situations of acute trauma to the SFA that is not bypassable by traditional surgery.

40

Knowing the operative game plan: a pilot study of a surgical cognitive competence assessment tool. ***J. Balayla, S. Bergman, L.S. Feldman, G. Ghitulescu, S.A. Fraser.*** **From the Department of Surgery, McGill University, Montréal, Que.**

The objective of our study was to develop and evaluate a tool to assess cognitive competence in surgical trainees.

Five participants in 7 different training groups (medical student, PGY 1–5, staff) (n = 35) underwent an interview assessment based on surgical cognitive competence (SCC) assessment tools developed for 3 different common general surgical procedures: inguinal hernia repair with mesh in men, laparoscopic cholecystectomy and right hemicolectomy. The tools were developed as a stepwise assessment of specific surgical procedures based on techniques described in current surgical texts. Interviews were recorded and scored by 2 observers separately. Novice (medical student, PGY 2) and expert group (PGY 3, staff) scores were compared using the Mann–Whitney U test. A total SCC score was calculated by adding the 3 scores and dividing by 100. An SSC cut-off score was defined by a receiver operator curve analysis.

Median scores for each procedure and overall SCC scores increased with experience. The interclass correlation coefficient for the total SCC was 0.99 (95% CI 0.98–0.995) between the 2 observers. The median SCC for novices was 54.9 (95% CI 21.6–58.8) compared with 98.05 (95% CI 94.1–100) for experts ($p < 0.01$). The SCC cut-off score of 93.1 discriminates between novice and expert surgeons.

Surgical cognitive competence can reliably be assessed using our SCC assessment tool. It can be used to discriminate between novice and expert surgeons for basic procedures. Future studies are planned to evaluate its use for more complex procedures.

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A population-based study of emergency room presentation in colorectal cancer. ***R. Daigle, R. Urquart, M. Cox, E. Grunfeld, G. Porter.*** **From the Department of Surgery, Victoria General Hospital, Queen Elizabeth II Health Sciences Centre, Dalhousie University, Halifax, NS**

The objectives of this population-based study were to examine the incidence and impact of emergency room presentation (ERP) in colorectal cancer (CRC) and to identify factors associated with ERP focusing on prior health care utilization.

This study included all patients undergoing resection for primary CRC in Nova Scotia from Jan. 1, 2001 to Dec. 31, 2005. Linkage of the provincial cancer registry with other databases (hospital discharge, physician billing and national census data) provided clinicodemographic, diagnostic, treatment event data and measures of pre-CRC health care utilization (family physician visits, emergency department visits, colonoscopy 1–5 years before diagnosis). An ERP was defined as surgical resection occurring during an admission through the emergency department at 1 of the 9 full-service hospitals. Multivariate analyses were performed to examine the impact of ERP on the overall survival and length of stay (Cox proportional hazards). Logistic regression was used to identify factors independently associated with ERP.

Among the 2851 patients in the study cohort, ERP was found

in 597 (20.9%). When controlling for age, sex and stage, ERP was uniformly associated with inferior outcomes (Table).

Factors associated with ERP on multivariate analysis were non-rural residence ($p = 0.04$), colon location ($p < 0.0001$), comorbidity ($p < 0.0001$), advanced stage ($p < 0.0001$) and female sex ($p = 0.02$). For health care utilization, the presence of any family physician visit 1–4 years before diagnosis (OR 0.5, $p = 0.006$) and annual visit for 3 consecutive years (OR 0.7, $p = 0.02$) was associated with a lower risk of ERP. Factors not associated with ERP were emergency department visit 1–4 years before diagnosis, colonoscopy 1–5 years preceding diagnosis and health region colonoscopy volume.

Emergency room presentation was not uncommon in Nova Scotia and, consistent with previous publications, was associated with detrimental CRC outcomes. Several clinicodemographic and health care utilization factors are associated with ERP, specifically family physician access. Optimizing access to primary care may reduce the incidence of ERP.

Table, abstract 41. Outcomes of patients with colorectal cancer according to emergency versus non-emergency admission to hospital

Outcome	Non-ERP	ERP	Risk (95% CI)	*p* value
5-year overall survival, %	59.4	33.7	0.54 (0.48–0.61)	< 0.0001
5-year disease-specific survival, %	74.6	54.4	0.52 (0.45–0.60)	< 0.0001
Mean LOS, d	12.6	22.6	—	< 0.0001
30-day mortality, %	1.3	9.8	0.10 (0.10–0.20)	< 0.0001

CI = confidence interval; ERP = emergency room presentation; LOS = length of hospital stay.

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Laparoscopic assisted gastrectomy for gastric adenocarcinoma: Does it measure up to open procedure? A retrospective comparative study of 60 cases. ***J. Hallet, S. Labidi, A. Clairoux, J.-P. Gagné.*** **From the Centre de chirurgie minimalement invasive de Québec, Centre hospitalier universitaire de Québec, Université Laval, Québec, Que.**

The objective of this study was to review and compare the operative outcome of patients submitted to laparoscopic-assisted gastrectomy (LAG) versus open gastrectomy (OG) for gastric adenocarcinoma .

We reviewed charts of all patients who underwent either LAG (2007–2010) or OG (2000–2010) for gastric adenocarcinoma in an academic health science centre between 2000 and 2010. A standardized data extraction form was used by reviewers not involved in the treatment process. Whereas OG were performed by multiple academic surgeons, all LAG were performed by one fellowship-trained laparoscopic surgeon.

Sixty cases were retrieved: 47 OG (17 total, 27 subtotal, 3 wedge resections) and 13 LAG (1 total, 9 subtotal, 3 antrectomy). In the LAG group, the conversion rate was 23%. Mean operative time was 105 minutes longer ($p < 0.0001$), and there was on average 600 mL less blood loss ($p < 0.0001$) in the LAG group. The mean number of harvested lymph nodes was similar in both groups (14 OG v. 10 LAG, $p = 0.126$). Mean length of stay did not differ between groups (LAG 19 d v. OG 18.9 d). Major postoperative complications rates (13% OG v. 23% LAG, $p = 0.352$) and operative mortality rate (2% OG v. 6% LAG, $p = 0.323$) were similar.

Laparoscopic-assisted gastrectomy is a challenging procedure that compares to OG in terms of operative outcomes. However, given the dismal prognosis of gastric adenocarcinoma, long-term follow-up is essential.

43

Cardioprotective effects of cyclosporine in a newborn piglet model of asphyxia: a dose–response study. ***R.S. Gill, N. Manouchehri, J.Q. Liu, T.F. Lee, D.L. Bigam, P.-Y. Cheung.*** **From the Departments of Surgery and Pediatrics, Faculty of Medicine and Dentistry, University of Alberta, Edmonton, Alta.**

We conducted a randomized surgical animal model to assess the cardioprotective effects of cyclosporine in asphyxiated newborn piglets. We hypothesized that cyclosporine in asphyxiated newborn piglets would improve cardiac function, systemic hemodynamics and oxygen metabolism.

Thirty-six piglets (1–4 days old, weighing 1.4–2.5 kg) were acutely anesthetized and instrumented for continuous monitoring of cardiac output, systemic and pulmonary arterial pressures. After stabilization, normocapnic alveolar hypoxia (10%–15% oxygen) was instituted for 2 hours followed by reoxygenation with 100% oxygen for 0.5 hours, then 21% for 3.5 hours. The piglets were block randomized to receive 1 of 3 cyclosporine intravenous boluses (2.5, 10 or 25 mg/kg) or normal saline solution as a placebo (control) after 5 minutes of 100% reoxygenation ($n = 8$ each). A nonasphyxiated, sham-operated group was included ($n = 4$) to control for effects of the surgical model. Blood samples were collected for analysis of blood gases, arterial and venous co-oximetry, plasma troponin and plasma lactate concentration. Statistical analysis was performed using ANOVA.

All piglets demonstrated cardiogenic shock (cardiac output 45% of baseline), hypotension (systemic arterial pressure 30 mmHg) and acidosis (pH 7.04) at the end of 2 hours of hypoxia. Cyclosporine treatment at reoxygenation caused dose-related improvements in cardiac output and oxygen delivery compared with controls (both $p < 0.05$). Cyclosporine at 10 mg/kg significantly improved stroke volume compared with controls ($p < 0.05$), demonstrating preservation of cardiac function. Systemic and pulmonary arterial pressures were not different among groups. Plasma troponin and left ventricle lactate, both markers of myocardial damage, were significantly higher in controls than that of 2.5 and 10 mg/kg cyclosporine treatment groups ($p < 0.05$).

We are the first to demonstrate that the postresuscitation administration of cyclosporine causes dose-related preservation of cardiac function in newborn piglets following asphyxia reoxygenation.

44

An assessment of the impact of dedicated research resources on resident attitudes toward academic research during residency: literature review and survey of a general surgery program. ***J.A. Van Koughnett, P.H. Colquhoun.*** **From the Division of General Surgery, University of Western Ontario, London, the Ontario Institute for Studies in Education, University of Toronto, Toronto, Ont.**

The objectives of this study were to review the literature on resident research resources and evaluate the value of research resources

by comparing resident attitudes toward research before and after the introduction of new resources in a general surgery program.

A literature search using MEDLINE, ERIC and PsycINFO was conducted for published approaches to research during residency. Studies were assessed for tools and resources to facilitate resident success and resident attitudes toward research. A general surgery program that undertook a renewed commitment to resident research was examined for the impact of research resources on resident attitudes. Interventions included the appointment of a dedicated staff coordinator and clear expectations and opportunities. A survey gauging resident attitudes was distributed a month before the introduction of new resources and repeated 2 years later. Standard statistical analyses were performed.

Approximately 30 studies have examined the nature of research during residency. A range of strategies and expectations are described. The general surgery survey response rates were similar between iterations at 75%. After program changes, there was an improvement in the residents' perception of research as a priority of the program ($p < 0.05$). There were reductions in perceived barriers ($p < 0.05$), including lack of support for hypothesis development and lack of awareness of ongoing research. Motivating factors were similar. Of the 7 research resources examined, residents found all but one useful.

Resident research expectations are inconsistent between programs. Protected time, financial support and mentorship are valued by residents. Formal improvements to a research program have resulted in reduced perceived barriers to completing research and improved resident attitudes toward research in the general surgery program of study.

45

Practice patterns and perceptions of margin status for breast conserving surgery: national survey of Canadian general surgeons. ***M.L. Gordon, S. Cornacchi, F. Farrokhyar, N. Hodgson, G. Porter, M.L. Quan, F. Wright, P. Lovrics.***
From the Department of Surgery, McMaster University, Hamilton, Ont.

We surveyed general surgeons to determine how they manage early-stage breast cancer and attitudes/factors that guide those decisions.

A modified Dillman method was used for this mail survey of 1443 Canadian surgeons. Demographic information included community versus academic practice, breast surgery volume and years in practice. Practice patterns and factors that influence management choices for preoperative assessment, including knowledge of predictors of margin status and local recurrence; surgical techniques; and postoperative management, including definitions of margin status and patterns of re-excision and referral, were assessed.

The response rate was 51%, with 41% ($n = 301$) of responders treating breast cancer. Most (80%) considered themselves community surgeons, with approximately equal distribution of low/medium/high volume, and 0–10/11–20/> 20 years of practice. There was variation in surgeons' attitudes toward determinants of margin status and local recurrence risks. Twenty-five percent of surgeons "sometimes" or "frequently" performed diagnostic excisional biopsies, significantly more in community ($p < 0.01$) and low-volume ($p < 0.01$) settings. There was variation in defining clear margins (39% no tumour at inked margin, 14% within 1 mm, 29% within 2 mm, and 17% within 5 mm) but there was no difference among the surgeon groups. For extent of resection in ductal carcinoma in situ (DCIS) and invasive cancer, 90% of surgeons aimed for gross margins of 2 cm or greater. There was marked variation in the use of specimen orientation, skin resection and dissection to the chest wall. Patient age, disease burden and extent of margin positivity affected recommendations for reoperation versus referral to radiation oncology without reoperation for positive margins, whereas diagnosis of DCIS versus invasive cancer did not.

Responses revealed significant variation in attitudes and actions of surgeons. These findings likely reflect an absence of consensus in the literature, as well as potential gaps between best evidence and practice. Such insights are valuable in the development of practice guidelines, quality initiatives and future research.

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Reduction in overall cost of deep venous thrombosis (DVT) prophylaxis in general surgery patients: a lesson in using evidence-based medicine guidelines to implement change in practice to reduce hospital costs. ***I. Datta, S.S. Brar, C.G. Ball, J.A. Heine, B. Rothwell.***
From LSE Health, London School of Economics and Political Science, London, UK, and the Department of Surgery, Faculty of Medicine, University of Calgary, Calgary, Alta.

Rapidly increasing health care costs in developed countries have generated scrutiny regarding cost-effectiveness. The economics of health care delivery must be balanced against evidence-based guidelines ensuring adequate provision of care. The objective of this study was to determine if strict adherence to evidence-based guidelines regarding deep venous thrombosis (DVT) prophylaxis for patients undergoing laparoscopic or open appendectomy for acute appendicitis results in cost reduction.

A model was created comparing costs of unfractionated heparin (UH) versus UH and sequential compression stockings (SCS) for 1000 patients undergoing appendectomy. A clinical cohort from 2004 to 2005 of 1000 patients undergoing appendectomies at 3 clinical teaching hospitals was evaluated in comparison to our model cohort. Increased risk of DVTs was estimated from the literature at 1.6% of patients undergoing appendectomies. The overall cost difference between the UH group and the UH and SCS group in the model was $69000.00. The estimated cost difference between single-use SCS and single-dose UF was $67.50 per case.

Adherence to evidence-based guidelines for DVT prophylaxis can reduce costs significantly. Utilization of clinical pathways and the perioperative surgical checklist can be further studied as adjuncts to achieve these goals.

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Use of human patient simulation and validation of the Team Situation Awareness Global Assessment Technique (TSAGAT): a multidisciplinary team assessment tool in trauma education. ***M. Crozier, H. Ting, D. Boone, N. O'Regan, C. Brown, N. Bandrauk, J. Hapgood, M. Hogan.***
From the Memorial University of Newfoundland, St. John's, NL

We assessed team performance and teamwork of multidisciplinary teams performing trauma resuscitation using human patient simulation.

Using the Human Patient Simulator, we designed the Team Situation Awareness Global Assessment Technique (TSAGAT). Individual SAGAT tools were developed for each member of a trauma resuscitation team (trauma team leader, anesthesiologist and trauma nurse). Scores were calculated as the sum of individual SAGAT scores. Multidisciplinary trauma teams were assessed using TSAGAT and traditional checklist assessment. Teamwork was assessed using the Behaviourally Anchored Team Rating Scale (BATS) for individual performance and the Team Performance Observation Tool (TPOT) for group performance. Four teams completed 2 simulated scenarios each. The teams varied by experience, including a student team, a junior resident and nurse team, a senior resident and nurse team and a staff physician and highly experienced nurse team.

The TSAGAT was found to show significant difference in scores based on level of experience. Mean checklist scores also improved significantly with increasing level of experience. The TSAGAT displayed reliability and significant scoring correlation with traditional checklist performance measures. Mean BATS and mean TPOT scores also showed significant difference in scores based on level of experience.

The TSAGAT is a valid, reliable assessment tool for multidisciplinary team performance in a dynamic simulated trauma resuscitation environment. Teams with more individual trauma experience have greater scores on teamwork rating scales. The TSAGAT supports multidisciplinary training and assessment. Information provided by the TSAGAT could provide specific feedback, direct individualized teaching and support curriculum change. Introduction of the TSAGAT could improve the current assessment model for practical trauma education.

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Using the zebra fish model determine the role of the *HACE1* tumour suppressor in normal development and tumourigenesis. ***L.A. McDonald, S Da'as, P.H.B. Sorensen, J.N. Berman.*** **From the Departments of Surgery, Pathology and Pediatrics, University of British Columbia, Vancouver, BC, Dalhousie University, Halifax, NS**

HACE1 is a novel tumour suppressor gene located at human chromosome 6q21. *HACE1* possesses both an ankyrin repeat domain and a catalytically active HECT domain. It is downregulated in a variety of human cancers including Wilms tumour, melanoma, breast cancer, lung cancer, lymphoma and colon cancer, thus representing a potentially broadly applicable genetic target. Whereas *HACE1* has been found to be expressed in a number of tissues, its role in normal development remains unknown. The zebra fish has established itself as a robust model for studying vertebrate development and modelling human cancers. A zebra fish homologue of human *HACE1* has been identified. Whole-mount in-situ hybridization (WISH) assays with probes to the ankyrin repeat domain and to the HECT domain demonstrate expression of zebra fish *HACE1* in heart, brain and kidney at early developmental time points (24 h postfertilization [hpf] – 7 d postfertilization [dpf]), which is consistent with human expression. Colocalization studies in wild-type embryos employing a probe to the zebra fish *HACE1* HECT domain and *CMLC2* (heart) shows colocalization at 5 dpf. There appears to be colocalization of the zebra fish *HACE1* HECT domain with central nervous system markers, such as *KROX20* (rhombomeres 3 and 5) at 48 hpf. Colocalization studies with *CDH17* (kidney) are currently underway. A morpholino has been designed for the translational start site of zebra fish *HACE1*. Knockdown studies will further clarify the contribution of *HACE1* to normal development. Two destination vectors possessing fusion human *HACE1* genes (wild type and dominant negative versions) with a green fluorescent protein tag under the control of the ubiquitous β-*actin* promoter have been generated and injected into wild-type embryos. A dominant negative founder fish has been identified. Embryo screening for germline fish expressing green fluorescent protein is ongoing. These zebra fish models have tremendous potential to elucidate the role of *HACE1* in normal development and human tumourigenesis.

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Comparison of 2 ureter anastomosis techniques. ***A. Ameer, M. Jamal, M. Aljiffry, S. Doi, M. Hasanain, P. Chaudhury, P. Metrakos, J. Tchervenkov.*** **From the Department of Surgery, Royal Victoria Hospital, McGill University, Montréal, Que.**

Our aim was to determine the incidence of hematuria and other urologic complications in 2 different types of ureter anastomosis techniques (Taguch v. Lich–Gregoir) in patients who underwent adult renal transplant and to evaluate the impact of urologic complications on graft survival.

We conducted a retrospective analysis of our prospective transplant database. In all, 624 cases of adult renal transplant were performed between 2000 to 2009. Exclusion criteria included patients who had multiorgan transplant, more than 1 renal transplant and patients who had a ureteric anastomosis using another method. In all, 372 patients were included and divided into 2 groups according to the method of ureteric anastomosis. The Taguchi group had 209 patients (56%), whereas the Lich–Gregoir group had 163 patients (44%). The Fisher exact test was used to compare the groups for hematuria and urologic complications including urinary leak and ureteric stricture. A multivariate analysis was performed to identify factors associated with graft rejection and death, after censoring for warm and cold ischemia time, donor and recipient age and sex.

Twenty-one patients developed a urinary leak or stricture. Hematuria requiring an intervention developed in 55 patients. There was no difference in ureteric complications between the 2 groups. However, the Taguchi technique was associated with more incidences of complicated hematuria (37) when compared with the Lich–Gregoir technique (18). Multivariate analysis identified delayed graft function (OR 3.142, 95% CI 1.681–5.873) and cold ischemia (with cadaveric kidney; OR 2.077, 95% CI 1.016–4.248) as factors predictive of graft death. Factors predictive of first episode of rejection at multivariate analysis were delayed graft function (OR 2.416, 95% CI 1.33–4.37) and the development of a ureteric stricture (OR 3.93, 95% CI 1.77–8.7).

The Taguchi technique and the Lich–Gregoir technique can be used interchangeably for adult renal transplantation. The Taguchi technique was associated with more risk of complicated hematuria in our cohort of patients. Delayed graft function and prolonged cold ischemia time are factors associated with graft death. Ureteric stricture and delayed graft function are factors associated with a decrease in the time period from adult renal transplant to the first episode of graft rejection.

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Acute care surgery services: Does it affect the management of acute cholecystitis? ***S. Lapierre, W. Mohammad, N. Balaa, M. Akil, R. Mimeault, R. Fairfull-Smith.*** **From the Department of Surgery, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.**

Acute care surgery services (ACS) represent a new model of care for patients with acute surgical disease. Recently introduced at our institution, we evaluated its effect on the management of patients presenting with acute cholecystitis.

Our aim was to establish the effect of acute care surgery service introduction at a tertiary care academic centre on the management of acute chlolecystitis.

A retrospective chart review of patients presenting with acute cholecystitis from the period of May 2006 until May 2009 was completed. The acute care surgery service was introduced in January 2008. All patients presenting with acute calcular cholecystitis where included in the study. Patient demographics, work-up, management, complications and hospital stay were compared before and after the introduction of such service.

A total of 109 patients were eligible for analyses. Forty-six patients (42%) presented before the introduction of ACS service. The mean age was 63.9 years. The mean length of stay was 11.4 days in before the ACS service and 8.5 days after the introduction of the ACS service.

The introduction of the ACS service at a tertiary care academic centre has led to a reduction in the mean length of stay for patients presenting with acute calcular cholecystitis.

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Single incision laparoscopic surgery: initial Canadian 1-year experience. ***B.D. Teague, M.S. Butler, P.Y. Garneau, C.B. Sample, A. Kapoor, M.O. Cadeddu, M. Anvari.*** **From the Centre for Minimal Access Surgery, St. Joseph's Healthcare, McMaster University, Hamilton, Ont., the Service de chirurgie générale, Hôpital du Sacré-Coeur de Montréal, Université de Montréal, Montréal, Que., and the Centre for Advancement of Minimally Invasive Surgery, University of Alberta, Edmonton, Alta.**

With the introduction of single-incision laparoscopic surgery (SILS) as a new surgical technique in Canada, a prospective database was established to assess the safety and efficacy of these procedures in the Canadian setting. Patient and operative data were collected from 5 surgeons performing SILS in 3 Canadian institutions. All surgeons were experienced laparoscopic surgeons with training in the SILS procedure before performing independent surgeries. Operative data, inpatient complications and follow-up data were recorded. Forty-five patients underwent SILS procedures between March 2009 and March 2010. Twenty-seven patients had elective procedures (11 cholecystectomy, 8 colonic resection, 3 partial gastrectomy, 3 nephrectomy, 1 splenectomy, 1 appendectomy), and 18 patients had a SILS procedure for urgent surgery (15 appendectomy, 2 small bowel procedures, 1 cholecystectomy). Nine out of 45 cases (20%) required additional port placement, and 1 case was converted to open surgery. Conversion was related to case complexity and surgeon experience. One patient developed a postoperative pulmonary embolism, and there were 2 wound infections. Initial experience following the introduction of the SILS technique in 3 Canadian centres demonstrates that for specialized surgeons, in selected cases, operative outcomes for SILS is comparable to open and laparoscopic surgery. Our results suggest that SILS can be adopted safely into a laparoscopic practice by surgeons experienced in laparoscopic surgery. A longer follow-up on a larger series of patients will be needed to confirm the efficacy and utility of SILS.

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Canadian general surgery residents: ready for the 80-hour work week? ***W.C. Hanna, M.H. Jamal, L. Nguyen, S.A. Fraser.*** **From the Department of Surgery, McGill University, Montréal, Que.**

The purpose of this study is to describe the Canadian general surgery residents' perceptions regarding potential work-hour restrictions.

An ERB-approved and CAGS-accredited web-based survey was submitted to all Canadian general surgery residency programs between April and July 2009. Questions evaluated the perceived effects of an 80-hour work week on the length of training, operative exposure, learning and lifestyle. The Fisher exact test was used to compare senior and junior residents' responses.

In all, 158 residents out of 360 responded (70 senior residents, 88 junior). Of these, 79% work between 75 and 100 hours a week. Among senior residents, 74% believe that limiting their work hours will decrease their operative exposure; only 43% of junior residents agreed ($p < 0.0001$). Both senior and junior residents agreed that limiting their work hours will improve their lifestyle (86% v. 96%, $p = 0.123$). Overall, 60% of residents did not believe that limiting work hours would extend the length of their residency training. Regarding 24-hour call, 60% of junior residents thought that it was hazardous to their health; however, only 30% of seniors agreed ($p = 0.001$). Both senior and junior residents agreed that abolishing 24-hour call will decrease their operative exposure (84% v. 70%, $p = 0.214$). Overall, only 31% of residents supported abolishing 24-hour call. Only 47% of residents (senior residents 41%, junior 51%, $p = 0.26$) agreed to the adoption of the 80-hour work week.

There is a training level–based dichotomy of opinion among general surgery residents in Canada regarding the perceived effects of work-hour restrictions. Both groups have clearly voted against abolishing 24-hour call; however, neither group strongly supports the implementation of the 80-hour work week.

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An online video resource to enhance surgical medical education. ***K. Kwan, C.J.D. Wallis, S. Jones, T. Fraser, J. Masterso, G. Blair, D. Duffy.*** **From the Department of Urologic Sciences, Faculty of Medicine, University of British Columbia, the Division of Pediatric General Surgery, and the Office of Pediatric Surgical Evaluation and Innovation, BC Children's Hospital, Vancouver, BC**

The expanded and distributed medical program at the University of British Columbia (UBC) has created the potential for discrepancies among students' exposure to surgical procedures. Recently, the UBC Department of Urological Sciences and Division of Pediatric General Surgery, in partnership with the Office of Pediatric Surgical Evaluation and Innovation, developed an online

educational video resource to increase medical students' exposure to and understanding of important procedures.

A team of 13 UBC medical students produced these videos under the guidance of surgical residents and faculty. Following patient consent, 6- to 8-minute videos of key procedures were produced highlighting the materials used, identifying important anatomic landmarks, explaining the key surgical steps and discussing the indications, contraindications and potential complications of each procedure. These were then published to a secure Internet-based server to allow access to students from all distributed sites.

A total of 21 videos were produced in the fields of urology, pediatric general surgery, plastic surgery and anesthesia. In addition, a number of important safety videos were produced on topics including needlestick injuries and sterile gowning and gloving.

In conclusion, the collaboration between students and surgical faculty can result in the successful production of educational videos. Future plans include (1) the continued expansion of the project with additional videos, (2) linking of pertinent videos with online problem-based learning cases developed at UBC where such cases exist and (3) completion of a study assessing the efficacy of online videos in medical education.

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The use of cervical spine computed tomography for detecting occult pneumothoraces: Do we really need a CT chest? ***D.J. Roberts, A.W. Kirkpatrick, I. Datta, D.V. Feliciano, J.B. Kortbeek, K.B. Laupland, C.G. Ball.*** **From the Departments of Surgery, University of Calgary, Calgary, Alta., and Emory University, Atlanta, Ga.**

Screening computed tomography (CT) often detects posttraumatic pneumothoraces that were not diagnosed on a preceding supine anteroposterior chest radiograph: occult pneumothoraces (OPTXs). Because abdominal CT imaging misses OPTXs in the upper thorax, the objective of this study was to evaluate the utility of cervical spine CT screening for diagnosing OPTXs.

A dual-institution (Foothills Medical Centre and Grady Memorial Hospital trauma centres) retrospective review of consecutive OPTXs was performed. The accuracy of various CT screening protocols in detecting OPTXs was compared. Data were analyzed using standard statistical methodology ($p < 0.05$ = significant).

Occult pneumothoraces were detected in 75 patients. Patient demographics and injury characteristics were similar between both centres (65% male, 97% blunt mechanism, 29% hemodynamic instability upon presentation, mean ISS 27, mean length of stay 22 days, mortality = 9%) ($p > 0.05$). Patients received either abdominal (41%) or thoraco-abdominal (59%) CT imaging. Most patients (89%) also underwent cervical spine CT imaging. Occult pneumothoraces were evident on thoracic CT in 100% (44/44), abdominal CT in 83% (62/75) and cervical spine CT in 82% (55/67) of cases. All of the 13 (17%) patients with evidence of an OPTX solely on thoracic CT imaging (i.e., not abdominal CT) could also have been diagnosed using their cervical spine CT scan. Combining cervical and abdominal CT screening also diagnosed all (67/67) OPTXs. Hemothoraces (16%), subcutaneous emphysema (17%) and pulmonary contusions (53%) were also present. Tube thoracostomy was employed in 51% of patients at Foothills Medical Centre and 77% at GMH ($p < 0.05$).

Occult pneumothoraces will be evident solely on thoracic CT in up to 17% of severely injured patients. All of these OPTXs can be diagnosed by using the pulmonary window setting on a cervical spine CT imaging protocol. All OPTXs, regardless of location, can also be detected by combining cervical spine and abdominal CT screening. Thoracic CT imaging may not be necessary to rule out OPTXs.

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Needlescopic surgery: Are there any benefits to using smaller instruments? ***F. Haggar, E. Davenport, H. Moloo, J. Mamazza.*** **From The Ottawa Hospital, The Ottawa Hospital Research Institute, Ottawa, Ont.**

Laparoscopic needlescopic surgery has been touted as an alternative to conventional laparoscopic surgery as it uses smaller instruments and so might reduce postoperative pain and hospital stay while improving cosmesis.

We performed a meta-analysis of published randomized controlled trials (RCTs) and nonrandomized comparative studies (non-RCTs) to assess the efficacy of needlescopic surgery (NS) in comparison with conventional laparoscopic surgery (LS) in patients undergoing intra-abdominal surgeries. We searched the Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE and Science Citation Index until March 2010. Continuous variables were compared as weighted mean differences (WMD), and pooled odds ratios (OR) were calculated for categorical variables using random effects models.

We identified 14 RCTs and 6 non-RCTs with a total of 1367 participants. Of these, 10 RCTs and 2 non-RCTs reported on cholecystectomies, 2 RCTs and 2 non-RCTs reported on appendectomies, 1 RCT reported on Nissen fundoplications, and 3 separate non-RCTs reported on Heller myotomies, inguinal hernioplasties and sigmoid resections. Hospital stay, rates of overall complications and conversions for needlescopic cholecystectomy and appendectomy were not statistically different compared with LS, though this analysis is likely underpowered to detect any difference. Meta-analysis of postoperative pain and cosmesis was not possible for any of the studies because of an inadequate number of studies or heterogeneity in reported outcomes. However, results from individual studies seem to suggest that needlescopic cholecystectomy and appendectomy are associated with less postoperative pain and better cosmesis. The only drawback appears to be a longer operating time in NS groups (cholecystectomy: WMD 6.7 min, 95% CI 3.0–10.5 min, $p = 0.0005$; appendectomy: WMD 9.5 min, 95% CI 2.5–16.6 min, $p = 0.008$).

Needlescopic surgery appears to offer some benefits to patients requiring intra-abdominal surgery compared with LS, particularly regarding, cosmesis and postoperative pain. However, larger studies using standardized assessments tools are necessary to confirm or refute these findings.

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Milrinone preferred to levosimendan for mesenteric perfusion in hypoxia reoxygenated newborn piglets on Dopamine. ***N. Manouchehri, D. Bigam, T. Churchill, C. Joynt, P.-Y. Cheung.*** **From the Departments of Surgery, Pediatrics and Pharmacology, Faculty of Medicine and Dentistry, University of Alberta, Edmonton, Alta.**

We sought to determine the effect on systemic and regional perfu-

sion of adding milrinone or levosimendan to a background infusion of dopamine in hypoxia-reoxygenated (H-R) newborn piglets. We hypothesized that the addition of milrinone would improve regional circulation relative to the addition of levosimendan.

Twenty-eight piglets were instrumented for continuous monitoring of systemic (MAP) and pulmonary (PAP) arterial pressures, cardiac output (CI) and carotid (CAFI), superior mesenteric (SMAFI) and renal (RAFI) arterial flows. Intermittent blood analysis was performed for blood gases and biochemical tests. Piglets were randomized to 1 of 4 groups: sham, H-R control and H-R dopamine (10 μg/kg/min) with milrinone (D+M; D+M–50 μg/kg bolus then 0.5 μg/kg/min) or levosimendan (D+L; D+L–24 μg/kg bolus then 0.2 μg/kg/min). H-R piglets underwent 2 hours of hypoxia followed by 2 hours of reoxygenation before infusion of drugs. Tissue was ultimately collected for biochemical testing and histological analysis. Data were analyzed using ANOVA.

Following 2 hours of hypoxia, H-R piglets were in cardiogenic shock with depressed CI and MAP. With medication infusion, heart rate and CI improved in the D+M and D+L piglets ($p < 0.05$ v. control). Both regimens improved CAFI and carotid vascular resistance ($p < 0.05$ v. control). The D+M group additionally had improved SMAFI ($p < 0.05$ v. control). No disparate effect was appreciated on RAFI. Neither regimen prolonged the elevated lactate state, and D+M piglets' myocardium also had a lower oxidized/reduced glutathione ratio ($p = 0.051$ v. control).

In H-R newborn piglets, milrinone and levosimendan addition to dopamine similarly improved systemic hemodynamics. The addition of milrinone, in particular, improved mesenteric perfusion and attenuated myocardial oxidative stress.

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Comparison of mesh and primary repair of paraesophageal hernia. ***R. Al-Sairafi, C.B. Sample.*** **From the University of Alberta, Centre for the Advancement of Minimally Invasive Surgery (CAMIS), Edmonton, Alta.**

We conducted a retrospective study of 56 patients who had paraesophageal hernia (PEH) repair from 2004 to 2009 to determine the recurrence rate among the patients who had the repair with mesh or without mesh.

The results of 56 patients (mean age 59.38, SD 1.76) were evaluated. Seventy-five percent of patients were female. The majority of PEHs were type III (89.3%). In all, 98.3% of repairs were performed laparoscopically, with mean operative time of 141.89 (SD 6.36) minutes with no conversions. Mesh was used in 39.3% (89.3% Surgisis). Complications occurred in 16.8% (only 1 major) with a median length of stay of 2.0 (SD 3.06) days. The use of mesh showed a significant improvement in anatomic recurrence (3.03% v. 36.36% for primary repair, $p < 0.01$) with no increase in operative time with 145.84 (SD 7.03) minutes with mesh and 137.19 (SD 11.24) in primary repair ($p = 0.16$). Only 1 recurrence required reoperation (primary repair group).

We concluded that the use of mesh reinforcement in PEH repairs results in a significant improvement in anatomic recurrence rate without substantially increasing OR times.

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Formal research training during surgical residency: a scaffold for academic success. ***F. Paquette, S.A. Fraser, L.S. Feldman, G.M. Fried, I. Weissglas, G. Ghitulescu, S. Meterissian, S. Bergman.*** **From the Department of Surgery, Lady Davis Institute for Medical Research, Sir Mortimer B. Davis Jewish General Hospital, McGill University Health Centre, Montréal, Que.**

The purpose of this study was to determine the impact of formal research training during surgical residency on future academic productivity.

An online survey was sent to North American faculty who graduated from a single general surgery residency program between 1987 and 2005. Current and residency research activities were elicited. Number of publications was determined by searching MEDLINE, PubMed and Google Scholar. The primary outcome was yearly average of faculty publications, and the secondary outcomes were current research involvement and faculty funding. Linear regression analysis was used to determine predictors of the average number of faculty publications per year.

The response rate was 79 of 118 (67%). During residency, 5.1% were not involved in research, 15.2% for 6 months or less, 35.4% for 1 year and 32.9% and 11.4% in MSc and PhD programs, respectively (degree obtained by 77.1%). Residency parameters and faculty outcomes, stratified according to research activity during residency, are summarized in the Table. When adjusted for number of years in practice, average number of faculty publications per year was associated with residency publications ($p = 0.002$) and research commitment ($p = 0.03$).

At our institution, surgical residents who committed more time to research activities, especially in the context of a formal postgraduate degree program, and who published a greater number of papers, developed into the most productive surgical researchers.

Table, abstract 58. Impact of formal research training during surgical residency on future academic productivity

Research activity	≤ 6 mo research, no degree ($n = 15$)	12 mo research, no degree ($n = 25$)	MSc or PhD program ($n = 34$)
Residency			
Basic science, %	25.0	67.9	91.4
Publications, mean no. (SD)	1.6 (1.2)	2.8 (2.3)	5.6 (3.5)
External funding, %	6.3	46.4	57.1
Faculty			
Current research involvement, %	37.5	67.9	74.3
Publications/yr, mean no. (SD)	1.1 (1.1)	1.0 (1.2)	2.8 (2.3)
External funding, %	33.3	28.6	61.3

SD = standard deviation.

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Laparoscopic percutaneous transumbilical cholecystectomy. ***A. Al-Dohayan, M. Al-Naami, F. Bamehriz, A. Madkhali.*** **From the Department of Surgery, College of Medicine, King Saud University, Riyadh, Saudi Arabia**

We report the initial results of laparoscopic percutaneous transumbilical cholecystectomy (LPTLC) in 10 patients.

Eleven patients underwent LPTLC for systematic cholelithiasis. The technique was done using 2 periumbilical incisions, 5 mm and 8 mm each, and 2-mm incisions in the right hypochon-

drial for holding sutures placed in the fundus and neck of the gallbladder. The scope and instruments were introduced through umbilical incisions.

One patient converted to a traditional port technique, and the others were successfully managed by LPTLC. The patients were happy with their cosmetic appearance. No incisional hernias were reported in 4 months of follow-up.

Laparoscopic cutaneous transumbilical cholecystectomy is technically feasible with good cosmetic effect with minimal incisions.

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Early single parathormone dosage to assess postoperative hypocalcemia: Total thyroidectomy as same-day surgery? *J. Hallet, M. LeBlanc, A. Gilbert.* From the Centre hospitalier universitaire de Québec, Pavillon Hôtel-Dieu-de-Québec, Québec, Que.

The aim of this study was to determine the role of a single parathormone dosage (PTH-0) immediately after total thyroidectomy (TT) to assess the risk of postoperative hypocalcemia. We hypothesized that a PTH-0 lower than 20 pg/dL would accurately identify patients at higher risk of hypocalcemia after surgery.

We reviewed prospectively collected data from the charts of all total and complementary thyroidectomies practiced by a single surgeon from January 2006 to January 2010. A standardized data extraction form was used by reviewers not involved in the treatment process.

Of the 74 consecutive patients included, 18 patients (24%) developed postoperative hypocalcemia (either calcemia < 1.9 mmoL/L or hypocalcemic symptoms). There was a significant difference in mean PTH-0 level in hypocalcemic and normocalcemic patients (6.74 v. 29.34 pg/dL, $p < 0.0001$). All hypocalcemia cases had a PTH-0 less than 20 pg/dL and none was above (sensitivity 100%, negative likelihood ratio 0). An exploratory ROC curve showed an area under the curve of 0.95 (95% confidence interval 0.92–0.98) and confirmed the adequacy of the selected cut-off value. Admitting only patients with a PTH-0 under 20 pg/dL for monitoring would have saved a mean of 2.3 in-hospital days by patients (total 81 d).

A single PTH dosage inferior to 20 pg/dL immediately after surgery can be used to predict hypocalcemia following TT. Used in clinical practice, it would obviate the need to routinely monitor calcemia during 48 hours for all patients by admitting only those filling this criteria and discharging others. Our results open the door to performing total thyroidectomy as a same-day surgery.

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Monitoring patient conditions while performing laparoscopic procedure in simulated environment. *C. Daigle, G. Tien, M.S. Atkins, B. Zheng, H. Tanin, C. Swindells, A. Meneghetti, O.N.M. Panton, A.K. Qayumi.* From the Department of Surgery, University of British Columbia, Vancouver, The School of Computing Science, Simon Fraser University, Burnaby, and the University of Victoria and Locarna Systems, Inc., Victoria, BC

This study used eye-tracking techniques to monitor surgeons' vigilance regarding patient condition during a simulated laparoscopic procedure.

In a virtual reality trainer (SurgicalSim, METI Inc.), a partial cholecystectomy was performed by surgeons wearing a lightweight head-mounted eye tracker (Locarna Systems Inc.). The patient was preprogrammed to present a stable or a mildly unstable cardiac condition during the procedure. The vital signs of the patient were displayed on an anesthesia monitor placed beside the surgical monitor. Surgical performance (evaluated by task time, instrument trajectory and errors), mental workload (by NASA Task Load Index) and eye movement were recorded and compared between 6 experienced and 6 novice surgeons.

Experienced surgeons performed the task taking longer time than novices (204 v. 173 s, $p = 0.101$), and they reported a higher lever of frustration (51 v. 29, $p = 0.027$), perhaps because of the difficulty for experts to transfer skills developed in the OR to the virtual reality setting. Novices concentrated intently on the surgical task regardless of the patient's cardiac condition. Only 1 of the 6 novices scanned the vital signs on the anesthesia monitor (fixation time 0.8 s). In contrast, more experts (4/6) glanced frequently at the anesthesia monitor (fixation time 2.6 s), indicating their awareness of the change in the patient's stability.

These results show promise for using eye-tracking technology to measure surgeons' vigilance during an operation. Eye-tracking observations can lead to inferences of surgeons' cognition, which along with technical skills can be used to assess surgical expertise. The unsatisfactory performance of expert surgeons on the virtual reality simulator suggests that the fidelity of the virtual simulator needs to be improved to allow surgeons to transfer their skills. This in turn suggests using caution when having clinical experts as instructors teaching skills with virtual simulators.

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Correlation between histopathologic and fine-needle aspiration biopsy diagnosis in thyroid nodules: a multicentre study. *M. Chhiv, S. Drolet, É. Sirois-Giguère, A. Gilbert.* From the *Département de chirurgie générale, Centre hospitalier universitaire de Québec,* Québec, Que.

The purpose of the study was to verify the correlation between histopathologic and fine-needle aspiration biopsy (FNAB) diagnosis in thyroid nodules. A total of 342 thyroid resections were retrospectively reviewed from 3 academic centres. Procedures were performed between 2000 and 2006. Only adults, mostly women (79%), were included with a mean age of 51 (19–96) years old. Of the 342 cases reviewed, 69% (237) were benign and 31% (105) were malignant histopathologically. Cytologic diagnoses by FNAB were benign, malignant, follicular or inadequate in 5%, 23%, 38% and 35%, respectively. Twenty-nine carcinomas (22%) were found among patients with follicular FNAB. Considering that all malignant FNABs had thyroid resections, the calculated positive predictive value of FNAB is 66%. Of 16 patients who had thyroid resection with benign FNAB, 25% (4) of them ended up with a malignant histopathologic diagnosis.

In our experience, FNAB does not seem to demonstrate the expected accuracy described in the published literature. We are concerned about the high rate of patients with malignant pathologies that were described as benign by FNAB. We think that the high proportion of inadequate samples might explain, in part, those discordant results. A review of our sampling methods should be done. Surgeons must stay vigilant in front of FNAB results and interpret them based on clinical grounds.

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Management of complex intra-abdominal infections: a review of practice at 7 teaching hospitals. ***J.D. Doyle, U. Sheth, H. Huang, E. Pearsall, R.S. McLeod, A.B. Nathens.*** **From the Department of Surgery and the Interdepartmental Division of Critical Care, University of Toronto, Toronto, Ont.**

We reviewed the scope of complex intra-abdominal infections across the 7 University of Toronto teaching hospitals and the current strategies employed for their management, focusing on antimicrobial selection and adherence to published society guidelines.

A retrospective chart review was performed of patients with complex intra-abdominal infections. Data were extracted regarding demographics, surgical management and antimicrobial use. Antimicrobial use was classified as inadequate (not covering enteric gram negatives and/or anaerobes), conventional (covering enteric gram negatives and anaerobes) or broad (including antienterococcal, antifungal or extended gram negative coverage). We then focused on infections in the setting of perforated appendicitis and postoperative elective colon resections as paradigms of community-acquired and hospital-associated infections, respectively.

We identified 310 patients. The origin of infection was gastroduodenal in 17%, biliary in 6%, small bowel in 17%, colorectal in 34%, appendix in 18% and other in 9% of cases. Eighty-three (27%) occurred postoperatively. In all, 305 patients underwent a source control procedure: operation in 226 cases (74%) and percutaneous drainage in 79 (26%). Of 272 identified empiric antimicrobial regimens, 252 (93%) were judged to be adequate according to society guidelines.

A wide variety of empiric antimicrobial regimens were employed. Patients with hospital-associated infections more frequently received broad empiric antimicrobial coverage (v. community-acquired infections), but this only occurred in 36% of cases. Educational initiatives may improve adherence to antimicrobial usage guidelines.

Table, abstract 63.

Antimicrobial regimen	Site of infection; no. (%)	
	Appendix	Postoperative colon
No. patients	57	39
None identified	7 (12)	4 (10)
Inadequate regimen	2 (4)	0
Conventional coverage	42 (74)	21 (54)
Broad coverage	6 (11)	14 (36)

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Computed tomography features associated with operative management for nonstrangulating small bowel obstruction. ***R.R Suri, P. Vora, J.M. Kirby, K. Chan, S. Smith, L. Ruo.*** **From the Departments of Surgery and Diagnostic Imaging, McMaster University, Hamilton, Ont.**

The purpose of this study was to determine whether specific features on computed tomography (CT) in patients with nonstrangulating small bowel obstruction (SBO) are associated with the need for surgical intervention.

We performed a retrospective review of all patients with SBO admitted to a tertiary care centre between 2004 and 2006. Patients with intra-abdominal cancer, inflammatory bowel disease, abdominal or pelvic radiation, recent surgery and those with a clinical indication for immediate surgery or comorbidities precluding surgery were excluded. All patients had CT scans performed within 48 hours of admission. All scans were independently reviewed by 2 staff gastrointestinal radiologists blinded to clinical outcomes. Concordance between CT observers was calculated by the kappa test. The primary outcome evaluated was whether SBO required surgical intervention or resolved with nonoperative management. Variables were examined by univariate analysis using the χ^2 or Fisher exact test. Independent predictive features were derived from a multivariable stepwise logistic regression analysis.

A total of 229 patients were identified of whom 125 met inclusion criteria. Computed tomography scans were available for 63 patients. Of these, 27 patients (43%) underwent surgical intervention, and 36 patients (57%) were managed nonoperatively. There were 5 CT features frequently associated with surgery on univariate analysis; of these, transition point, complete bowel obstruction and small bowel dilation greater than 4 cm had good concordance between radiologists. Only transition point remained significant (OR 19, 95% CI 1.8–201, $p = 0.014$) on multivariable logistic regression analysis.

The presence of a transition point on CT scan in patients with nonstrangulating SBO was significantly associated with the need for surgical intervention.

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An acute care surgical service: the full Winnipeg experience. ***A. Faryniuk, D. Hochman.*** **From the Department of Surgery, University of Manitoba, Winnipeg, Man**

The purpose of this study was to assess the effect of the creation of an acute care surgical service (ACSS) on surgical patient flow.

Three 3-month time periods were compared: a baseline period before ACSS, a post–ACSS implementation period and an established ACSS period with assessment room. A retrospective chart review of patients who were admitted with acute appendicitis, acute cholecystitis and small bowel obstruction during these 3 periods was included in the study. Time intervals in the assessment and management of the surgical patients were then examined and compared between the 3 periods.

There was a greater than 200% increase in patient volume during both ACSS periods over the baseline period (67 before ACSS and 142–137 ACSS). Patient demographics were similar. There was no time difference when comparing time from triage to consult. Time from consult to consult answered was significantly faster in both ACSS groups, and we improved our service over time (1 h 43 min before ACSS, 62 min implementation ACSS, 49 min established ACSS). Time to admission and operation showed no difference in light of increased patient load. Total time of admission overall showed no difference except with acute appendicitis, where the established ACSS was significantly faster than before ACSS (2 d 15 h before ACSS, 1 d 19 h established ACSS). The vast majority of operations occurred between the hours of 4 pm and midnight.

With the implementation of an acute surgical service, the number of surgical patients assessed and treated doubled. Despite this increase, in patient volume consults were answered significantly

faster, the assessment improved and time to OR was statistically unchanged. This highlights the ability of the ACSS to accommodate a large influx of patients effectively. In addition, with the bulk of operations occurring between 4 pm and midnight, perhaps an unrestricted access to the operating room would further improve patient flow.

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Should the gallbladder be prophylactically removed in astronauts to prevent acute pancreatitis during extended duration spaceflight? ***C.G. Ball, A.W. Kirkpatrick, T.J. Broderick, D.R. Williams.*** **From the Department of Surgery, University of Calgary, Calgary, Alta., the Department of Surgery, University of Cincinnati, Cincinnati, Ohio, and the Department of Surgery, McMaster University, Hamilton, Ont.**

Because treating acute pancreatitis during space exploration includes (1) restricted on-board imaging and laboratory capabilities, (2) limited medical equipment owing to payload weight constraints, (3) nonsurgeon crew medical officers and (4) the potential inability to offer basic critical care or perioperative anesthesia, the primary study objectives were to: identify the probable incidence of acute pancreatitis and its associated impact on mission and crewmember health and to develop a primary prevention consensus statement for astronauts tasked to extended duration spaceflight.

A systematic PRISMA review of the literature outlining the risk of acute pancreatitis, physiologic impact of spaceflight and cholecystectomy was completed.

Most etiologies of acute pancreatitis can be identified through the health screening process for astronaut selection and flight-ready maintenance. Whereas current protocols do not mandate cholecystectomy without symptomatic cholelithiasis, the effect of spaceflight-related alterations in physiology (hypovolemia, immunosuppression) on gallstone behaviour (cholesterol/lipid biochemistry, gallbladder contractility/absorption) is unknown. With missions of increasing distance, in-flight diagnosis/treatment becomes more problematic. Time to definitive medical care will also be much longer (Mars, 2- to 4-yr voyage; evacuation time, 9–12 mo; communication transmissions, 50 min). Given the poor sensitivity of screening ultrasonography for detecting biliary sludge (< 55%) coupled with both the potential for microlithiasis to cause acute pancreatitis (60% of 4.8–24.2 cases/100 000 people/yr) and spaceflight-associated gastrointestinal dysmotility, primary prevention via cholecystectomy should be contemplated. Considering the relatively low risk of bile duct injury (0.4%) and significant hemorrhage (0.1%) during laparoscopic cholecystectomy, contrasted with the higher risks (1%–4% bleeding/pancreatitis) associated with endoscopic retrograde cholangiopancreatography (bile aspiration to detect microlithiasis), prophylactic removal of astronaut gallbladders is recommended.

The impact of altered human physiology, anatomy and immunology during spaceflight on the natural history of acute pancreatitis is unknown. Because of the immense potential risk for loss of mission and human life, prophylactic cholecystectomy should be considered to prevent microlithiasis-induced pancreatitis.

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Evaluation of a regional acute care surgical service by residents in general surgery. ***R. Kholdebarin, R. Helewa, J. Bracken, B. Zabolotny, D. Hochman.*** **From the Department of Surgery, University of Manitoba, Winnipeg, Man.**

The establishment of the acute care surgical service (ACSS) within the Winnipeg Regional Health Authority (WRHA) has dramatically changed the management of acute, nontrauma surgical patients within Manitoba. This has resulted in a dramatic increase in the volume of patients encountered by general surgery residents at the University of Manitoba. This study will evaluate the effects of the ACSS on the general surgery residency program.

A questionnaire will be distributed among all 22 general surgery residents at the University of Manitoba. The first part of the survey will focus on demographic data, which may contribute to career satisfaction. The second part consists of the Maslach Burnout Inventory, a validated questionnaire for measuring the level of burnout among professionals in human services. The last part of the survey will evaluate the residents' experience on the ACSS according to the CanMEDS roles, a multifaceted framework produced by The Royal College of Physicians and Surgeons of Canada to guide physician training.

It is hypothesized that general surgery residents at the University of Manitoba will have a lower burnout score than that obtained from previous studies. Furthermore, we hypothesize that the ACSS provides a rich training experience for general surgery residents.

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Pregnancy among residents enrolled in general surgery (PREGS): a survey of residents in a single Canadian training program. ***S. Merchant, M. Hameed, A. Melck.*** **From the Department of General Surgery, University of British Columbia, Vancouver, BC**

We explored attitudes and experiences of general surgery residents at the University of British Columbia (UBC) regarding issues related to pregnancy during residency.

All residents (n = 81) enrolled in the UBC General Surgery Residency Program from 1997 to 2009 were surveyed using an anonymous web-based survey tool.

Our response rate was 65% (53/81). There were fewer pregnancies among female residents compared with partners of male residents (9/25 v. 22/28, p = 0.002). Both female residents and partners of male residents experienced pregnancy-related complications (2/9 v. 3/22, p = not significant). All (6/6) female residents who reported a pregnancy breastfed for 6 months or more; however, 67% (4/6) felt their role as a surgical resident prevented them from breastfeeding as long as they would have liked. The majority (5/6, 83%) pursued a graduate degree and/or research during maternity leave. Over 50% (23/45) of respondents reported an increased workload because of a colleague's pregnancy. Many (36/53, 68%) were unaware of the presence or absence of a maternity/parenting policy specific to the general surgery program, and most were in favour of instituting such a policy.

General surgery resident mothers do not breastfeed for the duration they desire; factors precluding this must be explored. Contingency plans should be in place when pregnant residents cannot perform their clinical duties so their colleagues are not overburdened. General surgery programs should have a formal policy that addresses these unique issues.

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Survival outcomes for node-negative esophageal cancer managed with chemoradiotherapy plus esophagectomy at the Cancer Centre of Southeastern Ontario, 1995–2005. ***A.L. McGuire, C. Wilson, D. Mercer.*** **From the Division of General Surgery, Department of Surgery, and Department of Radiation Oncology, Kingston General Hospital, Queen's University, Kingston, Ont.**

A retrospective subgroup analysis of people with node-negative esophageal cancer was preformed. Patients managed with chemoradiotherapy (CRT) alone were compared with those managed with neoadjuvant CRT plus esophagectomy to determine if esophagectomy adds survival advantage.

The outcomes of all patients undergoing treatment for node-negative esophageal cancer at the Cancer Centre of Southeastern Ontario from 1995 to 2005 were analyzed (n = 62). Neoadjuvant CRT was the standard of care. Neoadjuvant CRT plus esophagectomy was performed in medically fit patients with resectable primary esophageal cancer and no evidence of tumour spread beyond the primary site. Statistical analyses involved the χ^2 test and Kaplan–Meier estimates of survival.

A total of 51 patients were managed with CRT alone and 11 underwent neoadjuvant CRT plus esophagectomy. The mean follow-up from completion of therapy was 17 months. The recurrence rate was 66% for CRT alone and 87% for CRT plus esophagectomy. The overall survival was 25% for CRT alone and 27% for CRT plus esophagectomy. There was no significant difference found between those managed with CRT alone compared with those managed with adjuvant CRT plus esophagectomy for rate of tumour recurrence and overall mortality.

Although no significant difference in rates of disease recurrence and mortality were found comparing node-negative esophageal cancer patients managed with CRT alone to those managed with CRT plus esophagectomy, this study is significantly underpowered. Further investigation is necessary to determine if esophagectomy adds survival benefit in the management of the node-negative subgroup with esophageal cancer who undergo CRT.

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Nontechnical skills assessment in the postoperative setting. ***B. Sharma, N. Orzech, T. Grantcharov.*** **From the Department of Surgery, University of Toronto, Toronto, Ont.**

Adverse event analyses in surgery continue to highlight the importance of nontechnical skills training. Communication failures, poor decision-making or a lack of leadership can disrupt team dynamics and may result in negative patient outcomes. Despite this, most surgical training curricula emphasize technical skill and knowledge acquisition without formal nontechnical skills training. At present, 3 major nontechnical skills assessment tools, the Non-Technical Skills for Surgeons (NOTSS), the revised Non-Technical Skills (NOTECHS) Scale and the Ottawa Global Rating Scale (GRS), have been developed/modified for use in surgery. The present study evaluated the role of these tools in a postoperative crisis environment.

Using full-body simulator in a virtual operating room, surgical residents were exposed to standardized postoperative complications including hemorrhagic shock, septic shock and pulmonary embolism. All trainees were randomized to 1 of the scenarios, and their performance was assessed using a scenario-specific checklist. Nontechnical skills were assessed using the NOTSS, NOTECHS and Ottawa GRS by 2 independent experts.

The results demonstrated a significant (Spearman correlation 0.68, $p < 0.01$) correlation between the scenario-specific checklist and nontechnical skills global rating scales. Furthermore, there was good correlation between the various nontechnical skills assessment tools (Spearman correlation 0.95, $p < 0.001$).

Our results demonstrate that the existing nontechnical skills rating systems can be used reliably for assessment of performance during management of standardized postoperative complication scenarios. These tools should be incorporated in future training curricula for surgical residents.

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Impact of long-distance endurance training on academic and clinical productivity in a university department of surgery. ***A. Johner, D.C. Taylor, A.K. Buczkowski, S.W. Chung.*** **Department of Surgery, Vancouver General Hospital and the University of British Columbia, Vancouver, BC**

Our objective was to determine whether it is feasible for surgeons to undertake high-volume endurance training while maintaining the academic and clinical productivity required of a university teaching centre. An 18-month (January 2008 to July 2009) retrospective analysis of 14 Vancouver General Hospital general/vascular surgeonss' clinical and academic output was reviewed. The cadre was separated into 2 groups by longest distance of endurance event undertaken, with 10 km as the deciding distance. Clinical output was assessed by operations performed, hours of operation undertaken and on-call duties. Data were obtained from the hospital database and on-call scheduler. Academic output was assessed by teaching hours, research grants and publications, which were obtained from the Department of Surgery and UBC Faculty of Medicine databases as well as electronic indexes. Training logs and race entries of the "endurance" surgeons were analyzed to confirm activity level. The minimum average weekly hours of endurance training was 5.74 hours and the maximum was 13.71 hours, with each of the surgeons competing in at least 1 triathlon distance event. The "endurance" surgeons had a statistically higher number of call shifts ($p < 0.05$) than the comparison group. Although the comparator group performed significantly more scheduled operations ($p < 0.05$), the "endurance" group undertook more unscheduled operations and had comparable overall hours of operation. There was no significant difference between the groups in the number of teaching hours, publications or research grants. It is feasible to maintain the academic and clinical standards of a university teaching hospital while undertaking long-distance endurance training. Careful integration into residency training may ensure the health of future surgeons without impeding academic or clinical productivity.

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A hands-free pointer for surgical instruction in minimally invasive surgery. ***K.J. Lumb, A.L. Trejos, C.D.W. Ward, M.D. Naish, R.V. Patel, C.M. Schlachta.*** **Canadian Surgical Technologies and Advanced Robotics (CSTAR), Lawson Health Research Institute, and the Departments of**

Surgery, Electrical and Computer Engineering, Mechanical and Materials Engineering, University of Western Ontario, London, Ont.

The objective of the current study was to assess the performance of a second-generation, novel, hands-free pointing device for instruction during laparoscopic surgery compared with a previously tested device and with verbal instruction.

Using a previously validated test bed, 8 surgical residents were asked to use a fine-tip laparoscopic instrument to locate 30 standard points on an image of a partially dissected cholecystectomy. Points were randomly divided into 3 equal groups for which the instructor provided direction verbally (group 1), with the first-generation pointer (group 2) and with a second-generation pointer (group 3) that has been engineered to improve ergonomics and control over the original device. Time taken to locate each point was recorded. The cumulative time required to locate a set of 10 points was analyzed using ANOVA and is presented as mean ± standard deviation.

Pair-wise comparison of participants' performance revealed that the tasks were completed significantly faster with pointer assistance (41.8 ± 3.4 s and 43.3 ± 5.1 s, for groups 2 and 3, respectively) as compared with verbal direction alone (101.4 ± 20.1 s, $p < 0.001$). There was no difference in performance between the 2 pointer systems. Survey data collected at the time of the experiment indicated that trainees believe this technology would be helpful in assisting them to learn laparoscopic techniques in the clinical setting.

This study shows that a hands-free pointer significantly reduced the time needed for completion of localization tasks in a simulated laparoscopic model. Ergonomic and control enhancements to the second-generation device did not impair performance. Subsequent studies will measure the advantage of these enhancements from the instructor's perspective.

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The use of prosthetic mesh in paraesophageal hernia repair among Canadian experts: results of a follow-up survey. ***E. Davenport, F. Haggar, H. Moloo, R.P. Boushey, E.C. Poulin, J. Mamazza.*** **From The Ottawa Hospital, University of Ottawa, Ottawa, Ont.**

We undertook a national survey of surgeons who perform paraesophageal hernia (PEH) repair to determine practice patterns, estimates of recurrence and attitudes toward the use of mesh. A 3-year follow-up was conducted to determine if practice patterns have changed.

The survey was designed with input from surgeons and epidemiologists. The survey was voluntary and administered as a web-based survey.

In the initial survey, of 23 identified surgeons, 21 responded. Fourteen of these 21 responded to the follow-up survey. Respondents to the follow-up survey all performed PEH repairs by laparoscopy (for 2, this was a change in practice). Forty-three percent of respondents to the follow-up survey stated that the number of PEH repairs they were performing had increased. Variability in preferred method of crural repair was again noted in the follow-up. In both surveys, the most common was with pledgets (for 47.6% in the first survey and 35.7% in the second). The techniques for repair had changed for 4 of the 14 respondents to the second survey. The first added biomesh to repair with pledgets. The second abandoned synthetic mesh in favour of pledgets. The third abandoned use of pledgets in favour of primary repair only. The fourth abandoned synthetic mesh in favour of biomesh. One of the 14 respondents abandoned a routine postoperative upper gastrointestinal series (while none had newly adopted it). In the second survey, 43% of respondents had changed their view regarding the necessity of a large trial evaluating the use of biological mesh in PEH repair. Three no longer stated such a trial was necessary, whereas 3 now thought it was.

There remains considerable practice variation among expert surgeons performing PEH surgery. In our follow-up survey, all respondent surgeons have adopted laparoscopy, none are using synthetic mesh, and adoption of biological mesh has increased. There is still equipoise regarding the need for a large trial evaluating the use of biologic mesh in PEH repair.

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A prospective, survey-based, controlled study to examine whether surgeons are satisfying patients' expectations at first consultation for gallbladder and hernia complaints. ***K.M. Graybiel, V. T. Fernandes, J. Hoogenes, D. Dath.*** **From the Department of Surgery, McMaster University, St. Joseph's Healthcare, Hamilton, Ont.**

Since routine general surgical consultations comprise the bulk of elective cases, this study sought to determine whether patients presenting for gallbladder and hernia complaints have their expectations and needs satisfied by their surgeons during the initial consultation.

We recruited 66 patients presenting with gallbladder or hernia complaints at 2 tertiary care hospitals in Hamilton, Ontario. A validated patient expectation questionnaire from the literature was modified to include surgical items in 5 domains: knowledge, decision-making, emotional disposition, reassurance and plan. Thirty patients (noncontrol) completed a preconsultation questionnaire, whereas 36 control patients completed a sham questionnaire. All patients participated in a postconsultation phone interview based on the preconsultation questionnaire to assess whether patients' preconsultation expectations had been met. Responses were compared between the noncontrol and control groups to detect any bias from administering the preconsultation questionnaire.

No differences were detected in the responses of the 2 groups. Thirteen questions on the postconsultation interview, representing all domains, directly assessed whether patients were satisfied with the consultation. More than 90% of the patients were satisfied on 10 of the 13 indices ($p < 0.05$). Surgeons made patients comfortable, listened to their concerns, reassured them, gained their trust and discussed their operative plans so that they could make informed decisions. Although 63% of patients knew nothing about their diseases on arrival, surgeons provided enough information so that 89% felt they understood their diseases postconsultation.

Over all 5 domains, surgeons satisfy patients' expectations on presentation for common, frequent operative consultations.

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Application of global operative assessment of laparoscopic skills in a trainer box setting. ***W. Mohammad, D. Trottier, K. Nadolny, E.C. Poulin, J. Mamazza, F. Balaa.***

From the Department of Surgery, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.

Although the Global Operative Assessment of Laparoscopic Skills (GOALS) instrument has been validated as an intraoperative evaluation tool, it has not been validated in a simulated environment. We wanted to determine the face validity, interrater reliability and construct validity of the GOALS instrument in a simulated ex-vivo laparoscopic cholecystectomy model.

A platform was designed for performing laparoscopic cholecystectomy on an ex-vivo porcine en-bloc liver/gallbladder model through a collaborative effort between the Departments of Surgery and Biomedical Engineering. Participants were divided into a junior (PGY 1/2) and senior group (PGY 4/5). Each trainee performed a video-recorded dissection of the gallbladder. Two blinded evaluators were asked to view and assess performances using the GOALS. Construct validity was assessed by comparing the mean scores for the 2 groups using an unpaired *t* test and a Mann–Whitney *U* test was used for sensitivity analysis. Internal consistency for each of the domain scores was assessed using the Cronbach α. Trainees completed a postprocedure survey.

Twenty participants were divided into a junior (n = 10) and senior group (n = 10). Comparison of GOALS scores demonstrated a significant difference (mean 5.0, 95% CI 1.7–8.2, p = 0.005). The *t* test results were significant for each of the domains except for "tissue handling." Seventy-five percent of trainees strongly agreed "that practice on this model would be relevant to their training as a general surgeon," and 80% strongly agreed that "repeated practice on this model would be a productive use of time for a junior general surgery resident." Interrater reliability between the evaluators was good (0.73).

The GOALS instrument can be applied to this model with reasonable construct validity and inter-rater reliability. The ex-vivo laparoscopic cholecystectomy model as a teaching tool was very well received by the surgical trainees.

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Surgeons' involvement in preclinical medical education.

B. Diederichs, S. Turner, C. de Gara. **From the Division of General Surgery, Department of Surgery, University of Alberta, Edmonton, Alta.**

Early exposure to surgical teachers has been demonstrated to influence medical students toward choosing surgical careers. Our aim was to develop an understanding of surgeon participation in preclinical medical education by gauging the volume and type of involvement in the preclinical years at Canadian medical schools and to identify barriers to surgeon involvement in preclinical education.

A questionnaire was administered to the deans of undergraduate medical education at all English-speaking Canadian medical schools. The survey was administered through surverymonkey .com and included a 5-point Likert scale and multiple choice questions. Question domains included general participation, participation in lectures, participation in small group learning, participation in counselling roles, participation in administrative roles, instruction of surgery-specific topics and identification of barriers to surgeon involvement in preclinical education.

The response rate was 71%. The majority of respondents (85.7%–87.5%) estimated the proportion of preclinical lectures taught by surgeons, small group sessions led by surgeons, counselling roles filled by surgeons and preclinical administrative roles held by surgeons to be 0%–25%. Seventy-five percent of respondents felt surgeon involvement in preclinical education should be increased, and 71% believed there was an advantage to having surgeons teach students about surgical illnesses. However, 71% indicated that the involvement of surgeons in teaching surgically relevant topics was not comparable to nonsurgeons. The most important barriers to involvement were lack of surgeons' time and lack of funding for surgeons to teach; the least important were lack of available teaching spots and lack of administrator interest in surgeon teaching.

Administrators identified a low rate of surgeon participation in Canadian preclinical medical education in general and across the domains specified, despite supporting the importance of surgical involvement. Preclinical education is an area for potential intervention to influence the career choice of medical students and increase applications to surgical residency programs.

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Retrospective review of a single institution's experience with laparoscopic versus open appendectomy: How do we compare?

G.A. Ghitulescu, I. Filip, S. Bergman, S. Fraser. **From the Department of Surgery, Jewish General Hospital, McGill University, Montréal, Que.**

The goal of this study was to review our experience with appendectomy from the time we began using the laparoscopic technique on a regular basis, and to compare the results of this method with the open technique. The charts of all patients who underwent appendectomy at our institution from 2002 were retrospectively reviewed by a single observer. The results were analyzed using the appropriate method. Intent-to-treat analysis was used for conversions.

There were 981 patients identified. Open appendectomy was performed in 747 patients (76.1%). The method was chosen by the surgeon, based on experience and patient characteristics. The characteristics of patients undergoing laparoscopic versus open appendectomy were comparable with respect to age and sex. The rate of conversion was 8.5%. Operative time was longer in the laparoscopic cases (51 min v. 44 min, $p < 0.05$). Postoperative length of stay in nonperforated cases was 32 hours in laparoscopic and 44 hours in open appendectomy ($p < 0.0001$). In perforated cases, the postoperative length of stay was longer in laparoscopic cases (45.5 h v. 28.5 h, $p < 0.05$). The rate of intra-abdominal abscess was also higher in laparoscopic cases (21% v. 9%), but the rate of wound infections was lower (5% v. 16%).

The results at our institution are comparable to the literature, and show that laparoscopic appendectomy is safe and carries advantages in certain circumstances.

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Image-guided video-assisted thoracoscopic (VATS) resection for diagnosis of small peripheral pulmonary nodules (SPN). ***R.J. Finley, J. Mayo, J. Clifton, J. Yee, K. Evans, A. MacWilliams, S. Lam, J. English.*** **From the University of British Columbia, Vancouver General Hospital, Vancouver, BC**

Since nodules more than 5 mm deep to the visceral pleura require conversion to open thoracotomy due to poor localization in 2-thirds of video-assisted thoracoscopies (VATS), we evaluated the use of platinum microcoils with CT guidance to guide subsequent fluoroscopically guided VATS resection of undiagnosed small peripheral nodules (SPN).

From April 2003 to September 2009, 98 undiagnosed SPN (≤ 15 mm) in 92 consecutive patients were preoperatively localized using percutaneously placed, CT-guided platinum microcoils. Coils were placed with distal end deep to the nodule and the superficial end coiled on the pleural surface. The nodule and microcoil were removed using endostaplers with fluoroscopically guided VATS wedge excision. Intraoperative frozen section histopathologic diagnosis was performed.

On average, nodules were 10 ± 3 mm in diameter and 29 ± 12 mm deep to the visceral pleural surface. Using CT guidance, the microcoil was placed within 5 mm of the nodule in 96 of 98 patients, with 2 of 98 requiring a chest tube for pneumothoraces. Complete resection was successful in all patients (96/98 by VATS and 2/98 by thoracotomy). Mean microcoil insertion, fluoroscopy and wedge resection operative minutes were 31 ± 10, 1.4 ± 1.2 and 32 ± 22, respectively. Backward stepwise linear regression of fluoroscopy time showed sex and coil depth significant ($p < 0.05$). Operating time was dependent on weight and nodule diameter ($p < 0.05$). Postoperatively, 5% (5/98) had prolonged air leaks for more than 5 days; there were no operative deaths. Frozen section and final pathologic diagnoses included 24 benign, 14 metastatic and 60 primary cancers. Thirty-one patients underwent completion lobectomy. There was no local tumour recurrence in wedge resection patients. In the 48% (47/98) of patients with preoperative bronchoscopy, needle biopsy and PET investigations, the preoperative treatment plan was changed by microcoil-guided VATS excision biopsy in 40% (19/47).

Preoperative localization of small peripheral pulmonary nodules (< 15 mm) using percutaneous CT-guided platinum microcoils followed by fluoroscopy-guided VATS excision provided pathologic diagnosis in 98% of cases.

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The effect of regionalization on outcome in esophagectomy: a Canadian national study. ***C. Finley, L. Jacks, G. Darling.*** **From the Toronto General Hospital, University of Toronto, Toronto, Ont.**

Our aim was to examine the changing relation between hospital volume and in-hospital mortality (IHM) and length of stay (LOS) after esophagectomy.

Esophagectomy patients in the Canadian Institute for Health Information Discharge Abstract Database from 1998 to 2007 were included. The impact of hospital volume on each outcome (LOS and IHM) was estimated using multivariable regression (linear and logistic, respectively), controlling for patient age, sex, Charlson comorbidity index and year of esophagectomy.

The study included 6985 patients, 5159 male (74%), with a median age of 66 years and a blood transfusion rate of 38%. From 1998 to 2007, the number of hospitals performing esophagectomy decreased from 101 to 85, the percentage of patients treated in large-volume centres (> 20 cases/yr) increased from 29% to 61% and IHM decreased from around 9% to less than 3.8%. Hospital volume was inversely associated with risk of IHM ($p = 0.02$). Specifically, for every 20 additional cases performed per year, the odds of in-hospital mortality decreased by 28% (95% CI 5%–45%). Hospital volume was positively associated with length of stay ($p = 0.03$). For every 20 additional cases performed per year, the expected length of stay increased by 7.7% (95%CI 0.6%–15%). As well, in both multivariate models, Charlson index and year were also significant for predicting IHM and LOS, whereas age was only significant for predicting IHM.

In-hospital mortality has decreased in Canada, with high-volume centres having improved overall outcomes. An increase in LOS did occur in hospitals where volume increased. The improved mortality over time is most associated with increasing numbers of patients being treated in high-volume centres, but there also exists a decrease in time beyond this effect.

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The management of dysphagia in inoperable esophageal cancer. ***W.C. Hanna, M. Sudarshan, D. Roberge, M. David, K.A. Waschke, S. Mayrand, L.E. Ferri.*** **From the Montréal General Hospital, McGill University Health Centre, Montréal, Que.**

The palliation of dysphagia in metastatic esophageal cancer remains a challenge, and the optimal approach for this difficult clinical scenario is not clear. We thus sought to define and determine the efficacy of various treatment options employed at our institution for this condition.

A prospective database for all patients managed in an esophageal cancer referral centre was reviewed over a 5-year period. All patients receiving palliation of malignant dysphagia

were reviewed for demographics, palliative treatment modalities, complications and dysphagia scores (0 = none, 4 = complete). The Wilcoxon signed ranks test determined significance (*$p < 0.05$).

From 2004 to 2009, 63 patients with inoperable esophageal cancer were treated for palliation of dysphagia. The primary treatment was radiotherapy in 79% (brachytherapy 18/50, external beam 10/50, both 22/50) and stent in 21% (13/50). The mean waiting time from diagnosis to treatment was 22 days in the stent group and 54 days in the radiotherapy group ($p = 0.003$). Mean duration of treatment was 1 day in the stent group and 48 days in the radiotherapy group ($p = 0.001$). In patients treated initially with stent, dysphagia improved within 2 weeks of treatment in 85% of patients (dysphagia score of 0 or 1). However, 20% of patients presented with recurrence of dysphagia at 10 weeks of treatment. In the radiotherapy group, the onset of palliation was slower, with only 50% of patients palliated at 2 weeks (dysphagia score of 0 or 1). However, the long-term palliation was more satisfactory, with 90% of patients remaining palliated after 10 weeks of treatment.

In inoperable esophageal cancer, we have shown that although radiation treatment provides durable long-term relief, it comes at a high price of long waiting times for initiation of treatment and long lag times between initiation of treatment and relief of symptoms. On the other hand, endoluminal stenting provides more rapid and effective early relief of symptoms but is plagued by recurrence of dysphagia in the long term. It is now time for a prospective randomized trial to assess the safety and efficacy of combined-modality treatment with endoluminal stenting and radiation therapy, as compared with either treatment alone.

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Water seal gets chest tubes out sooner: a systematic review and meta-analysis. ***S. Coughlin, H. Emmerton-Coughlin, R. Malthaner.*** **From the Department of Surgery, University of Western Ontario, London, Ont.**

A systematic review and meta-analysis was performed to determine the effect of suction with water seal applied to intrapleural chest tubes compared with water seal alone on the duration of air leaks in patients undergoing pulmonary surgery.

A search was performed using MEDLINE, EMBASE, the Cochrane Central Register of Controlled Trials, as well as reference lists of textbooks and relevant articles to find randomized controlled trials (RCTs) comparing chest tubes placed to suction versus water seal on the duration of air leaks. Trials were systematically assessed for eligibility and validity. Data were extracted in duplicate and pooled across studies using both a fixed effects and a random effects model to account for potential clinical and statistical heterogeneity.

The initial search yielded 1061 citations, of which 7 RCTs met the eligibility criteria. The study quality was generally good. Using the random effects model, there was a trend toward decreased duration of air leak in patients managed with water seal compared with suction (weighted mean difference [WMD] 1.15 d, 95% CI –0.64 to 2.94); however, these results were not statistically significant. There was an absolute risk reduction (ARR) in the incidence of prolonged air leak of 0.04 (95% CI –0.01 to 0.09) favouring management with water seal. The time to removal of chest tubes in the water seal group was significantly improved (WMD 1.27 d, 95% CI 0.33–2.22); however, this did not result in a difference in time to discharge (WMD 2.19 d, 95% CI –0.63 to 5.01). Water seal was associated with a significantly increased incidence of postoperative pneumothorax with chest tubes in place (ARR –0.14, 95% CI –0.21 to –0.07). Data analysis using the fixed effects model caused the time to discharge and duration of air leak to become statistically significant in favour of water seal. Removal of one outlier study from analysis did not change any results.

Despite a general trend toward improvement in duration of air leaks, risk of prolonged air leak and time to discharge, placement of chest tube to water seal compared with suction in patients undergoing lung surgery does not result in a significant differences in any of these measures. Water seal is superior to suction, however, in reducing the amount of time patients require chest tubes. Surgeons should balance these potential benefits of water seal with the increased risk of pneumothorax when managing postoperative air leaks.

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Minimally invasive esophagectomy: the Canadian experience from a community hospital. ***H.S. Grover, S. Basi, P. Chiasson, S. Basi, K. Irshad.*** **From the Division of Thoracic Surgery, Department of Surgery, William Osler Health Centre, Brampton, and McMaster University, Hamilton, Ont.**

Within the past 10 years, several reports have been published outlining the feasibility of minimally invasive esophagectomy (MIE). However, all of these studies have been conducted at tertiary care hospitals, and none of them has involved Canadian centres. The purpose of this study is to review our outcomes with MIE, all of which were performed at a Canadian non–tertiary care centre.

We conducted a single-centre retrospective chart review of all patients who underwent an MIE for the treatment of malignant disease between September 2006 and December 2009. All of the procedures were carried out by 1 of 3 thoracic surgeons at a community hospital.

Thirty-two MIEs were performed in 28 men (87.5%) and 4 women (12.5%), with a mean age of 65.6 (range 38–82) years. Operative indications included cancer ($n = 31$) and high-grade dysplasia ($n = 1$). Median intensive care unit and hospital stays were 3 and 8 days, respectively. Surgical approaches included MIE with cervical anastomosis ($n = 4$) and Ivor Lewis esophagectomy ($n = 28$). Four patients (12.5%) required nonemergent conversion to an open procedure owing to pleural/abdominal adhesions resulting in poor exposure or adherent tumour/lymph nodes. The mean operative time was 332.5 minutes, with a significant decline noted after 20 cases (360 min v. 287 min, $p = 0.001$). The mean number of lymph nodes retrieved was 15.2. There was 1 in-hospital mortality and 1 30-day mortality. The anastomotic leak rate was 9.4% ($n = 3$). Other major complications including myocardial infarction ($n = 2$), pneumonia ($n = 6$) and bleeding ($n = 1$) occurred in 7 patients (21.9%).

Minimally invasive esophagectomy is a feasible procedure with a low conversion rate and an acceptable morbidity and mortality. Our outcomes with MIE performed at a Canadian non–tertiary care centre are comparable to those stated in the published literature.

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Tissue-type plasminogen activator reduces the need for surgical decortication in complex pleural effusions.

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A retrospective review was performed to determine the rate of operative intervention and mortality among patients who received intrapleural recombinant tissue-type plasminogen activator (tPa) for treatment of complex pleural effusion (CPE) and to identify factors that may be related to failure of tPa therapy.

All adult patients with CPE who were treated with tPa from 2007 to 2009 at LHSC were identified using the prospectively collected pharmacy database. Demographic, diagnostic, treatment and outcome data were extracted from patient medical records. Rate of failure of tPa treatment was defined as the need for operative intervention or mortality following at least 1 instillation of intrapleural tPa. The Student *t* test and Fisher exact test were used to compare patients successfully managed with tPa to those who failed.

Fifty patients were treated with tPa for CPE over the study period. Of these, 9 went on to have either video-assisted thoracoscopic (VATS, $n = 3$) or open thoracotomy decortication ($n = 6$), and 3 patients died. The overall success rate of medical management with tPa was 76% after a mean of 3 doses of tPA. Success of tPa treatment was significantly higher in patients who had been treated with antibiotics before admission for management of CPE (85% v. 56%, $p = 0.03$). Univariate analysis failed to demonstrate a difference between those who did and did not fail tPA therapy with respect to age ($p = 0.80$), duration of symptoms before presentation ($p = 0.56$), the presence of loculations identified on imaging studies ($p = 0.41$) and the mean number of doses of tPA given ($p = 0.33$). Blood transfusions were required in 4 patients (8%) in the perioperative period.

Intrapleural recombinant tissue-type plasminogen activator appears to reduce the need for surgical decortication in most patients with complex pleural effusions. There do not appear to be any predictors of success.

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The role of neutrophils in lung cancer metastasis: Friend or foe? ***J.D. Spicer, B. McDonald, R. Perera, M.C. Rousseau, C.H.F. Chan, R.Y.C. Hsu, B. Giannias, L.E. Ferri.*** **From the L.D. Maclean Surgical Research Laboratories, Department of Surgery, McGill University Health Centre, Montréal, Que.**

Perioperative inflammation as measured by elevated neutrophil (PMN) counts is associated with a high rate of metastasis and poor outcomes in non–small cell lung cancer patients.

Intravital video microscopy and in vitro adhesion assays tested for interactions between murine lung carcinoma H-59 cells, PMNs and endothelial cells. Intrasplenic injection of H-59 cells was used as a model of liver metastasis. In some experiments, mice were depleted of PMNs, and in others PMNs were reinfused into depleted animals. Bacterial lipopolysaccharide (LPS) was used as a model of acute inflammation in mice and was used to activate PMNs in vitro. ($^*p < 0.05$).

Intravital video microscopy revealed that H-59 cells adhere directly over arrested PMNs in liver sinusoids at a high rate. In vitro adhesion assays showed that coincubation of H-59 cells with control and LPS-treated PMNs before coculture with endothelial cells resulted in a 2.8- and 3.5-fold increase in H-59/endothelial cell adhesion.* Preinfusion of LPS-treated PMNs in a PMN-depleted mouse before H-59 infusion caused a 42% increase in H-59 adhesion to liver sinusoids as compared with phosphate buffered saline preinfusion (16.5 ± 0.5 v. 11.7 ± 0.5).* Neutrophil depletion before intrasplenic injection of H-59 cells decreased gross surface metastases at 2 weeks by 88% from a mean of 48 ± 12.2 to 6 ± 2.6,* and coincubation of H-59 cells with LPS-treated PMNs before injection returned the number of surface metastases to control levels.

In conclusion, PMNs can facilitate liver metastasis by direct interactions with cancer cells and potentially by remote action via PMN-derived factors. They are key participants in the development of gross metastasis owing to their effects on early adhesive events. Together, these results suggest that PMNs are important contributors to the implantation and growth of liver metastases and constitute a possible target for antimetastatic therapy.

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Pathologic response after neoadjuvant carboplatin and weekly paclitaxel for early early non–small cell lung cancer: a Brown University Oncology Group phase II study. ***S. Ahmed, A.E. Birnbaum, D. Berz, J.P. Fontaine, T.A. Dipetrillo, N.E. Ready, T. Ng.*** **From the Brown University Oncology Group, Providence, Rhode Island**

Pathologic complete response (pCR) to neoadjuvant chemotherapy has been associated with improved survival in solid tumours. SWOG 9900 demonstrated a 3% pCR following 3 cycles of paclitaxel/carboplatin every 21 days. In a phase II study, we sought to determine if more intensive weekly paclitaxel would increase the rate of pCR.

Patients with biopsy-proven non–small cell pathology, stage IB-IIIA and predicted postresection forced expiratory volume in 1 second (FEV1) greater than 40% were eligible. All patients underwent a staging PET scan and mediastinoscopy. Informed consent was obtained, and eligible patients received carboplatin, with a target area under the curve of 6 mg/mL/min, every 21 days (3 doses total) and paclitaxel 80 mg/m^2 weekly (for 9 weeks). The primary outcome was the rate of pCR. Other outcomes examined included chemotherapy toxicity, surgical morbidity and survival.

Twenty patients with clinical stage IB ($n = 16$), IIA ($n = 1$), IIB ($n = 1$) and IIIA ($n = 2$) cancer were enrolled. Their mean age was 65 years. Toxicity included grade 4 neutropenia in 1 (5%), grade 3 neutropenia in 3 (15%), grade 3 neuropathy in 1 (5%) and grade 3 nausea in 1 (5%). After induction therapy, complete radiographic response was seen in 1 (5%), partial response in 7 (35%), stable disease in 12 (60%), and no patient had disease progression. Following induction therapy, 1 patient refused surgery and received chemoradiation, and 1 patient died unexpectedly of a non–treatment related event. The other 18 patients underwent complete resection, 15 by lobectomy and 3 by pneumonectomy. There were no major surgical complications. Pathology revealed 3 (17%) patients with pCR. The median follow-up is 61 months. For clinical stage IB ($n = 16$) cancer, the median overall survival has not been reached, and the 5-year overall survival is 68%. All patients with pCR ($n = 3$) remain alive and disease-free.

Neoadjuvant chemotherapy with intensive weekly paclitaxel and carboplatin every 21 days is well tolerated and does not increase the morbidity of surgery. This intense regimen achieves rates of pCR that compare favourably with other reported induction regimens and merits further investigation.

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A case–control study of video-assisted thoracoscopic lobectomy: short-term outcomes and safety. ***A. Alhussaini, M. Oberoi, J.Threader, J. Villeneuve, S. Gilbert, F.M. Shamji, S. Sundaresan, D. Maziak, A. Seely.*** **From the Division of Thoracic Surgery, University of Ottawa, The Ottawa Hospital, Ottawa, Ont.**

Lobectomy done by video-assisted thoracoscopic surgery (VATS) is increasingly being performed for resection of non–small cell lung cancer; however, short-term outcomes and safety are not clearly defined, in particular during the learning curve. Our objectives were to utilize a novel standardized grading system of postoperative complications to evaluate outcomes and safety following the initiation of a VATS lobectomy program, in comparison to age- and stage-matched controls undergoing open lobectomy.

A retrospective review of all consecutive VATS lobectomies performed at The Ottawa Hospital (January 2006–January 2009) was followed by a comparison with an age-matched (± 5 yr), stage-matched control cohort of open lobectomies. Demographics, comorbidities, pulmonary function, clinical and pathological stage, operative procedure and time, blood loss, postoperative complications, chest tube duration and hospital length of stay were recorded. The Ottawa Thoracic Morbidity and Mortality system (modified from the Clavien–Dindo system) was used to identify both presence and severity of postoperative complications.

A total of 77 VATS lobectomies (mean age 69, range 46–87 yr) were performed between September 2006 and February 2009, and were matched to an equal number of cases (mean age 67, range 48–90 yr) of open lobectomy performed in the same period. All patients had stage I or II disease. No differences existed in either presence or severity of complications: 35 patients (46%) in the VATS group had at least 1 complication, 22 (29%) had at most a minor complication (grade I-II), 13 (17%) had a major complication (grade III-V), including 4 patients who died; whereas 37 (48%) patients of the open lobectomy group had at least 1 complication, 27 (35%) had at most a minor complication, 10 (13%) had a major complication, including 1 patient who died. Median length of hospital stay was 5 days following VATS lobectomy and 6 days for open lobectomy; 17% who underwent a VATS lobectomy and 22% of the open lobectomy cohort had a length of stay greater than 10 days (NS). The median procedure time was 221 minutes for VATS cases and 185 minutes for open ones (p = 0.0001). A progressive decrease in operative time with no difference in the postoperative complications were observed over the first 45 cases performed by VATS, from 280 ± 60 minutes (cases 1–15), 227 ± 47 minutes (16–30), to 202 ± 40 minutes (31–45), which stabilized thereafter. The overall conversion rate was 7.8% (n = 6).

The initiation of a VATS lobectomy program led to equivalent short-term outcomes and safety as evaluated by a standardized assessment of postoperative complications compared with open lobectomy controls. There was a progressive improvement in operative time with no change in outcomes with continued experience.

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Does conversion to thoracotomy in video-assisted lobectomies have a negative outcome? A cost, length of stay and clinical outcome analysis. ***K.S. Rammohan, I. Hunt, A. Chuck, S. Gazala, A. Valji, K. Stewart, E.L.R. Bedard.*** **From the Department of Thoracic Surgery, University of Alberta, Institute of Health Economics, Edmonton, Alta.**

Video-assisted (VATS) lobectomies constitute only 5%–15% of cancer resections across most of North America and Europe. Surgeons' concerns revolve around vascular catastrophes requiring urgent conversion to a thoracotomy and the perceived negative outcomes thereafter.

We performed chart reviews for 493 patients who had anatomic lung resections at our 750-bed, tertiary care, teaching hospital between January 2006 and January 2009. The specific goal of our study was to capture our reasons for conversions to thoracotomies and the subsequent clinical outcomes and financial implications. In all, 285 of the 493 patients underwent VATS lobectomies, including 14 patients with redo procedures.

Video-assisted lobectomies increased from 2% to over 80%, with conversion rates falling from 15% to 11% between 2006 and 2009. Two surgeons commenced their VATS practice in this timeframe. The commonest reason for conversion was vascular injuries, principally to the pulmonary artery (17/39, 43%). Six of the 14 redo patients (42%) were converted to thoracotomies mainly owing to adhesions. All thoracotomies (conversions) were performed in a planned manner after the bleeding source was under control. The "converted" patients stayed half a day longer than the nonconverted in hospital (5.4 d v. 4.9 d). The length of stay cost difference was Can$610, with an overall cost difference of Can$303 (Can$8546 no conversion v. Can$8849 conversion). Eighty percent of conversions were done with a transaxillary incision, as this was the best access for establishing vascular control. There was no significant difference in morbidity between the groups.

Conversion to thoracotomy in VATS lobectomies can be done with minimal adverse influence on length of stay, no significantly raised morbidity and at only a small additional cost. Our preferred approach to vascular injuries was an extension of our axillary port, as this gave us good access to the pulmonary vasculature.

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A comparison of laparoscopic versus VATS esophagectomy for distal esophageal cancers. ***M. Plourde, D. Fortin, A. Arab, R.I. Inculet, R.A. Malthaner.*** **From the Division of Thoracic Surgery, London Health Sciences Centre, London, Ont.**

We performed a retrospective review comparing laparoscopic-assisted transhiatal (LATH) and video-assisted thoracoscopic (VATS) esophagectomies performed between January 2006 and January 2010 for distal esophageal and gastresophageal cancers.

Laparoscopic-assisted transhiatal esophagectomies were performed in 92 patients, and 26 patients underwent VATS esophagectomies. Surgical approach was based on surgeon preference. The average age was 67 in both groups. The majority of patients had locally advanced (T3 and/or N1) disease, with 72% in the LATH group and 77% in the VATS group. Ninety-five percent of patients had a diagnosis of cancer and 5% had high-grade dysplasia. In-hospital mortality was 2% in the LATH group and 0% in the VATS group. The overall complication rate

was 33% for the LATH group and 58% for the VATS group. The conversion rate for the LATH group was 13% and 23% for the VATS group. The most common reasons for conversion in the LATH group were poor exposure and adhesions from previous laparotomy. In the VATS group, conversion was most often owing to large tumour size. The median operative time in the LATH group was 225 (146–395) minutes compared with 407 (235–599) minutes in the VATS group. The median number of lymph nodes harvested was 10 (0–26) in the LATH group and 15 (3–42) in the VATS group. The median length of hospital stay was 11 (2–175) days in the LATH group and 12 (7–80) days in the VATS group. The median follow-up was 9 months in the LATH group and 12 months in the VATS group. The mean survival times for the LATH and VATS groups were 29.6 and 27.5 months, respectively ($p = 0.856$, log rank test).

Video-assisted thoracoscopic esophagectomies have longer operative times and higher complication rates, but more lymph nodes are harvested. Perioperative mortality and survival appear to be similar.

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The likelihood of death after esophagectomy with increasing age. ***S.C. Bharadwaj, T. Hamin, L.A. Tan, H.W. Unruh, S.K. Srinathan.*** **From the Department of Surgery, University of Manitoba, Winnipeg, Man.**

In this study, we quantify the risk of in-hospital death after esophagectomy for carcinoma associated with advancing age in a contemporary patient cohort.

We reviewed the charts of adults undergoing esophagectomy for cancer between January 2000 and June 2008. The outcome was in-hospital mortality. We classified morbidity according to the Charlson criteria and collected data on body mass index (BMI). We calculated likelihood ratios for death according to age groups (< 65, 65–75 and > 75). We performed a logistic regression analysis with hospital death as the outcome to correct for comorbidities and BMI and to test for the robustness of our findings.

There were 143 patients in our cohort. We found that age is a significant and independent predictor of hospital death after esophagectomy for cancer. The likelihood ratio for death in those aged 75 and above is 3 (95% CI 1.6–5.7). The odds ratio for in hospital deaths was 30.2 (95% CI 3.5–261.2) when comorbidity and BMI are accounted for in the model.

Patients aged 75 and over face a risk of death that is 3 times that of the overall risk of mortality for this operation at a particular centre. This information is easy to communicate and of direct importance when counselling patients about the risk of surgery and deciding on therapeutic options.

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Outcomes: wedge resection versus lobectomy for non–small cell lung cancer at the Cancer Centre of Southeastern Ontario, 1998–2009. ***A.L. McGuire, D. Petsikas, K. Reid, W. Hopman.*** **From the Division of Thoracic Surgery, Department of Surgery, Kingston General Hospital, Queen's University, Kingston, Ont.**

A long-term retrospective analysis of outcomes comparing wedge resection to lobectomy for non–small cell lung cancer was carried out in a Canadian tertiary referral university hospital centre to determine the efficacy of wedge resection as an oncological procedure.

The outcomes of all non–small cell lung cancer patients undergoing surgical resection at the Cancer Centre of Southeastern Ontario from 1998 to 2009 were analyzed ($n = 423$). The standard of care for patients with adequate cardiopulmonary reserve was lobectomy. Wedge resection was performed for patients with inadequate reserve to tolerate lobectomy. Predictors of recurrence and survival were assessed. Appropriate statistical analyses involved the χ^2 test, the t test and Kaplan–Meier estimates of survival. Outcomes were stratified for tumour size and American Joint Committee on Cancer 7th edition TNM stage for non–small cell lung cancer.

Wedge resection was performed in 71 patients and lobectomy in 352. The mean age was 64 years. The mean follow-up for cancer survivors was 39 months. There was no significant difference found between wedge resection and lobectomy for rate of tumour recurrence, mortality and disease-free survival in stage IA tumours less than 2 cm in size.

Wedge resection is an adequate oncological procedure for non–small cell lung cancer in properly selected patients: specifically, stage IA tumours less than 2 cm in diameter.

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Isolated supraclavicular lymph node metastasis in resected esophageal cancer: Systematic or regional disease? ***P. Levine, M. Rousseau, J. Spicer, L.E. Ferri.*** **From the Department of Surgery, Montréal General Hospital, McGill University, Montréal, Que.**

Supraclavicular lymph node (SLN) metastasis from esophageal carcinoma is regarded as systemic disease. It is possible that in some patients, the SLN may represent the sole site of spread. We sought to identify the significance of isolated SLN metastasis in patients undergoing resection of esophageal cancer.

A prospectively entered database of all patients undergoing resection of esophageal cancer at a single institution (2005–2009) was accessed. In cases with isolated SNL metastasis, patient, tumour, treatment characteristics as well as outcome were reviewed. Data are presented as median (range).

In 120 esophagectomies for squamous cell ($n = 22$) or adenocarcinoma ($n = 98$), isolated SLN metastases was identified in 7 (5.8%). The median age of patients was 57 (42–67) years, and most (6/7) were male. Supraclavicular lymph node metastases were identified preoperatively in 2 patients. In these, a 3-field esophagectomy followed neoadjuvant therapy, and patients died of disease at 13 and 21 months. One patient had SLN metastasis diagnosed at pathology following 3-field esophagectomy. No subsequent therapy was given, and she is alive without disease at 42 months. Four patients developed SLN metastasis following Ivor-Lewis (3) or 3-field esophagectomy (1) at 9 (5–14) months. Two were treated with salvage chemoradiotherapy and are alive without disease at 25 and 40 months. Two received chemotherapy alone: 1 is alive with disease at 28 months and the other died of disease at 15 months. Overall, 3 of 7 (42%) patients with isolated SNL metastasis remain alive without disease at 40 (25–42) months.

In a highly selected group of esophageal cancer patients, the SLN may represent the sole site of disease and should be treated with curative intent multimodal therapy.

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Successful implementation of video-assisted thoracoscopic surgery lobectomy in British Columbia: a preliminary experience. ***A.S. Ashrafi, R.J. Bond, S.R. Ong, S.Y. Ahmadi.*** **From the Surrey Thoracic Surgery Group, Surrey Memorial Hospital, Surrey, BC**

Advantages of video-assisted thoracoscopic (VATS) lobectomy as compared with thoracotomy include reduced hospital length of stay, decreased pain and decreased inflammatory response. A prospective database of patients undergoing VATS lobectomy was analyzed.

Between January 2009 and March 2010, a total of 83 VATS lobectomies were performed by 3 surgeons. One surgeon (A.S.A.) has fellowship training in advanced minimally invasive thoracic surgery. The other 2 surgeons had training in minimally invasive surgery but not in VATS lobectomies. The patients included 53 women (63.86%), with a mean age of 67.7 (range 19–87) years.

The pathology confirmed benign disease in 4, pulmonary metastases in 6, lymphoma in 1, leiomyosarcoma in 1, carcinoid in 1, small cell carcinoma in 2 and non–small cell lung cancer (NSCLC) in 68 patients. In the NSCLC group, analysis demonstrated stage I disease in 48 (70.59%), stage II in 17 (25.00%) and stage III in 3 (4.41%) cases. The median length of stay was 5 days (range 2–16 d). Thirty-seven (44.58%) patients were discharged home by postoperative day 4. There were no intraoperative deaths and only 1 (1.20%) postoperative mortality (day 4, myocardial infarction). Fifty-nine (71.08%) patients had no postoperative complication. There were 9 (10.84%) conversions to thoracotomy: 4 (4.82%) for bleeding, 4 (4.82%) for difficult anatomy and 1 (1.20%) for oncologic reasons.

Video-assisted thoracoscopic lobectomy is gradually gaining acceptance as a feasible alternative for pulmonary resections. Successful implementation, however, remains a challenge. Given the relatively modest experience of the surgical team with VATS lobectomy, the data presented here are of 2-fold significance. Whereas the inherent technical challenges in introducing VATS lobectomy were overcome, the team managed to acquire the requisite skills within the framework of recognized standards. Our intraoperative and postoperative mortality rate of 0% and 1.2%, respectively, are comparable to major series in the literature.

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Pulmonary vein compression in post-pneumonectomy patients. ***S.L. Partington, A.J. Graham, S. Owen, E.J. Kelly, G. Gelfand, S.C. Grondin, SD McFadden, E. Oddone Paolucci, S.G. Weeks.*** **From the Department of Cardiovascular Sciences, Division of Thoracic Surgery, the Department of Surgery, University of Calgary, Calgary, Alta.**

The objective of this study was to determine if pulmonary vein compression is an under-recognized and potentially reversible cause of functional limitation following pneumonectomy.

Patients from the Calgary Health Region who were at least 6 months postpneumonectomy had a transthoracic echocardiogram (TTE) performed to assess pulmonary venous flow velocities, pulmonary artery systolic pressures and right- and left-sided stroke volumes. Pulmonary venous flow velocities greater than 1.0 m/s were considered positive for pulmonary vein obstruction. Measurements were obtained in the left decubitous, right decubitous and standing positions to enhance mediastinal displacement. Four healthy controls were also evaluated. All patients completed a 6-minute walk test (6MWT), functional activity questionnaires and had their transverse to anterior–posterior chest dimensions assessed on a prior chest CT. Correlations between these findings and TTE measurements were performed using Spearman's rho correlation coefficients.

Although 14 patients were enrolled, interpretable echocardiographic data were available for only 12 (86%). One patient (8%) had evidence of pulmonary vein obstruction in the decubitous position, and 6 patients (50%) had evidence of dynamic pulmonary vein compression only in the standing position. Although 6MWT distances were lower in patients with higher peak pulmonary venous flow velocities, this association was not statistically significant. A larger transverse dimension of the chest relative to the anterior–posterior dimension was associated with positional pulmonary vein obstruction.

A proportion of patients postpneumonectomy have evidence of positional pulmonary vein obstruction, making this entity an under-recognized hemodynamic complication of pneumonectomy. It is recommended that pulmonary veins be assessed in patients with unexplained dyspnea following pneumonectomy, particularly in patients with low anterior–posterior chest dimensions.

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Severe acute pancreatitis and abdominal compartment syndrome: incidence and outcomes of decompressive laporotomy. ***P.J. Davis, M. Molinari, T. Topp, M.J. Walsh.*** **From the Division of General Surgery, Department of Surgery, Dalhousie University, Halifax, NS**

Our aim was to determine the incidence and outcomes of decompressive laparotomy in patients with severe acute pancreatitis (SAP) and abdominal compartment syndrome (ACS).

Using our intensive care unit database, we identified patients presenting to our intensive care unit with a diagnosis of pancreatitis (ICD 9 code 577.x) between July 1, 2005, and June 30, 2009. Charts were reviewed, and patients who did not meet the Atlanta criteria for SAP were excluded. A database was then compiled using our electronic medical record system (Horizon Patient Folder) to obtain demographic data (age, sex, obesity, Charlson comorbidity score), details of the admission (type of pancreatitis, Ranson and APACHE scores), whether ACS developed (intrabdominal pressure > 20 mm Hg with signs of organ failure), whether decompressive laparotomy was performed and the sequelae of this intervention. Descriptive and parametric statistics were then performed.

In all, 72 patients were identified, of whom 27 were excluded as they did not satisfy the inclusion criteria. Of the remaining 45, 13 patients (28%) developed ACS, and 16 (36%) decompressive laparotomies were preformed. The overall mortality was 24% and was not altered by decompressive laparotomy. Decompressive laparotomy was associated with significant morbidity (dehiscence 19%, ventral hernia 50%, wound infection 63%, pancreaticocutaneous fistula 19%, enterocutanous fistula 44%). Multivariable analysis showed that mortality was associated with obesity ($p = 0.019$) and Charlson comorbidity score ($p < 0.001$), whereas decompressive laparotomy was associated with male sex ($p = 0.012$).

Decompressive laparotomy does not alter mortality in patients with SAP and ACS but is associated with significant morbidity.

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The effect on disease burden on the Yttrium-90 radioembolization (TheraSphere) treatment for neuroendocrine liver metastasis. ***E. Simoneau, M. Hassanain, T. Cabrera, P. Chaudhury, S. Dumitra, M. Aljiffry, I. Feteih, S. Leduc, J. Rivera, M. Jamal, D. Valenti, P. Metrakos.*** **From the Departments of General Surgery, Radiology and Endocrinology, McGill University Health Centre, Montréal, Que.**

This study aims to examine the effect of disease burden on the response to radioembolization (Yttrium-90 microsphere) when treating patients with multiple liver neuroendocrine tumour (NET) lesions.

All patients with multiple (> 3) NET liver lesions who underwent radioembolization with TheraSphere (glass microspheres) at the McGill University Health Centre from January 2006 to March 2009 were reviewed. Patients were followed with triphasic CT scans before and 4 weeks after treatment. Response was determined by measuring the change in percentage of necrosis (Δ N) after the first radioembolization. Univariate and multivariate analyses were performed.

Twenty-five patients were identified, with a median follow-up of 15.4 months. Their average age was 63, 28% had extrahepatic metastasis and 82% had WHO stage I disease. Posttreatment, the mean Δ N was 41%, and 63% of patients had greater than 30% Δ N. Previous surgical therapy, disease burden and bilateral disease were significant predictors of response. Patients who had a previous operative intervention had a higher response rate of 78% (v. 31%, $p = 0.001$). Liver disease involvement correlated inversely with response rate, and patients with less than 33% of their liver involved had the highest response rate of 63% (v. 35%, $p = 0.004$). Bilateral disease was associated with a decreased rate of response 46% (v. 63%, $p = 0.02$).

Radioembolization increased necrosis of NET liver metastasis. The benefit is mainly seen in patients with lower tumour burden. These data warrant a larger prospective study using aggressive surgical debulking in combination with radioembolization in patients with multiple NET liver metastases.

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Long-term outcome after conservative management of nonfunctioning pancreatic neuroendocrine tumours. ***K. Elgadi, W. Cherniak, D. Chan, A.C. Wei, S. Gallinger.*** **From the University of Toronto, Toronto, Ont.**

Neuroendocrine tumours of the pancreas are rare tumours with usually slow growth rates. They are classified as functional or nonfunctional based on hormone production that is assessed clinically and biochemically, and they may metastasize to local lymph nodes, liver or bone. Since these tumours grow very slowly and are often detected incidentally, the need for resection of small asymptomatic tumours is controversial. We hypothesize that a conservative, nonsurgical approach for small nonfuntioning neuroendocrine tumours of the pancreas results in similar disease-specific survival compared with patients who undergo early surgical intervention.

We performed a retrospective chart review of patients with nonfunctioning neurendocrine tumours of the pancreas who have been conservatively followed at our institution. Patients were identified by searches of radiology reports at the University Health Network, the cancer registry at Princess Margaret Hospital and by contacting staff surgeons. Demographic, clinical and radiologic data were recorded.

We identified 50 patients (22 male, 28 female) who were diagnosed with nonfunctional, pancreatic neuroendocrine tumours

and treated conservatively between 1995 and 2009. The mean age at diagnosis was 60 (range 23–94) years. Four patients had multiple endocrine neoplasia type 1 syndrome and 4 were diagnosed with von Hippel–Lindau syndrome. The median size of tumours at diagnosis was 12 (range 5–120) mm. Ten tumours were located in the head, 12 in the neck, 5 in the uncinate process, 15 in the body and 17 in the tail of the pancreas. Seven patients had multiple tumours within the pancreas. Mean patient follow-up was 39 (range 8–120) months. Most of the tumours were stable in size over a prolonged period of time. Three patients developed metastatic disease after a mean follow-up of 41 (range 24–61) months. Two of these had large unresectable tumours at initial diagnosis (31 and 37 mm). The third had a stable small tumour for many years and presented with metastatic disease and a larger tumour after 3 years of no follow-up. Another 3 patients underwent surgery after a mean follow-up of 19 (range 14–30) months.

In conclusion, small nonfunctioning pancreatic neuroendocrine tumours tend to be stable in size or grow very slowly and are associated with low risk of metastasis. Radiologic monitoring of tumour growth is a reasonable alternative to surgical management.

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Resectability of colorectal liver metastases: an imaging-based survey of concordance between hepatic surgeons in Canada. ***W. Mohammad, R. Mimeault, R. Fairfull-Smith, R. Auer, F. Balaa.*** **From the Department of Surgery, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.**

Resectability of colorectal liver metastases is based mainly on a surgeon's assessment of cross-sectional imaging. We believe that there is a large element of subjectivity when determining resectability. The objective is to assess the concordance between Canadian hepatic surgeons regarding resectability of colorectal liver metastases when presented with a standardized case scenario and CT images.

Forty-six hepatic surgeons across Canada were invited to participate. They were presented with a standardized clinical scenario. The patient was described to be otherwise healthy, with biologically favourable disease and treated with modern neoadjuvant chemotherapy. The clinical scenario was then matched with 10 different abdominal triphasic CT scans representing maximum response after 6 cycles of chemotherapy. Surgeons were requested to offer an opinion on resectability based on the images, as well as the role for adjuncts such as radiofrequency ablation, portal vein embolization and staged hepatectomy.

A total of 26 responses were received (56.5% response rate). Twenty of those were complete. All participants were attending surgeons, and 60% had been in practice for at least 5 years. Half of the participants worked in groups of 3–5 surgeons, and hepatobiliary surgery represented more than 50% of the workload for 90% of participating surgeons. Two control cases demonstrated 100% concordance. A significant lack of concordance was demonstrated for the test cases. Agreement on resectability was as low as 50% in some cases. Even in the 4 out of 10 cases that trended toward a higher concordance rate for resectability, 8 different combinations of adjuncts to hepatic resection were used.

There is significant lack of concordance of surgeons' opinion on resectability and use of adjuncts in the treatment of colorectal liver metastases.

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Bevacizumab does not decrease liver hypertrophy after portal vein embolization. ***J. Kwan, M. Hassanain, P. Chaudhury, C. Dey, R. Gadahadh, A. Salman, E. Simoneau, N. Meti, M. Aljiffry, M. Jamal, T. Cabrera, N. Bouganim, P. Kavan, T. Alcindor, D. Valenti, P. Metrakos.*** **From the Departments of General Surgery, Radiology and Oncology, McGill University Health Centre, Montréal, Que.**

The size of the future liver remnant (FLR) is a main determinant of liver function after hepatectomy. Portal vein embolization (PVE) redistributes blood flow to the FLR to stimulate preoperative liver growth. Preoperative chemotherapy is widely used as part of the treatment of colorectal cancer liver metastasis (CRCLM). The addition of the anti-VEGF monoclonal antibody bevacizumab (Avastin) to standard chemotherapy is increasing. The effect of bevacizumab on liver regeneration after PVE is unknown. This study aims to determine whether prior treatment with bevacizumab compromises liver regeneration after PVE.

We conducted a retrospective review of patients with CRCLM treated at our institution between 2002 and 2009. We identified 83 patients who underwent PVE following preoperative chemotherapy. Portal vein embolization was done for patients undergoing a trisegmentectomy or as part of a staged liver resection. It was performed via an ipsilateral approach using 90–180 μ polyvinyl alcohol and coils to occlude segmental branches. Computed tomography scans before and 4 weeks after the PVE were evaluated. Total liver volume and FLR were measured using dedicated volume measurement software on a 3-dimensional workstation by 2 radiologists who were blinded to the type of chemotherapy given.

There were no differences in baseline characteristics between the bevacizumab and chemotherapy-only groups (Table). Both groups received a median of 6 chemotherapy cycles before PVE. The mean pre-embolization and postembolization FLR was 20.2% (bevacizumab) versus 23.4% (chemotherapy-only) and 28.7% (bevacizumab) versus 32.1% (chemotherapy-only), respectively (p = NS). The degree of hypertrophy was 8.5% in the bevacizumab group versus 8.7% in the chemotherapy-only group (p = NS).

The use of preoperative bevacizumab containing chemotherapy in patients undergoing PVE before liver resection for CRLM does not affect liver hypertrophy.

Table, abstract 97. Characteristics of patients who received chemotherapy with bevacizumab or alone after portal vein embolization for colorectal cancer liver metastases

Characteristic	Bevacizumab	Chemotherapy only
Percentage of patients	45.8	54.2
Sex, male:female	1.1:1	1.6:1
Mean age, yr	56	56
Synchronous liver metastases, %	89.7	88.6
Primary tumour, colon:rectum	4:1	4:1
Repeated PVE, %	23	34
Liver resection, %	71.8	75
Staged liver surgery, %	43.6	29.6

PVE = portal vein embolization.

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Value of prophylactic drainage in distal pancreatic surgery. ***B. Brar, F. Sutherland.*** **From the Department of Surgery, Foothills Hospital, Calgary, Alta.**

Use of closed suction draining systems in pancreatic surgery is commonly based on the belief that usage of these minimizes the incidence and sequela of potential intra-abdominal collections.

A retrospective chart review of elective distal pancreatectomies performed by hepatobiliary surgeons at large tertiary centre from 2003 to 2009 was done to assess if placement of drainage systems affected patient outcomes.

Seventy-one patient cases were reviewed. Forty patients had prophylactic drains inserted at the time of the operation, and 31 patients had no drains placed. Both groups were similar in respect to age, male:female ratio, American Society of Anesthesiologist score, operating time, estimated blood loss and proportion of patients with spleen preservation. The groups were not different in terms of length of stay (9.25 v. 10.2 d, $p = 0.2305$) or percentage of patients developing one or more complications (45% v. 48%, $p = 0.8141$). The groups did differ significantly in rates of pancreatic fistula detected, with 32.5% (13/40) in the drained group having fistulas compared with only 6.5% (2/31) in the nondrained group. However, the majority of fistulas seen in the drained group were of no clinical significance (9/13 were International Study Group for Pancreatic Fistula grade A). Both groups had equal proportions of clinically significant fistulas: 10% (4/40) were grade B and 6.5% (2/31) were grade C.

Our study failed to show a reduction in complications and clinically relevant pancreatic fistulas with the addition of closed suction drainage tubes after distal pancreatic surgery. This supports the notion that prophylactic drainage is not warranted in distal pancreatic surgery and should be evaluated further with a randomized trail.

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Impact of chemotherapy and medical comorbidities on the hepatic volume hypertrophy after portal vein embolization (PVE). ***A. Bégin, D. Bourdonnais, R. Lapointe, M. Plasse, R. Létourneau, A. Roy, M. Dagenais, F. Vandenbroucke-Menu.*** **From the Unit of Hepatobiliary Surgery and Liver Transplantation, *Hôpital Saint-Luc, CHUM*, Montréal, Que.**

Some studies have showed that diabetes, chemotherapy, age, dyslipidemia and obesity could restraint the degree of hypertrophy of the liver after portal vein embolization (PVE). The aim of this study was to analyze the impact of these factors on liver hypertrophy after preoperative PVE.

This was a retrospective study of 47 patients (27 male and 20 female) with a mean age of 59 years, who had undergone preoperative PVE. Total and future remnant liver volumes and tumour volume were calculated before and 1 month after PVE. The Mann–Whitney *U* test was used for statistical analysis.

There was no mortality and 5 minor complications after PVE. The average length of hospital stay was 1.8 days (1-d procedure in 19 patients [41%]). The percentage of future remnant liver volume hypertrophy was 12%. This volume hypertrophy was not statistically modified by sex (13% male v. 10.4% female), age (12% ≥ 60 v. 12% < 60 yr), body mass index (16.1% ≥ 30 v. 10.6% < 30), diabetes (15.1% yes v. 10.9% no), dyslipidemia (11.3% yes v. 12.3% no), type of chemotherapy (13.9% folfiri v. 7.6% folfox, $p = 0.05$), number of cycles of chemotherapy (13.2% ≤ 6, $p = 0.05$).

Portal vein embolization is secure and could be performed as a 1-day procedure. No studied factors restraint the degree of future remnant liver volume hypertrophy. In our experience, the number of chemotherapy cycles (> 6) and the type of chemotherapy need to be more studied to define exactly their impact on liver volume hypertrophy.

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Morbidity and mortality of liver resection for colorectal metastasis after preoperative portal vein embolization (PVE): a case–control study. ***A. Bégin, D. Bourdonnais, R. Lapointe, M. Plasse, R. Létourneau, M. Dagenais, A. Roy, F. Vandenbroucke-Menu.*** **From the Unit of Hepatobiliary Surgery and Liver Transplantation, *Hôpital Saint-Luc, CHUM*, Montréal, Que.**

One of the prerequisites for hepatic resection is that there is remaining parenchyma to avoid postoperative liver failure. Preoperative portal vein embolization (PVE) is a technique that induces an atrophy of the liver to be resected, leading to a compensatory hypertrophy of the remnant liver.

The aim of this study was to evaluate the morbidity and mortality of liver resection after PVE.

This was a retrospective case–control study of 58 patients (36 male and 22 female) with a mean age of 59 years. The matching criteria of the PVE group (PVEG) and the control group (CG) were type of liver resection, year of surgery, age and sex. Statistic analyses used were the Mann–Whitney *U* test and the χ^2 test.

The 2 groups (PVEG and CG) were similar for body mass index (27.7 v. 26.6), preoperative chemotherapy (19 v. 14 patients), diabetes (5 v. 2), dyslipidemia (6 v. 8) and extended hepatectomy (10 v. 6). Operative time (237 min v. 186 min, $p = 0.014$) and bleeding volume (933 mL v. 528 mL, $p = 0.001$) were significantly higher in the PVE group, but blood transfusion units were similar (3 v. 4, p = NS). No mortality was observed, and the morbidity rate was similar between both groups (PVEG 5 v. CG 7, p = NS).

In patients with insufficient future remnant liver, preoperative PVE allows liver resection without increasing morbidity, but longer operative time and more blood loss were observed.

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Surgical treatment of liver hydatid cysts: a challenging experience from a nonendemic country. ***A. Bégin, S. Ismail, F. Vandenbroucke-Menu, R. Létourneau, M. Plasse, A. Roy, M. Dagenais, R. Lapointe.*** **From the Unit of Hepatobiliary Surgery and Liver Transplantation, *Hôpital Saint-Luc, CHUM*, Montréal, Que.**

Hydatid cyst is a rare infectious liver disease in North American countries. Its management is a considerable challenge considering its rarity and tendency to recur.

The aim of this study was to review the results of surgery obtained in a country outside the endemic area.

This retrospective study over a 20-year period (1988–2008) included 33 patients (20 male, 13 female) with a mean age of 43 years. Surgical treatment was performed in a tertiary medical centre. Clinical presentation, investigation, management and long-term follow-up were evaluated.

Twenty-six patients (78.8%) were immigrants from endemic countries and 7 originated from Quebec (21.2%). Twenty-five patients (75.8%) were symptomatic. The investigations included ultrasound in 24 patients (84.8%), abdominal CT scan in 31 (93.9%) and MRI in 16 (48.5%). Cysts were mainly located in the right lobe (48.5%) and mostly solitary in 2-third of cases. The average cyst size was 9.04 cm (1–23 cm). Treatment was a radical surgery in 22 cases (66.7%), with 7 minor and 15 major liver resections, a conservative surgery in 8 (5 marsupialisations and 3 external drainages) and a combined surgery for bilateral disease in 3 with liver resection and marsupialisation. There was no operative mortality, and major complications were observed in 5 patients (4 bile leaks and 1 subphrenic abscess). Albendazole was given perioperatively in 91% of patients. Mean follow-up time was 35.6 months with recurrence in 3 cases in the conservative surgery group at 4, 9 and 12 months.

Liver resection combined with perioperative albendazole should be considered whenever it is feasible because of a higher risk of recurrence with conservative surgery.

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The indocyanine green retention rate at 15 minutes (ICG15) versus the Model for End-Stage Liver Disease (MELD) as a predictor of postoperative morbidity and liver dysfunction after liver resection in patients with chronic liver disease. ***E.F. Greco, S. Nanji, S.A. Shah, A.C. Wei, P.D. Greig, S. Gallinger, S.P. Cleary.*** **From the Division of General Surgery, Department of Surgery, University Health Network, University of Toronto, Toronto, Ont.**

Hepatic resection in patients with chronic liver disease (CLD) is associated with a risk of postoperative liver failure and higher morbidity than patients without liver disease. There is no universal risk stratification scheme for CLD patients undergoing resection.

Our aim was to determine factors associated with postoperative liver dysfunction and prolonged length of stay (LOS) in CLD patients undergoing liver resection. In particular, we wanted to evaluate the association between preoperative Model for End-Stage Liver Disease (MELD), indocyanine green retention rates at 15 minutes (ICG15) and postoperative outcomes.

A retrospective review of patients undergoing resection for hepatocellular carcinoma (HCC) was performed. Data collected were ICG15 and pre- and postoperative laboratory results. Adjusted odds ratios (AOR) were calculated for associations between preoperative factors and postoperative outcomes by multivariate logistic regression adjusting for patient age and number of segments resected.

In all, 129 CLD patients underwent surgical resection for HCC between 1998 and 2005. Thirty-day and 90-day postoperative mortality was 1.6% and 4.1%, respectively. Prolonged (> 10 d) hospital LOS was independently associated with an ICG15 of 15% or greater (AOR 8.5, 95% CI 1.4–51) and an internaltional normalized ratio of greater than 1.2 (AOR 5.0, 95% CI 1.4–8.6). If biochemical parameters of MELD are excluded from the analysis, an ICG15 of 15% or greater and MELD score were independent predictors of prolonged LOS. An ICG15 greater than 15% was associated with a MELD score greater than 20 on postoperative day 3 (AOR 24.3, 95% CI 1.8–319).

Elevated ICG retention is associated with postoperative liver dysfunction and morbidity. Elevated MELD and increased ICG15 are independently related to increasing LOS in CLD patients undergoing liver resection. In addition, we found that an increased ICG15 is a predictor of increased MELD postoperatively, and therefore postoperative liver dysfunction. The utility of ICG retention in combination with other biochemical measures (such as MELD score) to predict outcomes following hepatic resection in CLD patients requires further study.

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The role of natural killer cells in chimerism induction in the nonobese diabetic mouse. ***D.P. Al-Adra, C. Anderson.*** **From the Department of Surgery, University of Alberta Hospital, Edmonton, Alta.**

Islet transplantation has been a promising treatment option for patients with diabetes mellitus; however, a major obstacle is the recipients' immune response against the donor tissue and autoantigens. For islet transplantation to be successful, both allo- and autoimmunity in allograft rejection must be overcome. Establishing chimerism by bone marrow transplantation can lead to immunological tolerance in the nonobese diabetic (NOD) mouse model of human type 1 diabetes. However, chimerism induction in the NOD mouse is a difficult process. It is hypothesized that natural killer (NK) cells may be a barrier to chimerism induction in the NOD mouse. Natural killer cell tolerance to transplanted bone marrow may lead to stable mixed chimerism, and, therefore, the role of NK cells in chimerism induction needs to be defined.

In order to determine the role of NK cells in the NOD mouse resistance to chimerism, we have designed a series of experiments to observe the efficiency of allogeneic bone marrow engraftment and the establishment of chimerism in the absence of NK cells. In these experiments, NOD mouse NK cells will be depleted (NK cell depleting antibody), knocked out (gene knockout NOD mice) or rendered nonfunctional (parental mice transplanted with F1 cells). These NOD mice will subsequently be made chimeric through a C3H mouse (fully allogeneic) bone marrow transplant.

Natural killer cell depletion in NOD RAG (no T or B cells) mice significantly enhances hematopoietic cell reconstitution from fully allogeneic C3H mice. At the time of abstract submission, experiments where NK cells have been rendered nonfunctional and depleted in wild-type NOD mice have been completed and are in the process of being analyzed.

Preliminary data support our hypothesis and suggest that the reconstitution of the hematopoetic system of NOD RAG knockout mice with donor C3H bone marrow cells could only be accomplished after the depletion of recipient (NOD) NK cells.

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Up front hepatic resection for metastastatic colorectal cancer results in good long-term survival. ***S. Nanji, P. Ryan, M. Guindi, S. Selvarajah, P. Greig, I. McGilvray, B. Taylor, A. Wei, C. Moulton, S.P. Cleary, S. Gallinger.*** **From the Departments of Surgery and Pathology, University Health Network, and the Division of Hepatobiliary Surgery, University of Toronto, Toronto, Ont.**

Hepatic metastasis from colorectal cancer (CRC) is best managed

with a multimodality approach; however, the optimal timing of resection in relation to perioperative chemotherapy remains unclear. Our strategy has been to offer upfront liver resection for patients with resectable hepatic metastases and chemotherapy after liver resection for chemo-naïve patients. The objective of this study was to evaluate our surgical approach to CRC liver metastases by conducting a retrospective review of all patients undergoing liver resection for CRC metastases at the University Health Network over a 5-year period (2002–2007). Clinical and pathologic factors were evaluated using the Cox proportional hazard method. In all, 336 patients underwent liver resection with a median of 2 metastases (range 1–15). The median follow-up was 35 (range 8–80) months. The majority (n = 187, 56%) had synchronous disease and most patients (n = 286, 85%) had a major hepatectomy (> 3 segments). Thirty-six (11%) patients received preoperative chemotherapy, predominantly for downstaging unresectable disease. Ninety-day mortality was 2.1%, and perioperative morbidity occurred in 90 (27%) patients. Actual disease-free survival at 3 and 5 years was 46.2% and 42%, respectively. Actual overall survival at 3 and 5 years was 63.7% and 55%, respectively. Multivariate analysis revealed size greater than 6 cm (HR 2.5, 95% CI 1.5–4.2), positive lymph node status (HR 2.2, 95% CI 1.1–4.4) and treatment with chemotherapy after liver resection (HR 0.46, 95% CI 0.26–0.83) correlated significantly with overall survival. The results from this contemporary series suggest that an upfront surgical approach for patients with resectable CRC liver metastases, followed by chemotherapy, can lead to good long-term overall survival. There remains an urgent need for multicentre randomized trials to compare perioperative and postoperative chemotherapy for this common problem.

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Sociodemographics and comorbidities influence decisions to undergo pancreatic resection for neoplastic lesions. ***C. Sandroussi, C. Brace, E. Kennedy, N. Baxter, S. Gallinger, A.C. Wei.* From the Department of Surgery, Toronto General Hospital, University of Toronto, and the Department of Surgery, St. Michael's Hospital, University of Toronto, Toronto, Ont.**

Pancreatic resection is being performed with increasing frequency and safety. Technical outcomes and long-term survival for neoplastic lesions are well reported; however, reasons why patients do not undergo surgery for potentially resectable lesions are not well understood. The aim of this study was to determine the factors contributing to the decision not to operate for resectable pancreatic neoplasms.

From 2004 to 2008, all patients with resectable pancreatic neoplasms at a single high-volume hepato-pancreactico-biliary centre (HPB) were evaluated. The impact of patient factors, sociodemographics, medical comorbidities (Charlson combined comorbidity index [CCI] and its age-adjusted index [ACCI]), disease factors (tumour characteristics) and surgical factors (type of resection required) on the decision to undergo pancreatectomy were analyzed using univariate and multivariate binary logistic regression analysis.

In all, 375 patients with resectable pancreatic lesions were identified. Their median age was 62 (range 21–93) years, 203 of 375 (54.1%) were male, and 55 (14.7%) did not undergo resection. On univariate analysis age (OR 1.116, $p < 0.001$), non–English speaking background (NESB; OR 4.276, $p = 0.001$), tumour type ($p = 0.001$ increased for cystic neoplasms, including intraductal papillary mucinous neoplasms), CCI score (OR 1.239, $p = 0.001$) and ACCI score (OR 1.433, $p < 0.001$) were associated with an increased risk of not undergoing resection. Sex, age, marital status and urban residence were not predictive. On multivariate analysis, NESB ($p = 0.018$) and the ACCI ($p = 0.002$) remained predictive of not undergoing resection. The majority of patients did not undergo surgery because the patient declined in 25 of 55 (45.5%), and resection was not offered in 15 of 55 (27.3%). In the remainder, medical contraindications precluded surgery. Advanced age, tumour type, comorbidities (27.3%), age (21.8%), surgical risk (29.1%), frailty (18.2%) and uncertain diagnosis (5.5%) were cited as reasons for not proceeding with surgery.

Patients with a higher ACCI and those from an NESB are less likely to undergo surgery for resectable neoplastic lesions of the pancreas. These factors must be taken into consideration in the decision-making process when considering surgery for patients with pancreatic neoplasms. Novel strategies should be employed to optimize access to surgery for patients with resectable pancreatic neoplasms.

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Expandable metal stents for biliary obstruction in metastatic pancreatic cancer. ***T. Yamashita, K. Leslie.* From the University of Western Ontario, London, Ont.**

Pancreatic cancer often presents late with obstructive jaundice. Unfortunately, 90% of such cases are unresectable, and palliation is the goal of treatment. Endoscopic retrograde cholangiopancreatography (ERCP) stenting is performed to relieve biliary obstruction resulting in cholangitis or symptoms such as pruritis, pain and anorexia. Expandable metal stents (EMS) are regarded as superior to plastic stents in terms of patency, but are much more expensive ($900 v. $20). They are reserved for patients predicted to have a longer life expectancy, with the intent of preventing such patients from reobstruction. To be cost effective, patients should be expected to survive 4–6 months from the time of EMS.

We did a retrospective analysis of patients with pancreatic cancer who received EMS from September 2006 to the present performed by 1 surgical endoscopist. We analyzed this patient group for baseline characteristics, reobstruction requiring repeat ERCP, infection rate and survival. All patients had unresectable pancreatic tumours without gastric outlet obstruction. Stenting was indicated to relieve biliary obstruction.

Thirty-one patients were analyzed. The age ranged from 44 to 93 years with a mean age of 72 years, and 55% of patients were women. These patients were diagnosed with pancreatic cancer an average of 0.6 months before their first ERCP.

Eighty percent (25/31) were initially stented with a plastic stent. Of those 25 patients who initially received plastic stents, 40% went on to have repeat plastic stents an average of 1.8 months from initial stenting. Two of these patients go on for a third set of plastic stents.

Four patients were initially stented with EMS. Two patients started with transhepatic drains before EMS.

From the time of EMS placement, 20% (6/31) of patients went on to reobstruct at an average of 8.9 (range 4.6–15.6) months from EMS insertion. Three patients developed cholangitis, and 1 patient developed cholecystis.

Of the obstructed patients, 70% (4/6) resolved with ERCP flushing (Glowtip catheter) an average of 7.1 months from EMS insertion. Three out of 6 patients required repeat EMS stenting an average of 11.5 months from EMS insertion. One out of 6 patients required a transhepatic drain.

The vast majority of patients did not reobstruct before death. They survived an average of 4.9 (range 3.7–6.8) months without complication.

Eighty percent of patients at our centre received plastic stenting before EMS. If these patients remained clinically stable following plastic stenting, they were considered for EMS. Using this selection method, our EMS had good outcomes, with a 20% rate of obstruction about 9 months from EMS. The majority did not reobstruct and went on to survive 4.9 months palliating without a procedure.

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Effect of wait time on resectability of pancreatic adenocarcinoma. ***S.R. McLean, D. Karsanji, E. Dixon, F.R. Sutherland, O.F. Bathe.*** **From the Department of Surgery, University of Calgary, Calgary, Alta.**

We postulated that a prolonged delay in attempted resection would adversely affect outcomes related to surgery for pancreatic adenocarcinoma. The purpose of this study was to determine if the wait time from consultation with a hepatobiliary surgeon to date of surgery affected the rate of resectability of pancreatic adenocarcinoma.

We performed a retrospective chart review of patients who had surgery for apparently resectable pancreatic masses and biliary strictures from December 2001 to September 2008 at a tertiary care centre in Canada. Rate of resectability was determined as a function of wait time (time from consultation to surgery) and pathology.

A total of 207 patients were identified who underwent surgery with the intent of resecting a pancreatic or periampullary lesion. Eighty-nine patients had benign pathology. Of those with malignant pathology, 55% (65/118) were resectable. Wait times for patients with resectable cancers (47.0 ± 41.2 d) were not significantly different than wait times for individuals with unresectable cancers (41.6 ± 31.6 d). Moreover, rate of resectability did not vary with wait times.

Wait times encountered at our institution were relatively long compared with many published series. However, no change in rate of resectability was observed as a function of wait time. Further studies with larger groups will have to be performed to confirm these findings. In addition, the effects of wait times on other outcomes (e.g., tumour stage) will have to be examined.

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Benign histological diagnoses after pancreaticoduodenectomy in patients with suspected malignancy. ***R.R. Suri, M.J. Marcaccio, L. Ruo.*** **From the Department of Surgery, McMaster University, Hamilton, Ont.**

Our study was conducted to determine the incidence and characteristics of patients undergoing pancreaticoduodenectomy (PD) for a suspected periampullary malignancy found to have benign disease after resection.

A retrospective review of all patients undergoing PD for a suspected malignancy between 2005 and 2009 at a single tertiary referral centre was completed. We determined the incidence of benign diagnoses on histology after resection. The clinical presentation, diagnostic imaging modalities and postoperative morbidity and mortality were assessed in patients with benign and malignant disease.

Of 161 patients who underwent PD, the preoperative clinical diagnosis in 158 patients was a malignant or premalignant lesion. Three patients with a benign preoperative diagnosis (insulinoma $n = 2$, serous cystadenoma) were excluded. In those patients with a suspected malignancy, surgical pathology confirmed a malignancy in 139 (88%) patients and diagnosed benign disease in 19 (12%) patients. Benign diagnoses included biliary or pancreatic inflammation ($n = 10$), adenomas ($n = 8$) and adenomyoma. Clinical presentation and preoperative evaluation were similar between patients with benign and malignant disease. Despite obtaining preoperative biopsies in 79% of patients found to have benign disease, it was not possible to exclude a malignancy and spare the patient from PD. Operative mortality in patients with benign disease was 10%. Postperative morbidity was 37%, and complications included anastomotic leak (21%), intraabdominal abscess (21%), respiratory failure (10%), hemorrhage (5%), pulmonary embolism (5%) and reoperation (5%).

Benign pathologic entities can mimic periampullary malignancy. Current preoperative investigations are unable to exclude a malignancy such that 12% of patients with benign pathology are subjected to PD with its associated mortality and morbidity. Nevertheless, PD should be performed in suspected malignancy as resection is the only modality to achieve long-term survival.

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Utility of the McGill–Brisbane scoring system in the resectable pancreatic adenocarcinoma. ***M.H. Jamal, E. Simoneau, J. Abou Khalil, M. Hassanain, P. Chaudhury, J. Tchervenkov, P. Metrakos, S.A. Doi, J.S. Barkun.*** **From the Department of Surgery, McGill University Health Centre, Montréal, Que., and the School of Population Health, University of Queensland, Brisbane, Australia**

The goal of surgical resection in pancreatic adenocarcinoma (PA) is the achievement of an R0 resection. Predicting this preoperatively is not possible by conventional imaging modalities. We have previously described and validated the McGill–Brisbane scoring system (MBSS), which predicted survival in patients with palliative PA. The aims of this study were to determine factors predictive of overall survival and disease-free survival in patients undergoing Whipple procedure for PA and to determine the value of the MBSS in predicting disease-free survival and overall survival in PA patients and in predicting margin status preoperatively.

We conducted a retrospective study of 84 consecutive patients diagnosed with PA who had a Whipple procedure at our institution from January 2001 to August 2009. Kaplan–Meier overall and disease-free survival were calculated. Multivariable analyses were performed to determine factors influencing overall and disease-free survival. Eight factors were included in the multivariate model: age, sex, margin status, MBSS, size (cm), local invasion, chemotherapy and days from diagnosis to surgery.

The margin status was the strongest and only predictor of overall survival in PA patients (adjusting for age). The MBSS predicts overall survival that is largely a function of local invasion, which in turn predicts overall survival that is largely a function of margin status. In this indirect fashion, patients who scored high

on the MBSS had a lower overall survival as well as a higher chance of having a local invasion. On the other hand, the MBSS was an independent predictor of recurrence-free survival (HR 2.11, 95% CI 1.09–4.09) even after adjusting for age, size of tumour and margin status.

The MBSS is an indirect predictor of overall survival in patients undergoing Whipple procedure. It is also an independent predictor of recurrence-free survival in this cohort of patients.

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Predictors of perioperative blood transfusion for surgical resection of hepatobiliary and pancreas cancer. ***C. Barnett, M.J. Marcaccio, J.J. Hankinson, L. Ruo.*** **From the Departments of Surgery and Anesthesia, McMaster University Medical Centre, Hamilton, Ont.**

Major oncologic resections for hepatobiliary and pancreas (HBP) malignancies often result in significant blood loss and frequently require perioperative red blood cell (RBC) transfusion. Allogenic blood transfusion (ABT) is associated with adverse short- and long-term risks. Blood conservation strategies should be targeted to high-risk patients. Thus, our aim was to identify possible predictive factors for perioperative blood transfusion in patients undergoing resection of HBP cancers.

In all, 263 consecutive patients from a single institution who underwent elective hepatobiliary (91) or pancreatic (172) oncologic resections between January 2005 and May 2008 comprised this retrospective review. Variables of interest, including clinical-, operative-, tumour- and treatment-related factors, were collected along with transfusion requirements in this study population. Variables were examined by the χ^2 or independent samples t test to determine which factors were predictive of perioperative blood transfusion.

There were 116 female and 147 male patients. The mean age of the study population was 62 (range 20–85) years. Median blood loss was 1000 mL, and transfusions were administered to 151 (57%) patients, of whom 47 (31%) had liver resections and 104 (69%) had pancreatic resections for HBP cancer. The median number of packed red cell units transfused was 2. Increasing age, anemia, hypoalbuminemia, higher American Society of Anesthesiologists' (ASA) physical status classification and major hepatic resection (≥ lobe) were associated with a higher likelihood of requiring ABT.

Elderly patients with preoperative anemia, hypoalbuminemia and higher ASA classification undergoing major hepatic resections for cancer more frequently require perioperative blood transfusion and should be targeted for blood conservation strategies.

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Interventional radiology assisted endoscopic transgastric peripancreatic fluid collection. ***A. Alawashez, J. Ellsmere.*** **From the Department of Surgery, Dalhousie University, Halifax, NS**

The aim is to evalutate the technical success and safety profile of interventional radiology (IR)–assisted endoscopic transgastric peripancreatic fluid collection (PFC) drainage.

This study involved 12 consecutive patients referred for endoscopic drainage of PFCs over a 2-year period.

The intervention is performed in 2 stages, the first stage is performed by IR under CT guidance. A suitable window to the PFC through the stomach is determined. An 18-gauge trochar needle is then advanced through the anterior and posterior wall of the stomach into the PFC. Following removal of the inner stylet, a stiff Amplatz wire is advanced. The tract is dilated and an 8.5 F multipurpose cathether is positioned over the wire in the PFC. The second stage is performed under endoscopic and fluoroscopic guidance. The drain is removed. The posterior gastrotomy is cannulated using a wire-guided sphincterotome. The tract is dilated to 15 mm using an endoscopic dilating balloon. Two 5-cm 10 F double pigtail stents are left across the posterior gastrostomy. The anterior gastrostomy is closed with endoscopic clips.

Twelve patients (7 male and 5 female) with a mean age of 61 (range 38–79) years underwent IR-assisted endoscopic transgastric PFC drainage (7 pseudocysts, 5 abscesses) over a 2-year period. The PFCs were gallstone related in 8 patients, postsurgical in 2 patients and idiopathic in 2 patients. The mean size of the PFCs was 12 cm (range 6–19 cm) in its largest dimension. The procedures were technically successful in all 12 patients. There were 3 complications (pneumothorax that was treated with a chest tube, uncomplicated pneumoperitoneum that was confirmed by diagnostic laparoscopy, delayed bleeding from posterior gastrostomy requiring endoscopic hemostasis). All patients had a successful resolution of their PFCs on follow-up imaging. The median length of hospital stay was 11.5 days (range 1–86 d). At a mean follow-up 14 months (range 2–29 mo), all patients were doing well.

We conclude that IR-assisted endoscopic transgastric PFC drainage is technically feasible and safe and is associated with favourable clinical outcomes.

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The validation of a classification system for biliary complications following orthotic liver transplantation (OLTx). ***A. Neville, M. Boutros, J. Barkun.*** **From the McGill University, Montréal, Que.**

Biliary tract complications remain a significant source of morbidity following orthotic liver transplantation (OLTx). Estimates range from 10% to 40%, but the absence of a validated classification system prevents accurate documentation. We propose a structured classification for biliary complications following choledocho-choledochal anastomosis at non–living related OLTx. It is based on 4 major components: leaks (anastomotic, Luschka), filling defects (stones/sludge/casts), extrahepatic strictures (common hepatic or anastomotic) and intrahepatic strictures. These components are based on the appearance of contrast cholangiograms.

A selected sample was chosen from OLTx patients at McGill University from 2004 to 2008 who had at least 1 contrast cholangiogram postoperatively. The components of the classification system were correlated with relevant patient outcomes including patient survival, graft survival, length of stay in hospital after transplant, number of hospital readmissions and number of required interventions related to biliary complications using regression analysis.

Two independent reviewers assessed endoscopic retrograde cholangiopancreatography films from 65 patients. Significant relations were found between classification components and the following outcome variables: number of hospital readmissions, total

length of hospital stay and number of interventions required. Both patient survival and graft survival were found to not be significantly affected by postoperative biliary complications.

The components of the proposed classification correlate positively with relevant patient outcomes, therefore demonstrating high construct validity and confirming their clinical significance as the basis of a scoring system of biliary complications.

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Quality of narrative operative notes in pancreatic surgery. ***M.E. Wiebe, L. Sandhu, J.L. Takata, E.D. Kennedy, N.N. Baxter, A.R. Gagliardi, D.R. Urbach, A.C. Wei.*** **From the Division of General Surgery, University Health Network, and the Department of Surgery, University of Toronto, Toronto, Ont.**

Quality in healthcare can be determined using process measures called quality indicators, an example of which could be elements contained in the surgical operative report. Currently, a narrative operative report (NR) is the standard for documenting surgical procedures. However, little is known about the quality or completeness of the NR. Limited data indicate that NRs are of variable quality owing to incomplete and/or inaccurate data reporting. It has been suggested that a standardized method of reporting could provide more complete and higher quality data for performance evaluation, quality improvement and research purposes. The objective of this study was to evaluate the completeness of the NR for patients undergoing a pancreaticoduodenectomy at a large academic hospital.

We reviewed all NRs for a consecutive series of patients undergoing a pancreaticoduodenectomy at a single institution from Jan. 1 to Dec. 31, 2008. Seventy-nine variables related to process, surgical manoeuvres and cancer measures were extracted, as well as patient and narrator demographics. The variables were chosen based on the procedure steps and requirements of an NR. The gathered information was coded and evaluated for completeness.

Of the 78 patients identified, 74 NRs were available. The median number of total variables reported was 43.5 (range 13–54). The NRs were dictated by the staff surgeon (19%), clinical fellow (58%) and senior surgical resident (22%). Processes of care and oncologic variables were most commonly omitted from the NRs. Surgical manoeuvre variables were most commonly complete.

Multiple elements related to processes of care and cancer status were often missing from the NRs at a major teaching hospital. Thus, the NR is inadequate to serve as a quality indicator, and its data incompleteness limits its use for research purposes and medico-legal documentation. For quality improvement purposes, development of a synoptic operative report may improve documentation of care.

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Revisiting an old indication: liver transplantation for metastases of neuroendocrine tumour in Canada. ***G. Chan, W. Kocha, R. Reid, W. Wall, D. Quan.*** **From the Multi-Organ Transplant Program, University Hospital, London Regional Cancer Program, Victoria Hospital, London, Ont.**

Neuroendocrine tumours (NET) can be slow-growing and have extended survival despite liver metastases. Liver transplantation (LT) has been reported from numerous centres but has suffered high recurrence rates and variable survival rates. We have recently performed a review of our experience at London Health Sciences Centre and established criteria for the indication of LT for liver metastases of NET: symptomatic and unresectable liver metastases, absence of extrahepatic disease, Ki-67 less than 5% and a minimal interval since initial disease presentation of 5 years.

Four patients have had LT performed for neuroendocrine tumours. Their mean age was 48 years, and 3 were male. In the early era, 1 patient had progression of a previously unknown pancreatic primary with peritoneal metastases and eventually died 4 years after LT. The second patient had a fatal transplant complication of primary nonfunction.

In 2007, 2 patients with a history of small bowel NET were transplanted using the new criteria. The first patient had developed secondary biliary cirrhosis as a complication of hepatic arterial embolizations. The second patient had developed resistance to somatostatin analogues and carcinoid valvulopathy. After transplantation standard immunosuppression and somatostatin analogues were given. Currently, both are without evidence of disease 30 and 24 months after LT.

Liver transplantation is an effective option for patients with liver metastases of NET. Longer follow-up is awaited to fully assess these selection criteria. As with other malignancies and LT, the key to success is appropriate patient selection.

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A prospective, randomized controlled trial of radio-guided seed localization versus standard wire localization of nonpalpable invasive and in situ breast carcinomas. ***P. Lovrics, N. Hodgson, G. Ghola, S. Franic, C. Goldsmith, D. McCready, S. Cornacchi, A. Garnett, M. Reedijk.*** **From the Department of Surgery, McMaster University, Hamilton, and the Department of Surgical Oncology, Princess Margaret Hospital, University Health Network, Toronto, Ont.**

Surgical excision of nonpalpable breast tumours is performed using wire-guided localization (WL). Preliminary studies suggest that radio-guided seed localization (RSL) can decrease positive margin rates. The goal of this study is to determine whether RSL is superior to WL.

The study is a prospective, multicentre study of women with histologically confirmed invasive or ductal carcinoma in situ (DCIS) undergoing localization and breast conserving surgery (BCS). Eligible patients were randomized to either standard WL or RSL. The primary outcome measured was positive margin rate following BCS. Secondary outcomes include cavity margin excision rates, complications, reoperation rates and volume/weight of surgical specimens.

Patients were randomized to receive either wire (n = 151) or seed (n = 149) using either ultrasound (70%) or mammographic guidance (30%). The indication for surgery was either DCIS (18%) or invasive carcinoma (82%). Procedures were performed at 3 sites by 7 surgeons. No differences were found between groups for patient and tumour characteristics (i.e., patient age, tumour size, grade, location, histologic type, extensive intraductal component, lymphovascular invasion, nodal status and estrogen and progesterone receptor status) except for more multifocal disease in the RSL group. Using intention-to-treat analysis, there were no differences in positive margins rates for RSL (10.7%) and WL (11.9%) or for close margins (< 1 mm) (RSL 8.1% and WL 8.6%, p = 0.93). No differences in mean specimen volume (189.5 v. 185.0 mL, p = 0.75) or weight (87.1 v. 81.0 g, p = 0.34) were found between RSL and WL groups. Intraoperative excision of cavity margins (46% v. 47%, p = 0.90), reoperation (15% v. 18%, p = 0.38) and complication rates (12% v. 8%, p = 0.20) were similar.

This trial found that RSL is similar to WL in terms of margin status, reoperation rates and surgical specimen volume. We conclude that RSL is a safe and effective alternative to WL to guide surgical excision of nonpalpable invasive and noninvasive breast cancer.

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Postoperative venous thromboembolism independently predicts disease-specific survival in cancer patients. ***A.S. Scheer, J.I. McSparron, A.R. Schulman, S. Tuorto, M. Gonen, J. Gonsalves, Y. Fong, R.A.C. Auer.*** **From the University of Ottawa, Ottawa, Ont., and the Weill Cornell Medical College, Memorial Sloan-Kettering Cancer Center, New York, NY**

It is unknown whether oncology patients who develop a postoperative venous thromboembolic event (VTE) following complete surgical resection are at the same survival disadvantage as oncology patients who develop a spontaneous VTE.

An institutional database at Memorial Sloan-Kettering Cancer Center identified all cancer patients with abdominal, pelvic, thoracic or soft-tissue procedures between Jan.1, 2000, and Dec. 31, 2005. Patients with a VTE within 30 days of the procedure were identified from a prospective morbidity and mortality database. Patients with stage I–III cancer with a VTE following complete resection were matched 1:10 to controls by age, sex, cancer type, stage and surgical procedure. Overall (OS) and disease-specific survival (DSS) were compared for the entire cohort and for the matched cohort.

Of the 23 541 cancer patients who underwent surgery, 474 (2%) had a postoperative VTE. The median follow-up was 24.9 months. In the entire cohort, VTE patients had a significantly worse 5-year OS compared with controls (49.9% v. 61.1%, $p < 0.0001$). The survival difference was seen in stage I–III but not in stage IV cancer. The type of VTE did not impact OS, and patients with a deep vein thrombosis had a similar survival to patients with a pulmonary embolism. A total of 205 stage I–III VTE patients who underwent a complete resection were matched with 2050 controls. In this matched analysis, VTE patients demonstrated a significantly worse prognosis with an inferior 5-year OS (54.7% v. 66.2%, $p < 0.0001$) and DSS (67.8% v. 80.3%, $p = 0.0007$) for VTE patients as compared with controls.

Postoperative VTE in oncology patients with limited disease and a complete surgical resection is associated with an inferior cancer survival. A postoperative VTE remains a poor prognostic factor, even when controlling for age, stage, cancer type and surgical procedure, further supporting an independent link between hypercoagulability and cancer survival.

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Evidence of quality gaps in the use of radiation therapy for rectal cancer: results from the Quality Initiative in Rectal Cancer (QIRC) trial. ***V. Francescutti, A. Coates, L. Thabane, C.H. Goldsmith, M. Levine, M. Simunovic.*** **From the Department of General Surgery, McMaster University, Hamilton, Ont.**

Ontario guidelines recommend preoperative radiation therapy (RT) for stage II–III rectal cancer to decrease rates of local recurrence (LR). We describe rates of RT use and LR in the Quality Initiative in Rectal Cancer (QIRC) trial, which tested if a surgeon-directed strategy could improve patient outcomes following rectal cancer surgery.

Demographic, tumour and process of care measures were compared among patients receiving preoperative, postoperative or no

RT. A multivariate hazards model was designed for LR risk considering clustering of data at the hospital level, arm of trial and covariables.

The QIRC trial enrolled 1015 patients at 16 Ontario hospitals in 2002–2004. The median follow-up was 3.6 years. The percentage of patients in the preoperative, postoperative and no RT group was 12.8%, 19.3% and 67.9%, respectively. In these same groups, the percentage of stage II–III tumours was 57.0%, 88.7% and 48.1%, respectively. Therefore, only 43% of stage II–III tumours received any RT. Preoperative RT patients were more likely to be male ($p = 0.009$) and to have tumours closer to the anal verge ($p < 0.001$). Postoperative RT patients had tumours that were larger ($p < 0.001$) more poorly differentiated ($p < 0.001$) and with more positive lyphovascular invasion ($p < 0.001$). In the preoperative, postoperative and no RT groups, respectively, permanent colostomy rates were 54%, 27% and 23% ($p < 0.001$), whereas LR rates were 5.3%, 10.2% and 5.5% ($p = 0.095$). The hazard ratio for LR was increased in the postoperative versus no RT group (HR 2.32, 95% CI 1.46–3.67, $p < 0.001$).

Preoperative RT use was very low, most preoperative RT patients received a permanent colostomy, the majority of patients with stage II–III rectal cancer did not receive any RT, and patients receiving postoperative RT had the highest risk of LR. These outcomes and the current approach to RT use in Ontario encourage further research.

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A population-based description of the presentation and management of recurrent rectal cancer.

D.P. Richardson, G. Porter, P.M. Johnson. **From the Division of General Surgery, Dalhousie University, Halifax, NS**

It is unknown if there is variation in presentation and treatment for recurrent rectal cancer relative to the location of treatment for the primary tumour (community hospital v. tertiary care centre).The purpose of this research was to examine the patterns of presentation and care for patients with recurrent rectal cancer from a population perspective in a Canadian province.

A retrospective review of all patients with a new diagnosis of rectal cancer from July 1, 2002, to June 30, 2006, in Nova Scotia was performed. Data were collected from hospital in-patient and out-patient medical records and cancer centre charts in a comprehensive standardized fashion.

Of 468 rectal cancer patients who underwent treatment with curative intent, 124 (26%) developed recurrent disease. Of these, 38% had a local recurrence, 47% had distant disease and 15% had both. Recurrence was detected by surveillance investigations in 56% of patients and by development of symptoms in 44%. Patients who had primary treatment of rectal cancer in a tertiary care centre were more likely to have recurrent disease diagnosed by surveillance investigations compared with patients treated in a community hospital (63% v. 44%, respectively, $p = 0.008$). Overall, 34% of patients with recurrence underwent a potentially curative operation, and 82% of these procedures were performed in the tertiary care centre. Potentially curative treatment for recurrent disease was provided to 38% (18/47) of patients who received their primary treatment at the tertiary care centre and to 30% (23/77) of patients who received their primary treatment in the community ($p > 0.05$).

These data suggest that patients who undergo primary surgery for rectal cancer in community hospitals have equal access to potentially curative surgery for recurrent disease as those who have primary surgery in a tertiary care centre.

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A comparison of instruments to assess male sexual function following treatment for rectal cancer.

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Several studies have reported a high prevalence of sexual dysfunction in male patients following treatment for rectal cancer. Many of these studies have been limited by their retrospective design and failure to use validated instruments. Therefore, the purpose of this study was to compare the results for sexual function obtained on the EORTC QLQ-CR38, a validated colorectal cancer–specific scale, and the International Index of Erectile Dysfunction (IIEF), a validated scale designed to measure sexual function in males.

Male patients with newly diagnosed rectal cancer attending clinics at 5 academic centres were invited to participate in the study. Participants completed the IIEF, EORTC QLQ-C30 and EORTC QLQ-CR38 at the time of diagnosis (time 1), after preoperative chemoradiation when applicable (time 2) and 1 year after surgery (time 3).

Eighty-nine patients were invited to participate in the study and 35 completed the study. The mean age of the participants was 59 years, 92% had restorative procedures and 69% reported being sexually active by 12 months after surgery. Overall, the IIEF scores for each domain were low, reflecting a high degree of sexual dysfunction at all time points. There were no significant differences in the IIEF scores over time with the exception of the erectile function domain and the overall IIEF score, which substantially decreased from time 1 to time 3 but did not reach statistical significance. Interestingly, the scores for the male sexual problems domain of the EORTC QLQ-CR-38 showed a significant increase, reflecting an increase in symptoms relating to erection and ejaculation over time ($p = 0.002$).

Based on this study, the EORTC QLQ-CR-38 seems to be a relatively sensitive and reliable instrument to measure male sexual function following rectal cancer when compared with the IIEF.

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Impact of carcinoembryonic antigen-related cell adhesion molecule 1 (CEACAM1) expression in liver metastasis.

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Carcinoembryonic antigen-related cell adhesion molecules (CEACAM) are a group of intercellular adhesion molecules named after the tumour marker CEA. There are emerging data to suggest tumour overexpression of different CEACAMs may influence cancer metastasis; however, the mechanism is unclear. Since CEACAM1 was shown to bind to itself and other CEACAMs and CEACAM1 is expressed on hepatic endothelium, we hypothesized that CEACAM1 promotes cancer metastasis by directly mediating

binding between circulating tumour cells and hepatic endothelium.

To measure the impact of endothelial CEACAM1 expression, liver metastasis assays were performed by intrasplenic injection of MC38 cells (a mouse colon cancer cell line with low CEACAM1 expression) into CEACAM1+/+ and CEACAM1–/– mice. In addition, we have measured hepatic recruitment of intrasplenically injected MC38 cells immediately and 48 hours after injection by intravital microscopy (IVM) in CEACAM1+/+ and CEACAM1–/– mice. To measure the impact of CEACAM1 expression in cancer cells, we have increased the CEACAM1 expression level by infecting MC38 cells with retroviruses carrying CEACAM1 expression vectors. The migratory ability of CEACAM1 overexpressing MC38 cells was then compared with the parental MC38 cells by IVM.

Development of liver metastases after intrasplenic injection of MC38 cells was reduced by 81% in the CEACAM1–/– mice compared with CEACAM1+/+ mice. Using IVM, we observed a 45% decrease in hepatic recruitment of intrasplenically injected MC38 cells. Forced expression of CEACAM1 in MC38 cells, however, did not significantly increase hepatic recruitment. At 48 hours after injection, survival of recruited MC38 cells in CEACAM1–/– mice decreased by 3-fold compared with CEACAM1+/+ mice.

In conclusion, hepatic endothelial but not cancer cell CEACAM1 expression supports liver metastasis by increasing the adherence of circulating tumour cells to hepatic endothelium. Endogenous CEACAM1 expression also enhances cell survival in liver. Further investigation is required to dissect the exact molecular mechanism of how CEACAM1 mediates these effects.

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Mucinous tumour of the appendix with peritoneal spread: Is there a role for expectant observation? *F. Zih, T. Panzarella, C. Hummel, J. Petronis, A. McCart,C. Swallow.* From the Department of Surgical Oncology, Mount Sinai Hospital, Princess Margaret Hospital, University of Toronto, Toronto, Ont.

Cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC) are the standard management for mucinous tumours of appendiceal origin at many centres. We examined the role of expectant observational management in patients who had already undergone initial minimal resection at the time of referral to our centre.

Charts of patients referred for surgical management of peritoneal malignancy between January 1998 and December 2009 were retrospectively reviewed. In all, 101 patients with primary appendiceal malignancy comprised the study group. Overall (OS) and progression-free survival (PFS) curves were generated by the Kaplan–Meier method and compared using Log rank; significance was set at $p = 0.05$.

In the group of 101, 60 were female and their median age was 55. Treatment consisted of supportive care in 8, systemic chemotherapy in 8, referral to another centre for CRS/HIPEC in 7, CRS without HIPEC at our centre (SX) in 52 and observation only (OBS) in 26. The OBS group was selected based on favourable histology and no/minimal residual disease on imaging. There was no difference in sex, age or follow-up time between the SX and OBS groups. In the SX group, 2 patients died and 29 progressed, whereas in the OBS group, 0 died and 2 progressed ($p = 0.302$ for OS and 0.0005 for PFS) at last follow-up. In the SX group, determinants of OS were histology (low v. intermediate/high grade, $p = 0.037$) and age ($p = 0.009$), whereas determinants of PFS were extent of residual disease after CRS (none/minimal v. significant, $p = 0.0009$) and age ($p = 0.0008$).

In patients who underwent CRS for mucinous tumour of appendiceal origin, prognostic factors were the same as in many published series, with age being of particular importance. In well selected patients who have undergone an initial minimal resection, a program of observation (clinical and radiologic monitoring) can result in excellent OS and PFS.

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Use of adjuvant chemotherapy in elderly colorectal cancer patients: a case–control study. *A Mathieson, P.F. Ridgway, Y.J. Ko, A.J. Smith.* From the Departments of Surgery and Medical Oncology, Sunnybrook Health Sciences Centre, Odette Cancer Centre, Toronto, Ont.

Adjuvant chemotherapy in stage III colorectal cancer provides clear survival advantages; however, effectiveness in the elderly is unclear as surgeons and medical oncologists have been reticent to submit this group to adjuvant therapy. We examine the contemporary application and tolerability of chemotherapy in the elderly.

A single-institution case–control retrospective review of a prospective database was conducted. Stage III colorectal cancer patients treated between July 1999 and December 2005 were included. The elderly group was those over 70 years and the control group was aged 50–70. Statistical analysis was conducted using the Mann–Whitney *U* test and Kaplan–Meier estimates with chemotherapy use as the primary outcome measure.

A total of 100 elderly patients and 118 young patients was identified in the institutional database. Twenty-nine elderly patients and 36 young patients were excluded as data were incomplete, or they declared stage IV before chemotherapy. In all, 154 patients (71 elderly, 83 young) were analyzed. The rate of chemotherapy given to the elderly group was 61% versus 98.8% in the younger group ($p < 0.001$). The rate of dose reduction in the elderly and young groups was 39.5% and 31.7%, respectively ($p = 0.38$). The adjuvant chemotherapy completion rate was 81.4% for the elderly and 80.4% for the young group ($p = 0.90$). There was no clinical difference in ECOG score, ASA score, sex, nodes excised or number of positive nodes.

Outcomes in the elderly group were significantly influenced by adjuvant therapy. The overall 5-year survival rate for the elderly group that received chemotherapy was 90.4% versus 35.2% ($p < 0.001$) for those not given adjuvant therapy.

Adjuvant chemotherapy is prescribed less frequently to elderly patients. Once started on chemotherapy, elderly patients seem to tolerate chemotherapy well with increased survival. Age itself should not be contraindication to adjuvant chemotherapy and thus should be considered in all elderly patients.

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Local breast cancer recurrence after mastectomy and immediate reconstruction for invasive cancer: a meta-analysis. *M. Gieni, L. Dickson, N. Sne, R. Avram, F. Farrokhyar.* From the Department of Surgery, McMaster University, Hamilton, Ont.

There is a lack of consensus as to the oncologic safety of immedi-

ate breast reconstruction (IBR), particularly in those patients with advanced disease. The purpose of this paper is to systematically review the literature and to compare the recurrence rates in patients with and without IBR following mastectomy for first-time invasive breast cancer.

Two independent investigators searched PubMed, EMBASE and Cochrane databases from their origin to December 2008, using the search terms "breast reconstruction, immediate" and "breast cancer" or "carcinoma." This returned a total of 3080 titles. After the titles were reviewed, 228 abstracts remained. The abstracts were reviewed and resulted in 143 relevant articles. After inclusion and exclusion criteria were applied, 8 articles remained. Each article was assessed for quality by 2 independent investigators using a standardized scoring scale (MINORs). Relevant data were collected. The primary outcome was local recurrence of breast cancer.

Results demonstrated an interrater reliability of 75% with 95% confidence intervals. There was no evidence of study heterogeneity ($I^2 = 6.3\%$, $p = 0.397$). The odds ratio for recurrence of breast cancer with mastectomy and IBR as compared with mastectomy alone was 0.790 (p = of 0.285, 95% CI), indicating no significant difference. Subgroup analysis was not performed for recurrence based on stage or reconstruction type owing to the lack of data reported.

This meta-analysis, while limited by the quality of the studies it reviewed, concluded that there was no evidence of increased frequency of breast cancer recurrence when immediate postmastectomy reconstruction is compared with mastectomy alone in patients with invasive breast cancer. Data on recurrence rates in immediately reconstructed patients with advanced disease are limited, and future studies should focus on this patient population.

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Exploring the flavonoid fisetin as a possible novel treatment for breast cancer. *M. Smith, C. Giacomantonio, D. Hoskin.* From the Departments of Surgery, Microbiology and Immunology, Pathology, Queen Elizabeth II Health Science Centres, Dalhousie University, Halifax, NS

The objective of this study was to investigate the dietary phytochemical, fisetin, as a potential treatment for breast cancer. This study used molecular biological methods to investigate the in vitro effect of fisetin on a panel of breast cancer cell lines (MCF-7, MDA-MB-231 and MDA-MB-468 adenocarcinomas and T47-D ductal carcinoma). The in vitro effect of fisetin on human mammary epithelial cells was also determined. MTT, crystal violet, phosphatase and colony-forming assays were used to assess fisetin's effect on breast cancer cell viability. The mechanism of fisetin-induced cytotoxicity was determined using annexin V–propidium iodide staining and the JAM assay to measure DNA fragmentation. Apoptosis induction pathways were studied using selective caspase inhibitors and Western blotting, whereas the impact of fisetin on mitochondrial membrane stability was determined using DiOC6 staining. Cell viability assays demonstrated a variable effect by fisetin on breast cancer cell lines, ranging from a 26% (T47-D) to 70% (MDA-MB-468) decrease in cell viability at 100 μM fisetin after 72 hours. In contrast, human mammary epithelial cells were resistant to concentrations of fisetin that killed breast cancer cells. Annexin V–propidium iodide staining revealed that 50% of fisetin-treated breast cancer cells died by apoptosis. Caspase activation and mitochondrial destabilization are suggested as possible mechanisms of apoptosis induction. Additional study is required to further delineate the mechanism of action, as well as to show efficacy of fisetin in a mouse model of breast cancer. We conclude that fisetin warrants further investigation as a possible novel treatment for breast cancer. (Supported by the Canadian Breast Cancer Foundation, Atlantic Region).

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Retroperitoneal sarcoma: time to change. *C. Doyon, G. Martin, E. Patocskai.* From the Département de chirurgie oncologique et hépatobiliaire, Centres hospitaliers universitaires, Université de Montréal, Montréal, Que.

The aim of this study was to generate a hypothesis and propose possible solutions to improve management and survival of retroperitoneal sarcoma (RPS) in Montréal centres.

This retrospective study reviewed the treatment modalities used within the centres affiliated with the Centres hospitaliers de l'Université de Montréal (CHUM) and their success with recurrence, disease-free (DFS) and overall survival (OS). Thirty-nine patients' medical records were reviewed; primary, recurrent, local and metastatic diseases were included.

Thirty-six patients presented with a primary RPS and 3 patients with recurrence. Thirty-one patients (79%) underwent surgery (median tumour size 21.5 cm^2). Ten percent received neoadjuvant or adjuvant radiotherapy and 26% received chemotherapy. After a median follow-up of 60.3 months, 23 patients (72%) developed recurrence at a median interval of 39 months after surgery. The median OS for the entire population was 46.2 months, and 5-year DFS and OS rates among patients with resection were 24% and 57%, respectively. More than 25% and 48% of pathological reports were missing data on margin status and tumour grade, respectively.

In the current study, the survival rate appears higher than in the literature (54% v. 44%) with similar follow-up; however, so does the recurrence rate (76% v. 50%). This could be explained in part by the larger median tumour size in our study, the underutilization of other treatment modalities and by the high percentage of referral for recurrence. The high proportion of missing data in pathological reports led us to suggest that every pathological report should use standardized methods of reporting pathology findings. Evidence of good results with a multimodal approach is increasing in the literature, and Montréal centres should improve their treatment modalities to stand in rivalry with international community.

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A structured strategy to develop a combined minimally invasive surgical oncology fellowship program. *S.S. Brar, F. Wright, A. Okrainec, A.J. Smith.* From the London School of Economics, London, UK, and the Division of General Surgery, University of Toronto, Toronto, Ont.

Fellowship training in surgical oncology is continually evolving, not only to keep up with the advances in cancer care and the adoption of new technologies, but also to meet the needs of their trainees for a structured, state-of-the-art education in the delivery of excellent patient care in a multimodality setting. Current guidelines reflect the growing acceptance in the mainstream of the use of minimally invasive surgery (MIS) in oncology. Graduates of Canadian general surgery residency programs are not ade-

quately taught advanced laparoscopic surgery skills. Incorporating advanced laparoscopic surgery training during fellowship training occurs on an ad hoc basis in many surgical oncology programs.

We present the template for a structured minimally invasive surgical oncology fellowship. This fellowship is a collaboration between existing MIS and surgical oncology fellowships at the University of Toronto.

The structure of the program will seek to incorporate evidence-based strategies in MIS training within the framework of multimodality training in surgical oncology. Fellows in this stream will train and certify in the Fundamentals of Laparoscopic Surgery (FLS) course. Fellows will complete 1 full year of dedicated MIS training followed by 15 months of surgical oncology training. Minimal standards for case volume will be established, and training will be tailored to meet the career goals of the fellows.

We propose that a formalized MIS surgical oncology fellowship will allow trainees to benefit from an effective training curriculum and draw upon existing structures and mentorship opportunities in both programs.

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Evaluation of a tool for colorectal cancer surveillance. ***D.A. Bischof, B. Maier, M. Fitch, F.C. Wright.*** **From the Department of Surgery, University of Toronto, Toronto, Ont.**

At our tertiary care cancer centre, we introduced a postoperative tool that described when visits, imaging and colonoscopies should be completed for patients with colorectal cancer (CRC). The purpose of this tool was to enhance patient understanding and engagement in their postoperative care.

Mixed methods were used to evaluate the effect of the tool on patients' surveillance experiences. A survey was mailed to all card recipients to evaluate their use of the tool and its perceived value. Qualitative interviews were completed with selected survey respondents to better understand how the tool affected surveillance and to identify how the process of using the passport may be improved. Themes were generated using standard qualitative methodology.

Fifty-eight percent of patients returned the survey, of whom 61% remembered receiving the tool. Of those, 35% reported still using the tool. Median surveillance was 71 months. Thirty-five percent of patients who remembered receiving the card were asked to show the tool by their health care provider in clinic. Twelve qualitative interviews were completed, and generated themes included satisfaction with follow-up care, understanding the importance of surveillance, lack of a system-wide approach to incorporating the tool into everyday use and patient generation of own tools for follow-up.

Most patients value close surveillance for CRC, and most frequently used their own tools to track surveillance. Successful implementation of surveillance tools would require a system-wide approach. We foresee with the anticipated increase in patient volumes that patients will become more involved in their own postoperative surveillance and survivorship plans.

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Initial institutional experience and validation of subareolar injection for sentinel lymph node biopsy in breast cancer patients. ***C. R. Baliski, A. Kluftinger, M. MacLeod, S. Kwong.*** **From the Departments of Surgery, Surgical Oncology and Diagnostic Imaging, Kelowna General Hospital, BC Cancer Agency, Kelowna, BC.**

Sentinel lymph node biopsy (SLNB) has become the standard of care in the initial treatment and staging of patients with early stage breast cancer. We sought to validate the subareolar concept and the SLNB procedure in our initial institutional experience with SLNB for breast cancer.

We conducted a retrospective cohort study involving simultaneous SLNB and completion axillary dissections in patients with clinical T1 and T2 tumours.

Over a period of 16 months, 97 patients with clinical stage I and II breast cancer underwent simultaneous SLNB and completion axillary dissection. There were 98 SLNBs performed in 97 patients, with a SLN identified in 89.8% (85/98) of patients. Only 1 patient had a pathologically involved non-SLN and a negative SLN resulting in a false negative rate of 1.2% (1/85).

Sentinel lymph node biopsy, using a subareolar injection, appears to be an accurate procedure at our institution. The sentinel lymph node identification rate was lower than other published reports, likely a result of the early learning curve. These outcomes appear to be consistent with other reports in the literature, and have allowed us to proceed with stand-alone SLNB in patients with early stage breast cancer.

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In search of a gold standard scoring system for cosmetic outcomes following breast conserving therapy. ***J.M. Racz, A. Fortin, S. Latosinsky.*** **From the Division of General Surgery, University of Western Ontario, London Health Sciences Centre, London, Ont.**

The absence of a widely accepted method for aesthetic evaluation following breast-conserving therapy limits the ability to evaluate cosmetic outcomes. In this study, 2 different approaches using previously described panel scores were compared in an attempt to identify a gold standard scoring system for cosmetic outcomes following breast-conserving therapy.

Women who underwent breast-conserving therapy within the past 1–2 years were recruited from a single breast centre. Photographs of each participant in 5 standard views were evaluated independently by 12 health care professionals involved in breast cancer diagnosis and treatment using the Danoff 4-point scale. Final cosmetic scores were obtained using a random 3 panel score derived from both the Danoff 4-point scale and the Delphi method. Agreement between these 2 approaches was assessed with a weighted kappa statistic.

Ninety-seven women were evaluated. The Delphi approach required 3 rounds of evaluation to obtain greater than 50% agreement in all photographs. The weighted kappa statistic between scores using the 2 approaches described above reached substantial agreement at 0.80 with a 95% confidence interval between 0.71 and 0.89.

Cosmetic outcomes following breast conserving therapy using a 3-panel and Delphi panel score provide similar results, suggesting the validity of either approach. Simplicity of use and interpretation, however, would favour the 3-panel score for breast cosmetic evaluation over the Delphi panel score.

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Synoptic reporting in rectal cancer: Has this standardized the quality of reporting between gastrointestinal pathologists? ***D.E. Messenger, R. Kirsch, R.S. McLeod.*** **From the Departments of General Surgery and Pathology, Dr. Zane Cohen Clinical Research Centre, Samuel Lunenfeld Research Institute, Mount Sinai Hospital, Toronto, Ont.**

The objectives of this study were to determine whether the introduction of a synoptic report increased the completeness of reporting of rectal cancer specimens and to detect differences in reporting between specialist gastrointestinal and nongastrointestinal pathologists.

All pathology reports from patients undergoing resection of a rectal cancer between 1997 and 2006 at Mount Sinai Hospital were identified and assessed for completeness according to a set of prognostic features identified by the College of American Pathologists checklist. Reporting inconsistencies were clarified by a gastrointestinal pathologist blinded to their original formulation. A standardized synoptic report was introduced in December 2001, although its use was not mandatory.

A total of 441 reports were analyzed, of which 51.1% (226/441) were synoptic. Gastrointestinal pathologists issued 26.3% (116/441) of all reports. Synoptic reports were more complete than narrative reports for TNM stage (92.5% v. 20.5%, $p < 0.001$), distance to radial margin (97.6% v. 86.4%, $p < 0.001$), tumour grade (96.9% v. 91.2%, $p = 0.015$), lymphovascular invasion (LVI; 96.9% v. 33.0%, $p < 0.001$), extramural venous invasion (EMVI; 95.1% v. 34.4%, $p < 0.001$) and perineural invasion (PNI; 97.7 v. 11.6, $p < 0.001$). Reports issued by nongastrointestinal pathologists using a narrative format were less likely to be complete for LVI (50.0% v. 30.1%, $p = 0.027$) and EMVI (59.4% v. 30.1%, $p = 0.001$), but there was no difference in completeness once synoptic reports were adopted. Narrative reports from gastrointestinal pathologists were more likely to identify the presence of EMVI (15.6% v. 4.4%, $p = 0.029$), with this difference still remaining despite the adoption of a synoptic report (27.4% v. 14.8%, $p = 0.021$).

Adoption of a synoptic report dramatically improved the completeness of reporting of rectal cancer, particularly among nongastrointestinal pathologists. However, nongastrointestinal pathologists continued to identify EMVI less frequently, highlighting concerns about quality and potential access to adjuvant chemotherapy.

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Withdrawn

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Utilization patterns and oncologic outcomes of laparoscopic colon cancer resection: a real-time synopsis of the BC experience. ***N. Aslani, B. Heidary, K. Lobo Prabhu, M. Raval, P.T. Phang, C. Brow.*** **From the University of British Columbia, BC Cancer Agency, Vancouver, BC**

Laparoscopic colon resection has been shown to have equivalent long-term outcomes for survival and disease recurrence in RCTs when performed by well trained surgeons experienced in both laparoscopic and open surgery. We examined the implementation of laparoscopic surgery for colon cancer in the province of British Columbia over the past 5 years. The goal of this study was to evaluate the outcomes of laparoscopic colon resection in the real world setting as performed by general surgeons with varied experiences and training. We identified all curable colon cancers referred to the BC Cancer Agency during 2003–2007, using the prospectively collected Colorectal Cancer Outcomes Unit (CRCOU) database. With the aid of the database and retrospective chart review, all laparoscopic colon resections were identified. Trends in utilization of laparoscopic surgery and its relation to surgical outcomes were analyzed. The use of laparoscopic colon resection increased annually from 2% of all resections in 2003 to 38% in 2007. Hospitals with high volumes of colon surgery performed a significantly higher proportion of those surgeries laparoscopically compared with low-volume hospitals (20% v. 7%, $p < 0.001$). Laparoscopic surgery was more likely to be performed in the elective setting ($p < 0.001$) and for smaller tumours ($p < 0.001$). There was no difference in the number of lymph nodes harvested, disease-free survival and overall survival between open and laparoscopic groups. Our results demonstrate the increased uptake of laparoscopic surgery in the province of British Columbia during 2003–2007. This increase was temporally related to the publication of the Clinical Outcomes of Surgical Therapy trial in 2004. The uptake of laparoscopic colon resection by general surgeons with varied backgrounds outside of the trial conditions appears to be effective and results in good patient outcomes.

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Self-reported patterns of rectal cancer care among general surgeons in Canada. ***D.P. Richardson, G. Porter, P.M. Johnson.*** **From the Division of General Surgery, Dalhousie University, Halifax, NS**

Surgeons play a central role in the management of rectal cancer and are responsible for making decisions that will impact patient outcomes. The purpose of this study was to examine practice patterns and surgeon knowledge of rectal cancer care issues among general surgeons in Canada.

A questionnaire was mailed to all practicing general surgeons in Canada. Data were collected regarding clinical practice patterns and knowledge of rectal cancer care.

Questionnaires were mailed to 1672 general surgeons and 644 (39%) were returned. Of surgeons who responded, 51% treat patients with rectal cancer and 16% have colorectal or surgical oncology fellowship training. Given a clinical scenario with a healthy 55-year-old patient with a rectal cancer 5 cm above the anorectal ring and T3N1 on preoperative imaging, 76% of surgeons would recommend neoadjuvant therapy followed by a radical sphincter-preserving procedure, 12% would refer the patient and 12% would perform an abdominoperineal resection. Given a clinical scenario with a healthy 55-year-old patient with rectal cancer 5 cm above the anorectal ring and T2N0 on preoperative imaging, 60% of surgeons would perform a radical sphincter-preserving procedure with adjuvant therapy if indicated by pathology, 12% would refer the patient and 28% selected other treatment options. Surgeons were asked how many lymph nodes are recommended for staging rectal cancer and only 57% answered correctly (12 nodes). Only 42% of surgeons felt an adequate distal margin for an upper rectal cancer was 5 cm. For all items on the survey, the responses from surgeons with colorectal or surgical oncology training were significantly different compared with surgeons without fellowship training.

The data suggest there is variability in the management of patients with low rectal cancer and deficiencies in surgeon knowledge of rectal cancer care issues.

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Hand-assisted versus conventional laparoscopic colorectal resections: a systematic review and meta-analysis. ***H. Moloo, F. Haggar, S. Duhaime, B. Hutton, J. Grimshaw, D. Coyle, E.C. Poulin, J. Mamazza, R.P. Boushey.*** **From the Departments of Surgery and Epidemiology, The Ottawa Hospital and The Ottawa Hospital Research Institute, Ottawa, Ont.**

Our aim was to estimate the perioperative outcomes of hand-assisted laparoscopic surgery (HALS) compared with conventional laparoscopic surgery in patients requiring colorectal resections.

We searched EMBASE, MEDLINE and the Cochrane Register of Controlled Trials for studies from 1980 to February 2010. Studies included randomized controlled trials comparing hand-assisted laparoscopic surgery or conventional laparoscopic colorectal surgery for benign or malignant colorectal disease. Reports of potentially relevant articles were retrieved in full text, and 2 reviewers independently assessed the eligibility of these studies. Data abstraction was performed independently by 2 reviewers. Meta-analysis of study level perioperative outcome measures was carried out using a random effects model for weighted mean differences for continuous variables and odds ratios for dichotomous variables.

Three randomized controlled studies met the inclusion criteria for this review (n = 189). These were clinically heterogeneous in terms of indication for surgery. One study focused on malignant pathology, the second on almost exclusively benign pathology, whereas the most recent trial had a mixed variety of pathology with approximately a third representing malignant pathology. Patient characteristics also varied between studies in terms of age. Conversion rate in the HALS group was significantly less decreased compared with the conventional laparoscopic group (OR 0.32 conversions, 95% CI 0.11–0.90 conversions, p = 0.03). There was a trend toward decreased operative time in patients undergoing hand-assisted surgery compared with the conventional approach (–23.0 min, 95% CI –46.4 to 2.41 min, p = 0.08). There was no difference in complication rates or length of stay.

Meta-analysis demonstrated a decreased conversion rate and a trend toward decreased operative time in the HALS group. Additional adequately powered and methodologically sound trials are needed to determine if there is a clinically important difference in perioperative outcomes. Owing to significant costs associated with the use of hand-assist devices, economic analyses are also warranted.

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Mortality and major morbidity following rectal cancer surgery in the United States. ***B.C. Paun, A.A.M. Shaheen, E. Dixon, A.R. Maclean, W.D. Buie.*** **From the Department of Surgery, Foothills Medical Centre, University of Calgary, Calgary, Alta.**

Patients undergoing rectal cancer surgery face significant risks of mortality and morbidity. The aim of this study was to determine complication rates for rectal cancer surgery in the Nationwide Inpatient Sample database.

Using ICD-9 codes, all adult patients with a diagnosis of malignant neoplasm of the rectum that underwent sphincter-saving surgery (SSS) or nonrestorative surgery (NRS) during 1993–2007 were identified. Primary outcomes were in-hospital death and major surgical complication requiring a second operation (reoperation). A reoperation was considered to have occurred if laparotomy or closure of abdominal wall (for either type of surgery) plus exteriorization of intestine or stoma (for SSS) was coded after the original operation. We used logistic regression to construct multivariable models for predictors of mortality using the entire cohort and for reoperation using the SSS and NRS cohorts separately.

There were 55 927 radical rectal cancer surgeries, 55.9% of which were SSS. The in-hospital mortality rate for SSS was 1.3% (95% CI 1.2–1.4) and for NRS 2.5% (95% CI 2.3–2.7). In the multivariable model, patient age, comorbidities, malnutrition and reoperation were strong predictors of in patient mortality, whereas male sex, nonprivate insurance, emergency admission, transfusion, low hospital volume and NRS were weaker predictors of mortality. The reoperation rate for SSS was 6.9% (95% CI 6.4–7.4) and for NRS 1.9% (95% CI 1.7–2.1). For SSS, significant predictors of reoperation were young age, male sex, elective admission, transfusion, malnutrition, high hospital volume and later year of admission. For NRS, significant predictors of reoperation were male sex, transfusion and malnutrition.

Nonrestorative surgeries for rectal cancer have higher mortality than sphincter-saving surgeries. The strongest predictors of postoperative mortality are patient-specific variables, like age and comorbidities, and major surgical complications, indicated by reoperation. Although high-volume hospitals have higher reoperation rates, the associated lower mortality rates reflect appropriate management of surgical complications.

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Transcolonic peritonoscopy and drainage of abdominal abscess in a canine survival model: experiment a natural orifice transluminal endoscopic surgery (NOTES). ***F. Moustarah, J. Talarico, J. Zink, P. Gatmaitan,***

P. Schauer, B. Chand, S. Brethauer. **From the Bariatric and Metabolic Institute, Cleveland Clinic Foundation, Cleveland, Ohio**

Natural orifice transcolonic drainage of intra-abdominal abscesses in a canine survival model was studied to evaluate the difficulty of peritonscopy and abscess drainage as well as the reliability of endoluminal colotomy closure.

A 7-cm nonsterile saline-filled latex balloon is placed intra-abdominally to mimic or induce formation of an abscess or inflammatory mass. Seven days later, a single channel endoscope is then advanced transanally into the sigmoid colon of the survived animal, where a colotomy is made and the endoscope is advanced intraperitoneally. The identified abscess is evacuated, and a drain is placed transabdominally and positioned under endoscopy. The colotomy is closed endoluminally with a tissue-approximation system (TAS; Ethicon Endo-surgery Inc.) using 2 polypropylene sutures attached to metal T bars. Two weeks later, the colotomy closure is evaluated at laparotomy.

Twelve dogs (25 kg average weight) were studied: 8 had subphrenic balloon implants and 4 had interbowel loop implants. Eleven animals survived to undergo transcolonic peritonoscopy. Of these, the "abscess" was identified in 9. One dog exited the study after a bladder injury, and the colotomy was successfully closed in 10 of 11 dogs. Although abscesses were easily identified, the overall difficulty of the peritonoscopy was rated as moderate to severe. One out of 10 dogs required colotomy closure via laparotomy, whereas 9 had successful endoluminal closure using TAS. After colotomy closure, 8 animals survived for 2 weeks (study end point) without surgical complications, sepsis or localized abdominal infections. Postmortem examinations revealed all closures to be intact without any adjacent organ damage or procedure-related complications.

A working canine survival model of intra-abdominal abscess formation and treatment is presented for natural orifice transluminal endoscopic surgery (NOTES) research. Natural orifice transluminal endoscopic surgery provides a novel alternative to treating intra-abdominal pathology. It is technically feasible to perform endoscopic transcolonic peritonoscopy and drainage of an intra-abdominal abscess with reliable closure of the colotomy.

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Laparoscopic and open surgery for colorectal cancer: an overview of reviews. ***G. Martel, S. Duhaime, C.R. Ramsay, J.S. Barkun, D.A. Ferguson, R.P. Boushey.*** **From the Department of Surgery, The Ottawa Hospital, The Ottawa Hospital Research Institute, University of Ottawa, Ottawa, Ont., the Health Services Research Unit, University of Aberdeen, Aberdeen, UK, and the Department of Surgery, McGill University, Montréal, Que.**

Several systematic reviews and meta-analyses populate the literature on laparoscopic surgery for colorectal cancer. The utility of this body of work is unclear. The objective of this study was to synthesize all systematic reviews pertaining to laparoscopic surgery for colorectal cancer and to determine whether areas of duplication exist across reviews.

A search for systematic reviews comparing laparoscopic and open surgery for colorectal cancer was conducted according to a comprehensive protocol (1991–2009). The primary outcome of interest was overall survival. The quality of included reviews was appraised using the AMSTAR instrument. Data abstraction and quality appraisal were carried out by 2 independent reviewers. Included reviews were synthesized, and outcomes of interests were compared across reviews.

In total, 25 reviews were included, spanning 1994 to 2008. Of those, 12 reviews included only randomized controlled trials. Rectal cancer was addressed exclusively by 4 reviews. Inclusion and exclusion criteria varied widely across reviews, as did the reported outcomes of interests. The median AMSTAR methodological quality score was 6 (range 1–11). Overall survival was evaluated by 5 reviews, of which only 2 provided a meta-analysis of time to event data. The reported hazard ratios for overall survival were 0.88 (95% CI 0.56–1.39) and 1.07 (95% CI 0.83–1.37). The incidence of port site metastasis was addressed by 8 reviews, none of which identified a significant difference. Among numerous other oncologic and short-term postoperative outcomes, only operative time (longer for laparoscopic surgery) and length of stay in hospital (shorter for laparoscopic surgery) yielded consistently congruent results across reviews.

Existing systematic reviews of laparoscopic surgery for colorectal cancer are highly variable in methods and quality. Significant areas of overlap exist across reviews, although few have adequately addressed overall survival as an outcome of interest. Only operative time and length of stay in hospital can be found to yield consistently congruent results across reviews.

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Development of an evaluation tool to assess technical skill in laparoscopic colorectal surgery: a Delphi approach. ***V.N. Palter, H.M. MacRae, T.P. Grantcharov.*** **From the Department of Surgery, St. Michael's Hospital, Mount Sinai Hospital, Toronto, Ont.**

A Delphi consensus methodology was used to design an objective technical skills assessment tool for laparoscopic colorectal surgery.

Eighteen experts in laparoscopic colorectal surgery participated in this study. Each expert was sent an online survey and were asked to rate, on a Likert scale from 1 to 5, the surgical substeps of laparoscopic right and sigmoid colectomy with respect to the level that they believed that each substep should be included in a final evaluation tool. In addition, participants were offered the opportunity to comment on each substep or to clarify their ratings. The survey was then returned to the panelists with the group mean and standard deviation for each substep. The experts were asked to rerate each substep given this information. This iterative process occurred until consensus was reached. Consensus was predefined as a Cronbach α greater than 0.80. Surgical substeps that 80% of experts rated as 4 or 5 on a Likert scale of 1–5 were included in the final instrument.

In the first round of the consensus survey, the Cronbach α was 0.81 for laparoscopic sigmoid colectomy, 0.77 for right (medial to lateral) laparoscopic colectomy and 0.74 for right (lateral to medial) laparoscopic colectomy. In the second round, it increased to 0.83 for medial to lateral laparoscopic right colectomy and 0.82 for lateral to medial laparoscopic right colectomy.

The Delphi method allowed the determination of expert consensus regarding the essential surgical substeps to be included in an evaluation tool designed to measure technical competence in laparo-

scopic colorectal surgery. The final technical skills assessment tool reflects the consensus of experts in minimally invasive colorectal surgery across Canada, the United States, Europe and Australia. This represents the initial step in outlining a rigorous methodology to define technical competence in laparoscopic colorectal surgery.

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Laparoscopic subtotal colectomy is safe in patients with active Crohn and ulcerative colitis. ***D.E. Messenger, J.C. Victor, B.I. O'Connor, H.M. MacRae, R.S. McLeod.*** **From the Department of General Surgery, Dr. Zane Cohen Clinical Research Centre, Samuel Lunenfeld Research Institute, Mount Sinai Hospital, Toronto, Ont.**

Cosmesis is a major concern to patients having surgery for inflammatory bowel disease. However, there is limited evidence about the safety and potential benefits of laparoscopic subtotal colectomy (STC) in patients with active colitis. This study compared outcomes between laparoscopic and open STCs in patients treated at a specialist centre.

A total of 244 consecutive patients undergoing STC between 2000 and 2009 were identified from a prospectively maintained database. A standard operative technique was employed for both laparoscopic and open STCs, with cases performed by non–laparoscopic surgeons being excluded. Demographic details, baseline indicators of disease severity and year of surgery were incorporated into a multivariate analysis of postoperative outcomes.

Laparoscopic STCs comprised 40.2% (98/244) of total cases. Only 7.1% (7/98) of laparoscopic cases were converted to an open procedure. Laparoscopic STCs were performed more frequently in female patients (62.2% v. 49.7%, $p = 0.047$) and those with nonurgent, severe colitis (75.5% v. 49.7%, $p < 0.001$). Patients in the laparoscopic group had a higher preoperative albumin level (35.5 g/L v. 32.0 g/L, $p = 0.003$), a lower prednisolone requirement (27 mg v. 42 mg, $p = 0.004$) and an increased use of antitumour necrosis factor agents (43.9% v. 15.1%, $p < 0.001$). There was no difference in the proportion of patients undergoing surgery for Crohn colitis in either group. Regression analysis revealed that laparoscopic cases took 28.3 minutes longer ($p < 0.001$) but experienced fewer minor complications (OR 0.17, 95% CI 0.04–0.48, $p = 0.002$) and had a shorter postoperative length of stay by 1.1 days ($p = 0.016$). No differences in blood loss, opiate requirements, major complications, small bowel obstruction or incisional herniation were demonstrated.

The laparoscopic approach to STC reduces the rate of minor complications and reduces the length of postoperative stay at the expense of increased operative duration. Laparoscopic STC is safe and advantageous, even in selected cases of acute severe colitis.

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Single-port laparoscopic colorectal surgery (SPLS): early clinical experience. ***S. Al-Sabah, L.S. Feldman, P. Charlebois, B. Stein, P.A. Kaneva, G.M. Fried, A.S. Liberman.*** **From the Steinberg-Bernstein Centre for Minimally Invasive Surgery and Innovation, Section of Colon and Rectal Surgery, Montréal General Hospital, McGill University Health Centre, Montréal, Que.**

Single-port laparoscopic surgery (SPLS) for colorectal pathology is an advanced technique wherein laparoscopic surgery is carried out through a single small incision hidden in the umbilicus. Advantages of this technique over standard laparoscopy are still under investigation.

Our objective is to report our initial experience and short-term outcomes of SPLS colorectal surgeries in a single academic-based institution.

We performed SPLS procedures in 5 patients for various indications (neoplasm, Crohn disease, diverticular disease, appendicitis). Cases included 3 right hemicolectomies, 1 sigmoidectomy and 1 appendectomy. Data were prospectively collected. All procedures were performed using a single-port device (SILS Port, Covidien) and a combination of standard and specialized articulating instruments. Operative and perioperative outcomes are described, and data are presented as mean (± SD).

Mean age was 52 (± 4.3) and BMI was 23 (± 3.8, range 19.7–27.9) kg/m^2. Operative time for right hemicolectomy was 120 (range 95–136) minutes, sigmoidectomy 201 minutes and appendectomy 69 minutes. Measured incision length was 3 (range 2–4) cm. There were no conversions to standard multiport laparoscopy or to open surgery. There were no intraoperative complications, and, postoperatively, 1 patient developed a minor leak treated with antibiotics, and 1 patient receiving perioperative anticoagulation had postoperative anastomotic bleeding requiring transfusion. The median postoperative stay was 3 (range 0–7) days.

The SPLS is technically feasible with proper patient selection for a variety of applications in colorectal surgery. Improvement in instrumentation and technology is likely to expand the role of SPLS in minimally invasive surgery. It is important to audit outcomes as this novel approach is introduced.

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The utility of lighted ureteric stents in laparoscopic colorectal resections: a survey of Canadian surgeons. ***A.M. Borowiec,*** **S. *Karmal*, From the Department of Surgery, University of Alberta, Edmonton, Alta.**

The objective of this study was to determine the frequency and indications for lighted ureteric stents (LUS) in laparoscopic colorectal resections among Canadian surgeons.

A 7-question survey was administered to Canadian surgeons through a monthly Canadian Association of General Surgeons e-news over a period of 3 months. The questions focused on surgeon demographics (training and years in practice), experience with laparoscopic colon resections (number per year) and the use of stents (indications).

Seventy-four surgeons completed the survey. The majority of those who responded (70%) were general surgeons. There was a wide range of experience, with 30% of responders being in practice for less than 5 years, 35% for 5–15 years and 35% for more than 15 years. The majority (84%) reported performing laparoscopic colorectal resections and, of those, 65% reported performing fewer than 25 resections annually. Only 26% of surgeons reported using LUS during laparoscopic surgeries. Furthermore, 75% of LUS users did not have fellowship training, 69% performed fewer than 25 resections per year and 50% were in practice for less than 5 years. When used, stents were inserted predominantly for left colon resections (94%), low anterior resections (75%) and diverticular disease (100%).

The majority of surgeons across Canada do not use LUS for laparoscopic colorectal resections. The single most common reported reason to insert stents was diverticular disease, and perhaps there is a role for stents in select complex cases, but further research is required to delineate the exact indications and benefits.

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Abnormal colonic wall thickening on computed tomography compared with colonoscopy findings: Is colonoscopy indicated when thickening is reported? ***I. Apriasz, B. Mysliwiec, N. Hussain, M. Ott, R. Reynolds, A. Lum.*** **From the Departments of General Surgery, Gastroenterology and Radiology, London Health Sciences Centre, University of Western Ontario, London, Ont.**

Our aim was to determine if colorectal wall thickening found on CT correlates with colonoscopy findings and therefore should be considered as a routine follow-up evaluation.

A retrospective review of 34 390 abdominopelvic CT scans, ordered at the London Health Sciences Centre between January 2007 and November 2009, was performed. In all, 434 CT scans had a finding of colon wall thickening. Forty-eight patients received colonoscopy within 30 days of CT. Colonoscopy and biopsy reports were compared with CT findings.

Forty-eight patients showed 67 abnormal thickening locations that were compared with findings on colonoscopic exam. Sixteen (23.9%) out of 67 abnormal locations were in the right colon, 35 (52.2%) out of 67 in the left colon, 12 (17.9%) out of 67 in the transverse colon and 4 (5.9%) out of 67 were mass lesions of any location. Colonoscopy confirmed right-sided pathologic changes in 9 (56.3%) out of 16 right-sided changes on CT, 24 (68.6%) out of 35 left-sided changes on CT, 4 (33.3%) out of 12 transverse colon changes on CT and 3 (75%) out of 4 mass lesions in any location.

Colonoscopy confirmed abnormal CT findings in 40 (59.7%) out of 67 locations. Four (25%) out of 16 right-sided mucosal thickening turned out to be mass lesions, versus 1 (2.9%) out of 35 left-sided lesions and 1 (8.3%) out of 12 transverse colon lesions. Therefore, if CT shows abnormal wall thickening on the right side, there is a higher chance of serious pathology being present. Follow-up colonoscopy, especially in these patients, should be recommended.

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Successful implementation of a novel communities of practice (CoP) model to facilitate quality improvement initiatives in colorectal cancer surgery. ***L.J. Williams, R. Morash, S. Shin, J. Smylie, H. Moloo, R. Auer, E.C. Poulin, J. Mamazza, J. Watters, M. Fung-Kee-Fung, R.P. Boushey.*** **From the Department of Surgery, Regional Cancer Program, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.**

We describe the successful implementation of a novel regional colorectal cancer surgery model designed to provide uniform high-quality care in a defined geographic area within Ontario (population 1.2 million). The Champlain Regional Colorectal Cancer Surgery Community of Practice (CoP) is a network of healthcare practitioners and administrators linking quality initiatives with individual and group learning.

In 2006, the Champlain Regional Colorectal Cancer Surgery CoP formed with representatives from 9 hospitals: surgeons, oncologists, administrators, nurses, pathologists, radiologists, gastroenterologists and other health care personnel. As a result, the following key ingredients to improving quality of colorectal cancer surgical care were identified: regional infrastructure, development of a comprehensive cancer assessment clinic (CAC), regional participation in multidisciplinary cancer conferences (MCCs), development of standards for cancer surgery and sharing of performance data.

The CoP has strengthened relationships among practitioners and hospitals as evidenced by survey responses, with 55% of CoP participants reporting changes in clinical practice. A multidisciplinary CAC has been created with the specific role of managing complex colorectal cases, and, since its inception, there has been a trend toward centralization of rectal cancer surgery. Surgical cases presented at MCCs have increased 3-fold. The CoP has developed regional clinical practice guidelines for the management of colorectal cancer patients, with 86% of CoP members incorporating them into their practice. Perioperative clinical pathways have been adopted across the region, with participation increasing to 82% in 2008. A regional database has been developed to monitor quality indicators, including wait times, adherence to regional guidelines, adequacy of surgical resection and outcomes.

The Champlain Region Colorectal Cancer CoP represents a unique model of healthcare delivery within the Canadian healthcare system, linking continuing professional development to implementation of evidence-based standards in order to facilitate quality improvement initiatives in colorectal cancer surgery.

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Surgical subspecialization and volume in the management of rectal cancer. ***J.S. Pelletier, C.J. de Gara, J. White, S. Ghosh, D. Schiller.*** **From the Department of Surgery, University of Alberta, and the Department of Biostatistics, Cross Cancer Institute, Edmonton, Alta.**

A study of all cases of rectal cancer in Northern Alberta diagnosed between 1998 and 2003 was performed to compare our results with an earlier study from our institution (Porter et al.),and to determine whether outcomes have improved and whether practice patterns have changed.

A chart review was performed to collect demographic, preoperative, intraoperative, pathologic and outcome variables. The main outcomes examined were 5-year local recurrence (LR) and disease-specific survival (DSS). Surgeons were classified as colorectal trained and non–colorectal trained and as high volume (≥ 3 cases/yr) and low volume. Univariate and multivariate analyses were performed to examine factors associated with LR and DSS.

In all, 433 cases were included. There were 42 surgeons included in this study compared with 52 in Porter's study. Colorectal-trained surgeons performed 35% of all surgeries in this study compared with 16% in Porter's study. The overall 5-year LR rate (7.4% v. 33%) and DSS (81% v. 59%) were improved compared with the previous study. On multivariate analysis, the only factor associated with increased 5-year LR was presence of obstruction (HR 4.09, $p = 0.01$). On multivariate analysis, the factors associated with decreased 5-year DSS were: non–colorectal training (HR 1.85, $p = 0.03$), presence of obstruction (HR 3.18, $p = 0.0014$) and increased stage (stage 2 v. 1, HR 3.65, $p = 0.007$; stage 3 v. 1, HR 8.7, $p < 0.0001$).

Since the publication of Porter's paper in 1998, there has been some change in practice patterns, and the long-term outcomes have improved dramatically. In this study, surgical subspecialization was found to be associated with improved DSS but not LR. We did not find surgical volume to be associated with either improved LR or DSS.

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Impact of urgent resection or resection after endoluminal stent on lymph node harvest in obstructing colorectal cancer. ***S. Drolet, E.O. Paolucci, J. Heine, W.D. Buie, A. R. Maclean.*** **From the Department of Surgery, University of Calgary, Calgary, Alta.**

Placement of an endoluminal stent for obstructing colon cancer, converts an urgent situation to an elective one. The aim of this study was to compare surgical quality as measured by lymph node harvest in 3 groups of patients with obstructing colorectal cancer: elective resection for near obstructing cancer, urgent resection for acute obstruction and elective resection following colonic stent.

All patients undergoing surgical resection of obstructing colorectal cancer between 2002 and 2009 were identified using the regional health record database. Exclusion criteria were palliative resections and incomplete pathologic information. Patients were classified into 3 groups: elective, urgent and stent. The total number of nodes examined in each specimen was determined using pathology reports. Analyses were performed with Predictive Analytics Software (PASW) using analysis of variance.

A total of 190 patients was identified. After extensive charts review, 86 patients were excluded because of palliative diversion (49), stent dysfunction (19), benign disease (13) or others reasons (5). The remaining 104 patients (30 elective, 40 urgent, 34 stent) were used for analysis. The mean number of nodes examined among the 3 groups was similar (elective 21.5, urgent 19.7, stent 21.2). The number of nodes retrieved was also compared according to the type of resection. Right hemicolectomy ($p = 0.471$), left hemicolectomy ($p = 0.441$), anterior resection ($p = 0.306$) and subtotal colectomy ($p = 0.664$) all had a similar number of lymph nodes analyzed in the 3 different clinical settings.

There is no evidence that surgical quality as measured by lymph node yield differs when surgery is performed emergently for acute colonic obstruction compared with elective resection with or without endoluminal stents.

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Outcomes of laparoscopic surgery for colorectal cancer: Does sex matter? ***A. Barnes, S. Liang, R. Auer, H. Moloo, J. Mamazza, E.C. Poulin, R.P. Boushey.*** **From the Department of Surgery, University of Ottawa, and The Ottawa Hospital, Ottawa, Ont.**

Sex has been implicated as a predictor of outcomes among patients undergoing laparoscopic colorectal resection. This study provides a direct comparison of male and female colorectal cancer patients with respect to significant perioperative outcomes.

Data were collected from patients undergoing laparoscopic colorectal cancer resection at 2 academic centres between January 2000 and October 2009. Separate analyses were conducted for colon and rectal cancer patients. Comparative analysis was used to identify differences in relevant surgical outcomes between male and female patients. Outcomes of interest included intra- and postoperative complications and pathologic findings.

A total of 433 patients with colon or rectal cancer were included ($n = 253$ and 180, respectively). There were no significant differences between male and female patients with rectal or colon cancers with respect to age or body mass index. In the rectal cancer group, operative time was significantly longer in male patients ($p = 0.01$). Female rectal cancer patients were more likely to have had previous abdominal surgery ($p = 0.04$), although the number with adhesions was not significantly higher. Despite these findings, there were no significant differences between the sexes with respect to perioperative complications, including bleeding, ureteric injury and anastomotic leak. In the colon cancer group, there was a trend toward increased rates of postoperative hemorrhage in male patients. There was no difference in conversion rates between the sexes in either the colon or rectum group. Lymph node retrieval and margin involvement were not affected by sex in either group.

The challenges of operating in the narrow male pelvis may account for the increased duration of surgery in the male rectal cancer patients. However, these patients were no more likely to experience adverse outcomes than female patients. It can be concluded that whereas the male pelvis may offer greater technical challenges, the quality of surgical and oncologic outcomes are not affected.

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Surveillance versus resection for malignant colorectal polyps. ***A.E. Klevan, A.A. Dalvi, J.A. Ramsay, W.J. Stephen.*** **From the Departments of Surgery, Pathology and Molecular Medicine, Hamilton Health Sciences, McMaster University, Hamilton, Ont.**

The objective of the study was to evaluate the management and outcomes of patients treated with endoscopic surveillance or resection for malignant colorectal polyps.

The laboratory database of a single pathology department within a large multicentre tertiary hospital was searched over a 6-year period for all pathology reports with keywords "carcinoma," "adenoma" and/or "polyp." Specimens included in the study demonstrated an invasive carcinoma (to submucosa) within a polyp, excised by endoscopic polypectomy. Pathology reports for malignant polyps were retrospectively reviewed for the reporting of prognostic factors. The subsequent management and follow-up of patients were examined. The Fisher exact test was used for group comparison ($p < 0.0125$ considered significant).

Thirty-three patients with malignant colorectal polyps met the study's inclusion and exclusion criteria and were subsequently analyzed. The mean patient age was 74.7 years, and the male-to-female ratio was 2.3:1. Following initial endoscopic polypectomy for a malignant polyp, 17 patients underwent a formal colectomy, and 16 patients received ongoing endoscopic surveillance. The colectomy group was more likely to have positive margins on initial endoscopic polypectomy ($p = 0.007$) and showed a trend toward higher rates of lymphovascular invasion ($p = 0.036$). No differences were found in tumour size or differentiation. Seven (41%) patients who underwent resection had evidence of metastatic/residual disease in the final pathological specimen. The median follow-up for the surveillance group was 14 (range 2–68) months. One (6.8%) patient in the surveillance group developed a

local recurrence at 6 months and underwent subsequent resection. One patient from each group died of unrelated causes during follow-up.

Reporting of prognostic factors for malignant colorectal polyps is an essential step that guides the management and outcomes of patients. Patients with positive margins, lymphovascular invasion or poor differentiation on endoscopic polypectomy specimens are at increased risk of adverse outcomes and should be considered for formal resection.

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Rectal cancer pathology reporting in Ontario: results of a 2007 audit of margin and lymph node reporting. ***C. Nhan, D.K. Driman, M. Raby, A.J. Smith, A. Hunter, J. Srigley, R.S. McLeod.*** **From the Surgical Oncology Program, Cancer Care Ontario, Department of Pathology, University of Western Ontario, London, and the Department of Surgery, University of Toronto, Toronto, Ont.**

A provincial, population-based pathology audit was performed to assess the positive margin rate for circumferential radial margins (CRM) and distal margins, the percent of reports in which more than 12 lymph nodes (LN) were assessed in rectal cancer surgery and to assess variation across regions. A random sample of pathology reports from patients having surgery for rectal cancer in Ontario between January and October 2007 was examined. Data were extracted by a trained methodologist as part of Cancer Care Ontario's Pathology Project Audit. A sample (25.8%) was reviewed by pathology and surgery experts to assess reliability. Details regarding surgical procedure, lymphatic invasion, venous invasion, circumferential margin, distal margin and the number of LN examined were included in the analysis. The data were further analyzed by geographic regions in Ontario. In all, 545 rectal cancer reports were audited with a mean of 37.4 (range 6–74) from each of the 14 regions: 166 (31.6%) were from rectal extirpative procedures (abdominoperineal resections, total protocolectomy and pelvic exenteration), and the rest had resections and restorative procedures or Hartman procedures (68.4%). The positive CRM rate in the province was 9.0% (95% CI 6.5%–11.4%, range 0%–15.5%), and the positive distal margin rate was 1.1% (95% CI 0.2%–2.1%, range 0%–4.8%). For rectal extirpative procedures, the positive CRM rate was 15.7% compared with a positive CRM rate of 5.8% for all other procedures ($p < 0.05$). The average number of reports with 12 or more lymph nodes assessed was 69.6% (95% CI 66.7%–73.5%, range 46.7%–87.0%). The overall CRM and LN rates are acceptable, although need for improvement was identified in some regions. These data can be useful to initiate provincial and regional quality improvement initiatives.

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Surgical outcome of mid- and distal T4 rectal cancer in the neoadjuvant era. ***S. Zolfaghari, R. Auer, H. Moloo, J. Mamazza, M. Friedlich, E.C. Poulin, H.S. Stern, R.P. Boushey.*** **From the Department of Surgery, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.**

This study examines the perioperative, oncologic and long-term outcomes in patients with locally advanced T4 tumours of the mid- and distal rectum in a period when neoadjuvant therapy is routinely used.

A colorectal oncology database was retrospectively reviewed. Demographic data as well as intraoperative and perioperative complications were examined. Oncologic data with respect to lymph node retrieval, resection margins and adjacent organ involvement were captured. Long-term survival was measured. Pelvic sidewall invasion was also specifically examined with respect to long-term prognosis.

A review was done between January 2002 and December 2008; this is when neoadjuvant therapy was routinely used at our centre. In all, 303 resected rectal cancers were identified; 35 were T4 rectal cancers. Of these, 23 represented elective resections with curative intent in which the tumour was in the mid-/distal rectum and underwent neoadjuvant chemoradiation therapy. The median distance from anal verge was 6 (range 0–10) cm. Nineteen patients were staged on the basis of final pathology and 4 on preneoadjuvant pelvic MRI. The median age was 60, and there were 9 female patients. Two patients had recurrent rectal cancer and 4 had liver metastases. Negative circumferential margins were achieved in 60%. The median lymph node harvest was 9, and all distal margins were negative. There was no 30-day mortality. Eighty-seven percent of patients received adjuvant chemotherapy. The local recurrence rate thus far is 9%. The median follow-up was 23 (IQR 15–37) months, with 7 deaths. Kaplan–Meier survival curves showed a 41-month median survival. As this may be an overestimation, 75% survival was calculated as well and was 16 months. Although survival curves suggest a trend toward a higher survival in patients without pelvic sidewall invasion, this was not statistically significant ($p = 0.24$).

Compared with historical controls, patients with neoadjuvant therapy for T4 rectal cancers in the mid- and distal rectum have favourable outcomes. Longer-term follow-up is necessary. In the neoadjuvant era, patients could potentially have better outcomes than historically reported.

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The long-term gastrointestinal functional outcomes following curative anterior resection in adults with rectal cancer: a systematic review, meta-analysis and meta-regression. ***A.S. Scheer, R.P. Boushey, S. Liang, S. Doucette, A.M. O'Connor, D. Moher.*** **From the Division of General Surgery, The Ottawa Hospital, Ottawa, Ont.**

Long-term bowel dysfunction and its risk factors following anterior resection are ubiquitously reported and with wide variability.

Our objectives were to quantify the incidence of long-term bowel dysfunction, including incontinence, following anterior resection for rectal cancer, and to identify prognostic factors for long-term incontinence.

MEDLINE, EMBASE and CINAHL were searched up to July 2009 using the terms rectal "neoplasms," "resection" and "gastrointestinal function." Any study that evaluated long-term bowel function, at a minimum of 1-year follow-up, following curative anterior resection in adult patients with rectal cancer was included. Two reviewers independently abstracted data on study and patient characteristics, functional assessment tool used, bowel function outcomes and prognostic factors. Disagreements were resolved by consensus. Risk of bias was assessed using the Cochrane risk of bias tool for randomized trials and the Downs and Black tool for observational studies. Pooled estimates of effects were computed using random effects

models. Metaregressions were conducted using logistic normal random effects models.

Forty-eight studies of 3349 participants from 17 countries with surgeries during 1978–2004 were summarized. The median follow-up was 24 (IQR 12–57) months. Sixty-five percent of studies did not use a validated function assessment tool. Reported outcomes and incidence rates were variable. The pooled incidence of incontinence was 35.2% (95% CI 27.9–43.3). Higher rates of incontinence were associated with preoperative radiation (p = 0.009) and in particular, neoadjuvant short-course radiation (p = 0.006) but not long-course therapy (p = 0.56). Higher-quality studies were also predictive of higher rates of incontinence (RCT quality p = 0.004, observational study quality p = 0.006).

Anterior resection is associated with significant long-term bowel dysfunction. Functional outcomes are inconsistently assessed and reported and require common definitions as well as more regular use of validated assessment tools. Short-course preoperative radiation, but not long-course, may be a risk factor for incontinence; however, further studies are needed.

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