

**Canadian Surgery  
Forum**

Abstracts of presentations to the  
Annual Meetings of the

**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**

Victoria, BC  
Sept. 10–13, 2009

**Forum canadien  
de chirurgie**

Résumés des communications  
présentées aux congrès annuels de

**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**

Victoria, BC  
du 10 au 13 sept., 2009



# Canadian Association of General Surgeons Association canadienne des chirurgiens généraux

## 1 (CAGS Clinical Research Award)

**Are hospital structures of care related to short-term outcomes in colorectal cancer surgery? R. Nenshi, E. Kennedy, N.N. Baxter, R. Saskin, R. Sutradhar, D.R. Urbach. From the Institute for Clinical and Evaluative Sciences, Toronto, Ont.**

Surgical treatment is the cornerstone of the management of colorectal cancer (CRC); however, there is enormous variation in both the patterns of surgical care and patient-level outcomes. The objective of this study was to describe hospital structure variability and to explore the relation between this variation and short-term patient outcomes.

Using a population-based cancer registry, all patients who underwent CRC surgery from 2003 to 2006 were identified. These data were then linked to administrative health databases in Ontario to identify all institutions performing CRC surgery and to measure hospital-level structures including availability of diagnostic imaging, endoscopy, specialists, ICU characteristics, hospital size and geographical characteristics. The impact of these structures on 30-day mortality, reoperation, readmission and return to the emergency department was evaluated. Multivariable models were estimated using generalized estimating equations to account for hospital-level clustering and repeated measures over time.

Overall, 20 784 patients underwent CRC surgery. Each year, between 106 and 109 institutions performed at least 1 CRC operation. There was variation in hospital-level structures of care: 56.3% had CT, 33.4% had MRI and 57.6% had interventional radiology; 45.2% of sites had no ventilator-capable ICU and 28.1% had a "closed" ICU. The median number of hospital beds was 139, and 92.2% of hospitals were located in an urban area. Within 30 days of the date of CRC surgery, 3.9% of patients died, 9.1% underwent reoperation, 10.7% were readmitted to hospital and 18.5% returned to an emergency department. After adjustment for patient characteristics, no hospital-level structures were independently associated with 30-day mortality, readmission, reoperation or return to the emergency department.

Although variation in surgical care and patient outcomes is likely related to variation in processes and structures of care, the results of this study did not show any substantial relation between hospital-level structures and short-term patient outcomes.

## 2

**Proficiency FLS simulator training improves laparoscopic performance in the operating room: a randomized controlled trial. G. Sroka, L.S. Feldman, M.C. Vassiliou, P.A. Kaneva, R. Fayez, G.M. Fried. From the Steinberg-Bernstein Centre for Minimally Invasive Surgery and Innovation, McGill University, Montréal, Que.**

The technical skills component of the Fundamentals of Laparoscopic Surgery (FLS) program has become a de facto standard for

the evaluation of technical skill in laparoscopy. The purpose of this study was to test the hypothesis that training to proficiency with the FLS simulator would result in improved technical skills while performing minimally invasive surgery in the operating room. Nineteen surgical resident volunteers (PGY 1–3) underwent baseline FLS testing and were assessed in the operating room using the Global Operative Assessment of Laparoscopic Skill (GOALS, a validated global rating scale for laparoscopic performance, highest score = 25). Those with a GOALS score less than 16 ( $n = 17$ ) were randomly assigned to training (T,  $n = 9$ ) or nontraining (NT,  $n = 8$ ) groups. The T group used the FLS simulator in a supervised proficiency-based skills training curriculum. Both groups went on with their regular residency training. At the end of the study period, residents were assessed again on the simulator and in the operating room. Attending surgeons and evaluators were blinded to randomization status. Data (mean and SD) were compared using the Student  $t$  test;  $p$  less than 0.05 was significant. Sixteen residents completed each evaluation (8 T, 8 NT). There were no differences in T and NT groups in baseline simulator scores (49.1 [SD 17] v. 39.5 [SD 16],  $p = 0.27$ ) or operating room scores (11.3 [SD 2.0] v. 12.0 [SD 1.8],  $p = 0.47$ ). After training, simulator scores were higher in the T compared with NT group (95.1 [SD 4] v. 60.5 [SD 23],  $p = 0.004$ ). At the final assessment, in the NT group, operating room performance was improved slightly by 1.8 points to 13.8 (SD 2.2) ( $p = 0.04$  v. baseline), whereas the T group improved by a mean of 6.1 points to 17.4 (SD 1.9) ( $p = 0.004$  v. NT;  $p < 0.0001$  v. baseline). These results show the transferability of basic laparoscopic skills gained on a physical simulator to the operating room and emphasize the educational value of laparoscopic simulators for surgical residents.

## 3

**Abdominal CT scans in the diagnosis of acute appendicitis: a decision analysis. S.A. Krajewski, C.J. Brown, C. Hur. From the Department of Surgery, University of British Columbia, Vancouver, BC, and the Institute for Technology Assessment, Massachusetts General Hospital, Boston, Mass.**

The purpose of this study was to evaluate the use of abdominal CT scans in the diagnosis of appendicitis using a decision analysis model.

A decision model was developed based on a theoretical cohort of 1000 patients presenting with suspected acute appendicitis. Each risk group (low, medium and high risk for acute appendicitis) was stratified based on age and sex. Three CT imaging guidelines were defined: none, selective and mandatory. Input variables were estimated from a pooled analysis of 70 published studies. Outcomes included negative appendectomy (NA), perforation (PR), missed appendectomy (MA), cost and total hospital days (LOS).

In women, NA rates, costs and LOS were lowest in the mandatory CT model for all risk groups (NA = 2.91% v. 7.96% v.

17.92%,  $p < 0.001$  in the medium-risk group). In men, NA rates, costs and LOS were lowest in the mandatory CT model for the low-risk group only (NA = 8.26% v. 10.71% v. 15.97%,  $p < 0.001$ ). The PR rates and MA rates were similar in all imaging strategies (PR = 19.40% v. 19.17% v. 19.33%,  $p = 0.95$ ). In elderly patients, there was no significant difference in the NA rates, PR rates, costs or LOS between imaging guidelines. The MA rates were significantly lower in the mandatory CT model for all risk groups (MA = 5.0% v. 7.48% v. 13.27%,  $p < 0.001$ ).

This model supports the use of mandatory CT scanning in all women with suspected appendicitis. In men, mandatory CT scans in those with low clinical probability of appendicitis is justified; when clinical suspicion is high, CT scan does not reduce the already low NA rates. Mandatory use of CT in elderly patients with atypical abdominal pain expedites the diagnosis of appendicitis and reduces MA and PR rates. Our decision model suggests that diagnostic CT scans in patients with suspected appendicitis should be based on clinical suspicion, age and sex.

#### 4 (CAGS Clinical Research Award)

**Pain management following breast cancer surgery: a double-blind randomized controlled study comparing acetaminophen plus ibuprofen to acetaminophen plus codeine plus caffeine. P.H. McCrea, A. Mitchell, G. Porter. From the Department of Surgery, Dalhousie University, Queen Elizabeth II Health Sciences Centre, Halifax, NS.**

Tylenol 3 (acetaminophen + codeine + caffeine; T3) is standard postoperative analgesia practice after breast surgery despite the undesirable side effects and variable efficacy of narcotics. This study sought to compare the efficacy of a nonnarcotic approach (acetaminophen + ibuprofen; AI) with T3 after outpatient breast surgery.

A double-blind randomized controlled equivalence trial was performed in patients undergoing outpatient (< 24 h in hospital) breast surgery (i.e., lumpectomy or mastectomy +/- axillary surgery). Patients were randomized (stratified by procedure type) to receive AI or T3 4 times daily for 7 days (or until pain-free). Pain intensity, measured 4 times daily by visual analogue scale (VAS), was the primary outcome; secondary end points were pain relief with analgesic, days until "pain-free," side effects, satisfaction and drainage (if a drain placed). A sample size of 140 was required to identify a 5-mm change in VAS (2-side  $\alpha = 0.05$ ,  $\beta = 0.8$ ).

There were 71 patients randomized to AI and 70 patients to T3; each group had 21 patients with drains. Repeated-measures analysis showed no significant difference in average pain intensity over 7 days (AI = 19.9 mm v. T3 = 20.6 mm,  $p = 0.78$ ). Similarly, there was no significant difference in average pain relief with analgesic as measured on a 6-point Likert scale ( $p = 0.46$ ). The incidence of side effects was 41% in each group; however, discontinuation secondary to side effects was more common with T3 (23% v. 6%,  $p = 0.018$ ). No significant differences were identified in days until "pain-free" or drain output. Finally, 92% of AI and 89% of T3 patients were satisfied with their pain control ( $p = 0.55$ ).

The combination of acetaminophen and ibuprofen is a safe and effective method of pain control after outpatient breast surgery. When compared to T3, it provides at least equivalent analgesia and has a more tolerable side effect profile.

#### 5

**Outcomes following angioembolization for high-grade blunt splenic injury. J. Grushka, T. Razek, K. Khwaja, P. Fata. From the Division of General Surgery, Montréal General Hospital, McGill University, Montréal, Que.**

Splenic artery angioembolization (EMBO) has been reported to increase the success rate of nonoperative management of blunt high-grade splenic injury. The aim of this study was to compare the clinical outcomes of both main splenic artery (MSA) and selective distal splenic artery (SSA) embolization in terms of morbidity, splenic function and time to splenic healing. We prospectively followed all patients identified at a level-1 trauma centre with high-grade blunt splenic injury who underwent EMBO beginning in September 2004 to January 2007. All patients underwent computed tomography (CT) scanning of the abdomen at initial presentation, at discharge and at 6, 10 and 14 weeks postdischarge or until the spleen appeared completely healed on CT. Circulating immunoglobulin levels were evaluated post-EMBO and after radiologic evidence of complete splenic healing. Seventeen patients underwent EMBO (MSA or SSA) for blunt splenic injury during the study period at the discretion of the trauma surgeon and interventional radiologist. Mean time to splenic healing was longer with MSA (136 d) compared with SSA (81 d) ( $p < 0.05$ ). Mean circulating IgG and IgA levels were decreased with MSA (7.7 g/L, 0.9 g/L) compared with SSA (11.9 g/L, 3.9 g/L) at the time of complete splenic healing ( $p < 0.05$ ). Immunologic function of the spleen is conserved after EMBO; however, SSA results in superior residual splenic function and allows for faster healing of the spleen compared with MSA. The longer healing time with activity restriction associated with MSA severely impacts quality of life since the majority of trauma patients are otherwise young and healthy.

#### 6

**Financial impact of laparoscopic surgery at a high-volume academic centre. G. Martel, H. Moloo, G. Picciano, R.P. Boushey, E.C. Poulin, J. Mamazza. From The Ottawa Hospital, University of Ottawa, Ottawa, Ont.**

The objective of this study was to compare the hospital costs of laparoscopic and open foregut and colorectal surgery at our institution.

Consecutive patients who underwent elective foregut surgery (fundoplication, paraesophageal hernia repair), segmental colectomy and rectal resection between 2005 and 2007 were identified from a hospital administrative database. The Eclipsys case costing system, used for hospital budgeting, produced data for each patient. Descriptive comparisons of matching laparoscopic and open operations were generated. To standardize comparisons, emergencies, day surgeries, perioperative deaths, transfers to and from our institution and outliers were excluded.

In total, 73% of foregut procedures (138/190) and 30% of colorectal resections (314/1050) were performed laparoscopically. The mean length of stay in hospital was 4.9 days shorter for laparoscopic foregut procedures (2.6 v. 7.4 d) and 2.2 days shorter for laparoscopic colorectal resections (5.7 v. 7.8 d). Laparoscopic foregut surgery was associated with a mean \$7961 total saving per case, over open surgery. Laparoscopic foregut procedures were associated with mean savings per case in nursing (\$876),

operating and recovery rooms (\$1009) and special care unit (\$2178) costs. Laparoscopic segmental colectomies were associated with a mean \$1287 total saving per case, whereas laparoscopic rectal resections yielded a mean \$2009 total saving per case. Although mean operating and recovery room costs per case were marginally greater for laparoscopic colorectal surgery (segmental \$504, rectal \$957), substantial savings were achieved with nursing (\$870) and special care unit (\$1818) expenditures. At current case volumes, laparoscopic procedures have yielded over \$500 000 per fiscal year in cost savings at our institution.

For both foregut and colorectal procedures, laparoscopy appears to be consistently cheaper than open surgery. Whereas operating room costs are marginally higher with laparoscopic colorectal surgery, substantial savings are achieved in other areas of patient care owing to shorter hospital stays.

## 7

**Overcoming barriers to population-based injury research: a new approach to deriving injury severity from administrative data.** *B. Haas, W. Xiong, M. Brennan-Barnes, D. Gomez, A.B. Nathens.* From the Division of General Surgery, St. Michael's Hospital, University of Toronto, Toronto, and the Children's Hospital of Eastern Ontario, Ottawa, Ont.

Although Injury Severity Score (ISS) is the most common measure of injury severity, it is unavailable outside of specialized trauma registries, which precludes its use in population-based studies. We have created an algorithm (crosswalk) to derive ISS from ICD-10-CM injury diagnoses codes. The crosswalk produces estimates of injury severity from data available in administrative databases, which enables the use of these data for injury research.

We tested the validity of our crosswalk using 2 approaches. To assess the reliability of crosswalk mapping, we used data from the Ontario Trauma Registry (OTR) to compare mapped scores with those assigned by expert abstractors. Weighted  $\kappa$  and intraclass correlation coefficients (ICC) were used as measures of concordance. To externally validate our algorithm, we evaluated the relation between risk-adjusted mortality and ISS in independent data sets: the Ontario Discharge Abstract Database (DAD), where ISS was crosswalk-derived, and the National Trauma Databank (NTDB), which contains abstracted ISS. Two-way analysis of variance was used to compare risk-adjusted mortality by ISS strata across data sets.

For our first analysis, 10 528 patients were identified in the OTR (2002–2004). Mapped and abstracted ISSs were similar; ICC across the entire cohort was 0.8 (95% CI 0.81–0.84), indicating good agreement. Concordance between mapped and abstracted ISSs was similar across strata of age, mechanism and mortality status. In our second approach, we identified 164 376 patients in the DAD (2002–2004) and 286 661 in the NTDB (2006). There was no significant difference in the relation between ISS and mortality in the DAD compared with the NTDB, indicating that crosswalk-derived ISSs provided a reliable estimate of injury severity.

The crosswalk has been applied to Ontario administrative data, and we have demonstrated that approximately 40% of severely injured patients do not receive care at designated trauma centres. Further data provided by this crosswalk will be essential for evaluating and improving access to appropriate trauma care.

## 8

**The impact of a standardized protocol on the appropriateness and cost of prophylactic antibiotic regimens for surgical site infections.** *I. Yang, S.S. Forbes, W.J. Stephen, M. Loeb, R. Smith, E.P. Christoffersen, R.F. McLean.* From the Departments of Surgery and Anesthesiology, McMaster University, Hamilton Health Sciences, Hamilton, Ont.

Whereas evidence exists to guide the use of perioperative antibiotic prophylaxis, the degree to which this knowledge is reflected in practice remains inconsistent. The objective of this study was to evaluate the effectiveness of a standardized protocol on the appropriate selection and duration of use of prophylactic antibiotics for surgical site infections.

Data were prospectively collected on 2 phases of adult patients undergoing elective, inpatient, hepatobiliary or colorectal surgery. The preintervention phase represented a needs assessment of current practices for antibiotic prophylaxis. In the postintervention phase, a bundle of perioperative initiatives was implemented that included preprinted order sheets for prophylactic antibiotics, designed using evidence from the literature and local expert opinion.

The standardized protocol increased the rate of appropriate antibiotic selection, both preoperatively (preintervention 82% v. postintervention 93%, RR = 1.1, 95% CI 1.0–1.3,  $p = 0.014$ ) and intraoperatively (72% v. 88%, RR = 1.2, 95% CI 1.1–1.4,  $p = 0.004$ ). A trend toward statistical significance was seen in the appropriate selection of postoperative antibiotics (78% v. 83%; RR = 1.1; 95% CI [1.0–1.4];  $p = 0.323$ ). There were significantly more patients in the postintervention phase who received postoperative antibiotics for the recommended duration (70% v. 83%, RR = 1.2, 95% CI 1.0–1.4,  $p = 0.018$ ), and Poisson regression demonstrated a 34% reduction in overall duration of use (Ln estimate = 0.657, 95% CI 0.50–0.86,  $p = 0.003$ ). The cost of perioperative antibiotics per patient decreased from \$13.11 to \$8.30 ( $p = 0.034$ ).

The implementation of the standardized protocol increased the appropriate use of prophylactic antibiotic regimens for surgical site infections and reduced the duration and cost of therapy. However, adherence to guidelines remained incomplete. Potential strategies for further improvement include identifying barriers to compliance through clinician feedback and providing additional education.

## 9

**Long-term outcomes of laparoscopic surgery for rectal cancer.** *J. Westerholm, S. Garcia-Osogobio, F. Farrokhyar, M. Cadeddu, M. Anvari.* From the Centre for Minimal Access Surgery, McMaster University, Hamilton, Ont.

This is a retrospective study to examine the long-term outcomes of laparoscopic surgery for rectal cancer at a single institution in Hamilton, with up to 11 years of follow-up.

We reviewed a prospective database of all rectal cancer surgeries performed at this institution between 1996 and 2006. Long-term follow-up data were obtained through chart review. Patients with T4 tumours, metastatic disease, synchronous cancers and those who underwent emergency surgery were excluded. The primary end points were 5-year overall and disease-free survival and local and distant recurrence.

A total of 167 patients met our inclusion criteria. Of these, 93 had laparoscopic surgery and 74 had open surgery. The 2 groups were similar with respect to stage of disease and comorbidities. Patients undergoing open surgery were older on average (mean 70.9 yr) than those undergoing laparoscopic surgery (mean 66.3 yr,  $p = 0.01$ ). More open cases were done during the earlier years of the study. Eight laparoscopic cases (8.6%) were converted to open. The median follow-up period was 36 (range 0–132) months. Overall survival was 94% at 60 months for laparoscopic cases and 80% for open ( $p = 0.013$ ). Disease-free survival at 60 months was 74% for laparoscopic surgery and 57% for open cases ( $p = 0.01$ ). Local recurrence developed in 5.4% of laparoscopic cases and 13.5% of open cases ( $p = 0.1$ ). Metastases occurred in 16.1% of laparoscopic cases and 29.7% of open ( $p = 0.041$ ).

Long-term survival and recurrence rates are not compromised when laparoscopic surgery is performed for rectal cancer, and may in fact be better than with open surgery. Prospective randomized trials are currently underway, and we eagerly await their results.

## 10

**Assessment of communication, professional, and surgical skills in an Objective Structured Performance-Related Examination (OSPRE): a psychometric study. A. Ponton-Cars, C. Hutchison, C. Violato. From the Department of Surgery, University of Calgary, Calgary, Alta.**

The CanMEDs competencies for surgical residents are not well assessed. It is important for surgeons to observe the performance of their residents in an objective way in order to identify the strengths and weaknesses of the system used in their training.

The primary research problem guiding this study concerns the reliability and validity of the OSPRE methodology for simultaneously assessing communication, professionalism and surgical skills.

Performance of communication, professional and surgical skills was rated using checklists and global rating scales in an OSPRE format. Fourteen residents from the general surgery program of the University of Calgary were assessed in 7 surgical simulation stations using a combination of Objective Structured Assessment of Technical Skills (OSATS) and Multiple Objective Measures of Skills (MOMS) models, modified by simultaneously embedding the assessment of communication and professionalism skills.

The reliability of the OSPRE for assessing competencies using checklists and global rating scales combined was: communication ( $\alpha = 0.75$ – $0.92$ ), professionalism ( $\alpha = 0$ ) and surgical skills ( $\alpha = 0.86$ – $0.96$ ). The OSPRE had construct validity for assessing surgical skills as a function of postgraduate year (PGY) level. For assessing communication, there was no statistically significant difference between PGY levels. The modified professionalism checklist used in the OSPRE could not be validated in this setting. Surgical skills and communication had a good correlation in the 2 stations tested ( $r = 0.55$ – $0.57$ ).

The OSPRE methodology is a valid and reliable tool for simultaneously assessing the competencies of surgical and communication skills in a surgical setting.

Surgical performance was good, probably due to the constant teaching and assessment of it. In contrast, communication skills performance was poor, probably because it is not specifically taught

at the postgraduate level. In order to assess professionalism in a surgical setting, appropriate instruments need to be developed.

## 11

**Determinants of sharps-related injuries in the operating room: a multicentre case-crossover study. M. Segedi, M. Mittleman, D. Fisman, L. Kinlin. From the Harvard School of Public Health, Beth Israel Deaconess Medical Center, Boston, Mass., the University of British Columbia, Vancouver, BC, and The Hospital for Sick Children, University of Toronto, Toronto, Ont.**

Our objective was to evaluate the predictors of sharps injuries among health care workers (HCWs) in operating room (OR) settings using a case-crossover design. The purpose was to identify (1) preventable risk factors and (2) predictors of underreporting, and (3) to examine the trainee subgroup.

All HCWs who sustained a sharps-related injury and presented to employee clinics of 5 academic medical centres in the United States and Canada were invited to participate in a telephone questionnaire within a week. This was a case-crossover study, characterized by self-matching, where the case and control data were obtained from the same subject. Mantel-Haentzel estimates were used for estimating the rate ratios, whereas Fisher exact and Wilcoxon rank sum tests were used for subgroup comparisons.

Of 626 interviewed participants, 195 (31%) were injured in an OR, with an average time to interview of 2.92 (SD 2.16, range 0–15) days. Of those injured in the OR, 79 (41%) were trainees. Trainees were more likely to be injured by a suture/solid bore needle ( $p = 0.01$ ), less likely to report prior injuries ( $< 0.0001$ ) and had fewer hours of sleep per night (4.5 v. 5.4 h,  $p = 0.02$ ). We examined the effects of double gloving (incident rate ratio [IRR] 0.34,  $p = 0.002$ ), noise (IRR 2.03,  $p = 0.011$ ), being taught (IRR 0.16,  $p < 0.0001$ ) or distracted (IRR 2.51,  $p < 0.0001$ ), emergency nature (IRR 0.87,  $p = 0.659$ ) and complexity of procedure (IRR 1.32, 0.178), as well as the presence of an obscured operative field (IRR 0.71  $p = 0.19$ ). Only the first 4 variables were significantly related to the risk of sharps injury. In a subgroup analysis of trainees, double gloving (IRR 0.38,  $p = 0.051$ ) and noise (IRR 0.89,  $p = 0.853$ ) did not remain significant.

Our findings confirm the previously reported role of double gloving, noise and distraction in the risk of sharps injury. More importantly, we identified the differences between trainees and nontrainees, such as under-reporting and differences in injury risk factors. Predictors of under-reporting will be further explored.

## 12

**Patient satisfaction best determines the management of recurrent dysphagia after Heller myotomy for achalasia. M. Rousseau, W. Saleh, L.E. Ferri, L.S. Feldman, D.D. Stanbridge, S. Mayrand, G.M. Fried. From the Steinberg-Bernstein Centre for Minimally Invasive Surgery, McGill University Health Centre, Montréal, Que.**

Heller myotomy (HM) is an effective treatment for achalasia; however, 10% fail to achieve long-term palliation of dysphagia. The optimal management of these patients is unclear. We sought to characterize patients with recurrent dysphagia with a focus on the management of this patient population.

A prospective database of achalasia patients who underwent

HM at a single institution (1997–2007) was reviewed for recurrent dysphagia. Variables collected include health-related physical and mental quality of life (QoL) (SF-12), dysphagia and satisfaction (SAT) scores (0 = best to 5 = worse), barium upper gastrointestinal radiograph, motility studies (EMS) and endoscopy (EGD). Recurrent dysphagia was defined as initial reduction of 2 or greater in the score followed by an increase of 2 or greater. Data are presented as median (and range); a paired *t* test or Wilcoxon signed ranks test determined significance ( $*p < 0.05$ ).

Recurrent dysphagia was found in 13 of 87 patients who underwent HM. Preoperative dysphagia scores, 3 (2–5), initially improved to 0 (0–2),\* but deteriorated to 2 (2–5)\* at 6 (3–24) months. Quality of life was maintained ( $p = 42.6$  preoperatively, 49.7 postoperative; mental QoL = 47.7 preoperatively, 53.3 postoperatively).\* Patients were dichotomized based on satisfaction (satisfied = SAT 0–1, unsatisfied = SAT 2–5). In the 6 satisfied patients (SAT = 0.5 [0–1]), investigations failed to find a treatable cause, so none underwent further therapy. In the 7 unsatisfied patients (SAT = 3 [2–5]), 4 had findings (delayed emptying, benign stricture, elevated postoperative EMS lower esophageal sphincter pressure) and underwent dilation without improvement. At last follow-up (36 [12–60] mo) 7 patients (4 satisfied, 3 unsatisfied) with recurrent dysphagia 2 (2–5) improved to 1 (0–2)\* without any invasive treatment.

Self-perception of dysphagia in achalasia patients varies over time and is not a reliable measure of success after HM. Although recurrent dysphagia is required to identify patients with objective evidence of a treatable problem, the timing and decision to proceed with therapy should consider overall satisfaction.

### 13

**Surgical workforce crisis: SWOT analysis (strengths weaknesses, opportunities, threats). A. Pandya, A. Gagliardi, A. Mathes, N. Ahmed. From the Division of General Surgery, University of Toronto, Toronto, Ont.**

There is a need to train and retain general surgeons. The purpose of this study is to conduct a SWOT analysis of issues related to career interest and satisfaction in general surgery using information gathered from literature review and discourse analysis. Discourse analysis is a method of deconstructive text analysis to understand its meaning by revealing its motivations and epistemological assumptions.

Relevant information from MEDLINE (1998–2008), tables of contents of major journals, online searches, listservs and professional associations was collected and analyzed. Eligible articles included empirical quantitative or qualitative studies that described factors influencing career satisfaction or interventions to improve career satisfaction. Relevant information from other data sources was analyzed using the traditions of discourse analysis in a grounded theory approach. Apart from duty hour restrictions for residents, which had both positive and negative effects, there were no interventions identified to address declining medical student interest, career dissatisfaction and burnout. The ideas generated were grouped into categories representing the SWOT of general surgery as a career. The table below summarizes the analysis.

There was a striking similarity between the ideas gathered from literature review and discourse analysis. There is a paucity of much-needed interventions for screening and management of medical student attrition and surgeon dissatisfaction. Discordance

**Table, abstract 13. Analysis of career interest and satisfaction in general surgery**

SWOT	Scoping review	Discourse analysis
Strengths	<ul style="list-style-type: none"> <li>• Achievement of career goals</li> <li>• Opportunity for mentorship</li> <li>• Time for research and professional development</li> <li>• Access to residents or fellows</li> </ul>	<ul style="list-style-type: none"> <li>• General surgery is a calling not a career</li> <li>• The essence of general surgery remains fulfilling and exciting</li> <li>• General surgeons are essential to patient care</li> <li>• Practice patterns are varied and tailored to local need and interest</li> </ul>
Weaknesses	<ul style="list-style-type: none"> <li>• Lack of access to quality health services</li> <li>• Poor organizational structure</li> </ul>	<ul style="list-style-type: none"> <li>• Many lifestyle challenges are related to logistical and resource issues versus true surgical emergencies</li> <li>• The continuous shortage of resources is untenable</li> </ul>
Opportunities	<ul style="list-style-type: none"> <li>• Address resource issues to minimize nighttime work</li> <li>• Enhanced professional development programs</li> <li>• Clinical mentorship</li> <li>• Acute care service</li> <li>• Shared call pools</li> <li>• Improved compensation</li> </ul>	<ul style="list-style-type: none"> <li>• Essential to attracting medical students: role-modelling from staff and residents</li> <li>• Students must have the opportunity to connect with patients and experience the satisfaction resulting from successful practice</li> <li>• Political activism and policy change to assure that general surgeons are recognized as indispensable to the health of their communities</li> </ul>
Threats	<ul style="list-style-type: none"> <li>• Poor compensation relative to other surgical specialties</li> <li>• Excessive workload</li> <li>• Inadequate work-life balance</li> <li>• Aging population and need for more general surgeons</li> </ul>	<ul style="list-style-type: none"> <li>• 20%–30% decrease in applicants; 17 unfilled spots (08/09)</li> <li>• Effects of chronic sleep deprivation on health</li> <li>• Lack of respect and recognition for contributions from hospital administration, society, colleagues</li> <li>• Behavioural economics</li> <li>• General surgeons are politically inactive and have little influence on health policy</li> <li>• The loss of general surgeons resulting in a hospital having to close its emergency department</li> </ul>

exists between the motivations for being a general surgeon versus the behavioural economics that govern the choices made by medical students and the frustrations voiced by practicing surgeons. Analyses such as this one should be used to inform academic and political agencies and align strategic policies with action that would mitigate the impending workforce crisis in general surgery.

### 14

**Recommended timing for surveillance ultrasonography to diagnose portal vein thrombosis after laparoscopic splenectomy. T. Tran, S.V. Demyttenaere, G. Polyhronopoulos, C. Seguin, G.P. Artho G, P. Kaneva, G.M. Fried, L.S. Feldman. From the Department of Surgery, McGill University, Montréal, Que.**

Symptomatic portal or splenic vein thrombosis (PSVT) is a rare but potentially lethal complication of laparoscopic splenectomy (LS). Routine postoperative duplex ultrasound surveillance can be used for early detection, though the optimal timing is unknown. The aim of this study was to estimate the incidence and progression of asymptomatic PSVT after LS.

Consecutive patients scheduled for LS for hematologic disease underwent surveillance for PSVT using duplex ultrasonography 1 week and 1 month postoperatively. Treatment with anticoagulation was initiated once a diagnosis was established.

Forty-three of 48 patients planning to undergo LS in the study period were enrolled, with 3 later excluded, leaving 40 patients for analysis. The indications for LS were benign disease in 31 (19 had immune thrombocytopenic purpura) and malignant disease in 9. Portal or splenic vein thrombosis was diagnosed in 9 of 40 patients (22.5%). Seven (77.8%) were diagnosed by 1 week with ultrasound, 1 of whom had mild symptoms. After anticoagulation, subsequent ultrasounds showed resolution or improvement in all 7 patients. Thirty-three patients had a normal ultrasound result at 1 week. One of these patients had a CT scan at 1 week owing to fever that diagnosed a PSVT not seen on ultrasound; there was complete resolution at 4 months without treatment. Twenty-seven patients returned for follow-up after normal 1-week imaging: 26 patients had an ultrasound at 1 month, with no new PSVT found. One additional patient did not return for subsequent ultrasound until 2 months postoperatively, when a new distal SVT was found; ultrasound at 6 months showed complete resolution without treatment.

The 1-week incidence of PSVT after laparoscopic splenectomy was 8/40 (20%, 95% CI 7.6–32.4). Routine 1-month ultrasounds did not reveal any additional cases. The majority of patients with early PSVT were anticoagulated and demonstrated complete or partial resolution. The high incidence warrants routine surveillance with Doppler ultrasonography on postoperative day 7, with low yield for a subsequent 1-month study.

## 15

**Transoral incisionless fundoplication for GERD: early North American results. S.V. Demyttenaere, S. Bergman, J. Anderson, D.J. Mikami, W.S. Melvin. From the Department of Surgery, Ohio State University, Columbus, Ohio, and the Department of Surgery, Jewish General Hospital, McGill University, Montréal, Que.**

EsophyX (EndoGastric Solutions) is an endoluminal approach to the treatment of gastroesophageal reflux disease (GERD). We report one of the earliest and largest single-institution North American experiences with this device.

Prospective data were gathered on consecutive patients undergoing EsophyX fundoplication for a 1-year period between September 2007 and March 2009. Data are expressed as mean (SD), with  $p < 0.05$  being significant.

Twenty-six consecutive patients with mean age of 45 (15) years were studied. There were 10 men (38%) with a BMI of 28 (5) and an ASA classification of 2 (1). Average valve circumference was 217° and valve length was 2.7 cm. Eleven patients had associated hiatal hernias, 3 patients had Barrett esophagus, 5 patients had esophageal dysmotility, and 1 patient had an esophageal stricture. Mean procedure time was 65 (27) minutes and mean length of stay was 1 (range 0–6) day. There were 2 procedural complications consisting of a postoperative bleed requiring transfusion. Mean follow-up was 10 months. Comparing preoperative with postoperative scores, the mean Anvari (34–18,  $p = 0.004$ ) and Velanovich (21–8,  $p = 0.004$ ) scores decreased significantly. Sixty-nine percent of patients were still taking antireflux medications, and only 32% of patients were entirely satisfied with the pro-

cedure. Three patients had persistent symptoms requiring Nissen fundoplication, and there was 1 death unrelated to the procedure.

This study represents an initial single-institution experience with EsophyX. Whereas mean subjective reflux scores improved after treatment, 69% of patients were still taking antireflux medication at follow-up, and there were 3 treatment failures. EsophyX may be a viable alternative for highly selected patients with GERD. Further follow-up and objective testing is required.

## 16

**Elective and emergency abdominal surgery in patients 90 years of age or older: clinical outcomes and the evaluation of the possum and p-possum scoring systems as predictors of mortality. J.M. Racz, L. Dubois, A. Katchky, W.J. Wall. From the Department of Surgery, University of Western Ontario, London, Ont.**

Few studies have examined the perioperative outcomes of patients 90 years of age or older who undergo abdominal surgery, and no study has reported on 1-year mortality rates.

The objectives of this study were to determine the outcomes of elective and emergency abdominal surgery in this age group and to assess the performance of the POSSUM and P-POSSUM scoring systems as predictors of mortality.

All patients 90 years of age or older who underwent emergency or elective abdominal surgery between 2000 and 2007 at the London Health Sciences Centre were identified. A chart review was performed using standardized data sheets, and 1-year mortality was obtained by contacting family physicians.

A total of 145 patients (median age 91, range 90–101 yr) were identified. The most common surgical procedures performed were bowel resection with primary anastomosis (25.5%), hernia repair (18.6%) and bowel resection with ostomy formation (10.3%). The overall in-hospital mortality was 15.2%. In-hospital mortality (20.8% v. 9.6%,  $p = 0.059$ ), 1-year mortality (49.1% v. 27.8%,  $p = 0.016$ ), complication rate (81.9% v. 61.6%,  $p = 0.007$ ) and ICU admission rate (44.4% v. 11.0%,  $p < 0.001$ ) were all higher among patients undergoing emergent versus elective procedures. The operative indication and procedure associated with the highest in-hospital mortality were large bowel obstruction (50.0%) and bowel resection with primary anastomosis (27.0%). Both the POSSUM and P-POSSUM scoring systems significantly over-predicted mortality as assessed by the Hosmer–Lemeshow goodness of fit test ( $p < 0.001$ ), particularly in the higher risk groups.

Patients 90 years of age or older who undergo emergent abdominal surgery are at increased risk of postoperative complications and death, with a 1-year mortality approaching 50%. The POSSUM and P-POSSUM scoring systems were not reliable predictors of in-hospital mortality in this age group.

## 17

**Effect of an acute care surgical service on the timeliness of care. A. Faryniuk, D. Hochman. From the Department of Surgery, University of Manitoba, Winnipeg, Man.**

The purpose of this study is to assess the effect of the creation of an Acute Care Surgical Service (ACSS) on surgical patient flow.

Two 3-month time periods were compared: a baseline period before ACSS and a post-ACSS implementation period. A retrospective chart review of patients who were admitted with acute



appendicitis, acute cholecystitis and small bowel obstruction during these 2 periods were included in the study. Time intervals in the assessment and management of the surgical patients were then examined and compared between the 2 periods.

There was a 221% increase in patient volume during the ACSS period over the baseline period (43 pre-ACSS and 138 ACSS). Patients were significantly older (54.2 v. 45.6 yr,  $p = 0.01$ ), and they were significantly more likely to have a diagnosis of small bowel obstruction (37% v. 19%,  $p = 0.02$ ) during the pre-ACSS period. With the creation of the ACSS, there was significant improvement in the time from surgical consultation to time of surgical assessment (103 min pre-ACSS v. 61 min ACSS,  $p = 0.002$ ). The times from surgical admission to operation (11.3 h pre-ACSS v. 12 h ACSS,  $p = 0.86$ ) and from operation to discharge (63.3 h pre-ACSS v. 74.3 h ACSS,  $p = 0.67$ ) were slower in the ACSS period. The secondary outcome of time of surgical admission to discharge from hospital was faster in the post-ACSS period (122 h pre-ACSS v. 95 h ACSS,  $p = 0.21$ ).

With the implementation of an acute surgical service, 221% more surgical patients were assessed and treated. With a dedicated ACSS service, patients were assessed significantly faster, and total time from admission to discharge was reduced when compared with the traditional model.

## 18

**Development of a trauma registry for use in low income countries. C.A. Clarkson, A.M. Rubiano. From the Neiva City University Hospital, Neiva, Huila, Colombia.**

The objective of this project is to develop a cost-effective trauma registry for use in low-income countries. The initial trauma registry was developed and then trialed over a 1-year period in the main public hospital in Neiva, a city of approximately 350 000 people in Southern Colombia, South America. A set of 16 data points was collected on all trauma patients presenting to the hospital during the study time frame (over 2500 trauma patients in total). The type of data collected covered such areas as basic patient demographics and prehospital information, to injuries, interventions and outcomes. A simplified coding system was developed and implemented, rather than relying upon the traditional International Classification of Diseases system (World Health Organization). Sufficient data were also gathered on each patient to enable the calculation of both a Revised Trauma Score (RTS) and the simpler Kampala Trauma Score (KTS). At the same time that data were being collected in Colombia, an electronic database was developed in Canada using the Microsoft ACCESS system. This database is in both English and Spanish, with the option of adding additional languages as required. The immediate future of this project includes expanding to a larger trauma centre in Colombia, mining the data for information that could assist with the development of injury prevention strategies and a comparing the RTS and KTS scoring systems. Longer-term plans are the development of a compatible web-based database and expansion to other areas.

## 19

**Trends in the use of DPL (diagnostic peritoneal lavage) in Canada. C.A. Clarkson, D. Boone. From the Department of Surgery, Memorial University of Newfoundland, St. John's, NL.**

The purpose of this project was to analyze trends in the use of diagnostic peritoneal lavage (DPL) across Canada, as well as to determine which general surgery programs in Canada are teaching the skill. The Canadian Institute for Health Information (CIHI) supplied the available data using the National Trauma Registry's minimum data set. Contact was attempted with all program directors of English-speaking general surgery residency programs across Canada to determine whether or not DPL was taught at their institution, outside of what takes place during an Advanced Trauma Life Support (ATLS) course.

Between 2001 and 2006 in Canada, 38 DPLs were coded into the CIHI database. Of those, 39.5% were performed in British Columbia, 31.6% in Ontario, and the remaining 28.9% were performed in Alberta, New Brunswick, Nova Scotia, Newfoundland and the Yukon Territory. Male patients underwent 84.2% of the DPLs, and 23.7% of all DPLs resulted in a laparotomy. Motor vehicle crashes accounted for 42% of the DPLs performed. The others were performed for a variety of reasons, but CIHI policies do not allow a more precise breakdown owing to the relatively small numbers performed. The majority of English-speaking general surgery residency programs in Canada are not teaching DPL outside of what is taught in the ATLS course.

In conclusion, DPL continues to be used in Canada in selected cases, although it is not being formally taught to general surgery residents.

## 20

**A decade of experience with injuries to the gallbladder. C.G. Ball, E. Dixon, A.W. Kirkpatrick, F.R. Sutherland, D.V. Feliciano. From the Departments of Surgery, Emory University, Atlanta, Ga., and the University of Calgary, Calgary, Alta.**

Considering that injuries to the gallbladder are rare, the objective of this study was to evaluate injury patterns, operative procedures and outcomes in patients with trauma to the gallbladder.

A retrospective review of traumatic injuries to the gallbladder at an urban level-1 trauma centre from 1996 to 2008 was performed. Injuries were identified via imaging or during operative exploration. Patient demographics and injury data were collected and analyzed using standard statistical methodology ( $p < 0.05$  was considered significant).

Injuries to the gallbladder occurred in 45 patients, 40 (89%) of whom suffered penetrating trauma. Associated injuries were present in 44 (98%) patients, including 10 (22%) pancreatic injuries requiring repair and/or drainage. Patients were severely injured (49% hemodynamically unstable at presentation, mean Injury Severity Score = 20, mean length of stay = 22 d; mortality rate = 24%). Cholecystectomy was performed in 42 patients (93%), whereas the remaining 3 had drainage only as part of a "damage control" operation related to their critical physiologic status. Injuries to the extrahepatic biliary ducts occurred in 3 patients (7%) as well. Although all patients developed trauma-related complications, none were a direct result of their biliary tract injuries.

Injuries to the gallbladder are rare even in the busiest urban trauma centres. Almost all patients have associated intra-abdominal injuries, and nearly 50% of patients are hemodynamically unstable on admission. Rapid cholecystectomy is the treatment of choice for all mechanisms of injury, except when the first operative procedure is of the "damage control" type.

21

**Foreign body ingestions: Who avoids the razor's edge? A.D. Wyrzykowski, J.M. Nicholas, C.J. Dente, C.G. Ball, D.V. Feliciano. From the Department of Surgery, Emory University, Atlanta, Ga.**

Foreign body ingestions located beyond the pylorus are traditionally managed with inpatient observation and serial radiographs until the object is passed. This often requires a prolonged hospital admission. The goal of this study was to identify patients who could be safely discharged from the emergency department, therefore avoiding costly inpatient monitoring.

A retrospective chart review of all patients with foreign body ingestions admitted to a surgical service in a large urban public hospital between 1997 and 2008 was completed. Standard statistical methodology was employed ( $p < 0.05$  was considered significant).

Over the study period, 19 patients were admitted for serial monitoring after ingestion of a foreign body (mean age 34 yr, 64% male). The number of admissions ranged from 1 to 5 per patient (33 total). The mean length of stay was 9.7 (range 1–24) days. Razor blades were the most commonly ingested foreign body (12 admissions). Other objects included screws, nails, sticks, pencils, glass and spoons. Of the 33 admissions, only 5 (15%) patients required a subsequent laparotomy. All patients who underwent a laparotomy presented with peritonitis or symptoms of obstruction ( $p = 0.0005$ ). The absence of abdominal pain was 100% predictive for avoiding an operation. All patients who ingested a razor blade (12) avoided surgical intervention. Nearly half (42%) of all patients with a previous history of a laparotomy (for any etiology) required a subsequent operative intervention to remove the foreign body.

It may be safe to discharge patients who have ingested razor blades directly from the emergency department to an appropriate psychiatric facility (v. admission to a surgical service for observation). Any patient who is symptomatic at presentation should be admitted for close monitoring. Patients who have undergone a previous laparotomy must also be followed for the development of ingestion-related complications.

22

**Scarpa fascia plays a structural role in the development of Cullen sign, Turner sign and icterus marginatus, a novel sign of retroperitoneal bile leakage. S.M. Ullah, V.C. McAlister. From the Division of Clinical Anatomy, Department of Anatomy and Cell Biology, Department of Surgery, University Hospital, University of Western Ontario, London, Ont.**

The anatomic distribution of Scarpa fascia was assessed to determine its structural role in the development of clinical signs associated with retroperitoneal hemorrhaging and bile leakage. The following clinical signs were examined: Cullen sign, Turner sign and icterus marginatus, a novel sign of retroperitoneal bile leakage. Dissections were completed on 7 embalmed cadavers, 3 male and 4 female (average age 76 yr). In addition, cross sectional images of a frozen cadaver from the Visible Human Project were analyzed. Scarpa fascia was demonstrated to create a small capsule by attaching circumferentially around the umbilicus. This capsule may account for the periumbilical bruising seen in Cullen sign. In the flanks, Scarpa fascia was shown to create a pocket between the

costal margin and the iliac crest. This pocket may provide an explanation for the development of the oval-shaped bruising in Turner sign. Superiorly, Scarpa fascia continued into the axilla and chest, where it was found to create an additional pocket with strong adhesions to the costal margin, anterior chest wall and nipple. The location of jaundice in the lateral chest wall, as seen in icterus marginatus, correlates with the location of this pocket. The thorough analysis of Scarpa fascia clearly demonstrates that its distribution extends beyond the abdomen to the flanks laterally and to the axilla and chest superiorly. Furthermore, the attachments and pockets formed by Scarpa fascia provide a physical explanation for the visual characteristics found in Cullen sign, Turner sign and icterus marginatus.

23

Withdrawn

24

**Management of acute mechanical small bowel obstruction in the octogenarian: Is a minimally invasive approach safe? S. Malik, D. Ramsey, S. Pooler, B. Teague, M. Misra, M. Cadeddu, M. Anvari. From the Centre for Minimal Access Surgery, St. Joseph's Hospital, McMaster University, Hamilton, Ont.**

Laparoscopic surgery (LS) in patients with a mechanical small bowel obstruction (SBO) has been studied, and SBO is no longer a relative contraindication to a minimally invasive approach. However, in patients older than 80, LS in the management of acute mechanical SBO has not been the subject of prior review.

The medical records of patients older than 80 years diagnosed with an acute SBO and treated with surgery between January 2000 and June 2008 were retrospectively reviewed. A total of 49 patients were included. Twelve patients underwent LS surgery, and 37 patients underwent open surgery (OS). Patient demographics and clinical data (sex, ASA status, previous surgeries, etiology and medical comorbidities) were similar between the 2 groups ( $p = 0.4$ ). The median age for the LS group (88.5 yr) and the OS (85.2 yr) group were similar ( $p = 0.1$ ). The median operating room time for the LS group was longer than for the OS group (139 v. 79 min,  $p < 0.01$ ). Laparoscopy was diagnostic and therapeutic in all LS patients. No LS patients required conversion to laparotomy. The OS group had more complications than the LS group (24.7% v. 16.7%,  $p < 0.01$ ). There were no deaths in LS group compared with 6 deaths in the OS group (16.2%) during the hospital admission ( $p < 0.01$ ). The median passage of flatus for the LS and OS groups was 2 and 3 days after surgery ( $p = 0.03$ ). The median return of bowel function for the LS and OS groups was 3.5 and 5 days after surgery ( $p < 0.01$ ). The median duration of hospital stay for the OS group was longer (14.0 v. 9.5 d,  $p < 0.01$ ).

Laparoscopic surgery in patients over the age of 80 with a mechanical SBO appears feasible and a safe alternative to formal laparotomy.

25

**General surgery graduates may be ill prepared to enter rural surgical practice. M. Kaminsky, A. Vergis, L.M. Gillman. From the Department of Surgery, University of Manitoba,**

**Winnipeg, Man., the Department of Critical Care Medicine and Regional Trauma Services, University of Calgary, Calgary, Alta., and the Division of General Surgery, University of Toronto, Toronto, Ont.**

Rural surgery presents unique challenges to general surgeons. Not only are they required to perform "classic" general surgery procedures, they are often expected to be competent in other surgical disciplines. These include skills in obstetrics, gynecology, orthopedics and plastic surgery. The purpose of this study was to assess career goals and to determine whether graduating general surgery residents feel prepared to enter practice in a rural surgery setting.

As part of a multipart project, final-year Canadian-trained residents who were scheduled to sit the Royal College of Physicians and Surgeons of Canada certifying examination in general surgery were asked to complete the survey. The survey explored chief residents' career plans for the following year, and whether or not they would independently perform various procedures, some general surgical, and others now considered within the domain of the subspecialties.

Sixty-four residents (71%) completed the survey. Twenty percent of residents planned to undertake a rural surgical practice, 17% opted for an urban community practice and 55% had confirmed fellowships, with the remainder undecided. The majority of residents (> 90%) expressed comfort with basic general surgical procedures including laparoscopic cholecystectomy, appendectomy, mesh hernia repair, simple mastectomy and hemorrhoidectomy. However, residents were less comfortable with subspecialty procedures that are still performed by general surgeons in many rural practices. Eighty-one percent of residents would not perform a closed reduction of a Colles' fracture, 75% would not perform a carpal tunnel release, 66% would not perform a simple skin advancement flap and 58% would not perform split-thickness skin grafting. Similarly, the majority were uncomfortable with gynecologic procedures, with 83%, 84% and 69% unwilling to perform cesarean section, abdominal hysterectomy and salpingo-oophorectomy, respectively.

More than half of graduating general surgery residents are choosing subspecialty fellowship training over proceeding directly to practice. Those choosing a rural practice are likely to feel ill-prepared to replace existing rural surgeons.

## 26

**Graduating Canadian general surgeons do not feel comfortable with advanced laparoscopic skills. L.M. Gillman, A. Vergis. From the Department of Surgery, University of Manitoba, Winnipeg, Man., the Department of Critical Care Medicine, Regional Trauma Services, University of Calgary, Calgary, Alta., and the Division of General Surgery, University of Toronto, Toronto, Ont.**

The proliferation of minimally invasive techniques over the last decade has changed surgical practice. The purpose of this study was to determine whether graduating general surgery residents would undertake a variety of basic and advanced laparoscopic procedures at training completion.

As part of a multiphase project, final-year Canadian-trained residents scheduled to sit the Royal College of Physicians and Surgeons of Canada certifying examination in general surgery

were asked to complete a survey. Sixty-four residents (71%) completed the survey. Thirty-seven percent planned to transition directly into practice, 55% had confirmed fellowships (23% of those being in minimally invasive surgery), with the remainder undecided.

Nearly 100% of residents responded that they were comfortable performing basic laparoscopic procedures including cholecystectomy, appendectomy and ventral hernia repair. Overall, 49% were comfortable with laparoscopic-assisted colon resection, although comfort depended on anatomic location (67% right sided, 48% left sided and 33% anterior resections). Finally, less than 25% were comfortable with more advanced techniques including splenectomy, Heller myotomy, fundoplication and adrenalectomy.

Although graduating general surgery trainees are comfortable with basic laparoscopic techniques, our results indicate that those wishing to perform advanced procedures may require further training after completion of their general surgery residency program.

## 27

**Hand-assisted laparoscopic splenectomy compared with conventional laparoscopic splenectomy. A. Altaf, J. Ellsmere, H.J. Bonjer, D. Klassen. From the Queen Elizabeth II Health Sciences Centre, Dalhousie University, Halifax, NS.**

We hypothesize patients who undergo hand-assisted laparoscopic splenectomy (HALS) may enjoy the benefits of laparoscopic surgery, offered with conventional laparoscopic splenectomy, while having their enlarged spleens safely removed.

A retrospective review of patients who underwent HALS or laparoscopic splenectomy (LS) at a tertiary care centre between Jan. 1, 2003, and Jun. 30, 2008. The main outcomes evaluated were intra- and early postoperative morbidity and mortality rates, conversion rate to open, need for blood transfusion and length of postoperative hospital stay.

One hundred and three patients underwent splenectomy during the study period (23 HALS and 80 LS). The HALS group had significantly larger spleens (2165 v. 209 g,  $p < 0.0001$ ), older patients (63.6 v. 53.2 yr,  $p = 0.0136$ ) and more patients with malignant diagnosis leading to splenectomy (20 v. 16 patients,  $p < 0.0001$ ). There was no statistically significant difference in intra- or early postoperative morbidity (8 v. 21,  $p = 0.4226$ ), conversion rate to open (1 v. 0,  $p = 0.2233$ ) or the need for blood transfusion (4 v. 8,  $p = 0.459$ ). The length of postoperative stay (6.96 v. 3.46 d,  $p < 0.0001$ ), operative time (171.9 v. 125.1 min,  $p < 0.0001$ ) and days to resuming full diet (3.5 v. 1.8 d,  $p = 0.013$ ) were significantly longer in the HALS group. There was no mortality observed. Group differences in these variables were statistically nonsignificant when controlling for splenic weight and malignant diagnosis using multivariate analysis.

Compared with LS, HALS showed similar postoperative morbidity and mortality rates, conversion rate to open and need for blood transfusion. Although the operative time and the length of postoperative stay were longer in the HALS group, this could be explained by the higher splenic weight, the larger proportion of patients with malignant diagnosis and older patient population in this group. In patients with splenomegaly, HALS is feasible and is associated with low morbidity and mortality.

## 30

**Assessment of intracorporeal suturing skills: a comparison of four tools using the FLS task model.** *N. Orzech, V. Palter, R. Aggarwal, A. Okrainec, T.P. Grantcharov.* From the Departments of Surgery, St. Michael's Hospital, Toronto Western Hospital, University of Toronto, Toronto, and the Department of Biosurgery and Surgical Technology, Imperial College, London, Ont.

To evaluate the correlation between 4 various previously validated assessment tools for intracorporeal suturing and to review the advantages and disadvantages of each of them as a tool for objective assessment.

The study included 15 senior (PGY 3–5) general surgery residents participating in a workshop for advanced laparoscopy. After a demonstration, all participants were asked to perform an intracorporeal suturing task using the standard Fundamentals of Laparoscopic Surgery (FLS) model. Resident performance was evaluated using the FLS scoring system, a 29-point laparoscopic suturing checklist, the Objective Structured Assessment of Technical Skills (OSATS) global rating scale and the Imperial College Surgical Assessment Device (ICSAD). Assessment was performed by 2 expert laparoscopic surgeons.

There was a significant correlation between the FLS scores and scores from the laparoscopic suturing checklist ( $r_s = 0.838$ ,  $p = 0.01$ ). Similarly, the FLS scores correlated significantly with scores obtained using the OSATS global rating scale ( $r_s = 0.874$ ,  $p = 0.01$ ). Finally, FLS scores had a strong negative correlation with the various measures of analysis of motion as recorded by the ICSAD ( $r_s = -0.986$ ,  $p = 0.01$  for total time, s;  $r_s = -0.961$ ,  $p = 0.01$  for total path length, m;  $r_s = -0.883$ ,  $p = 0.01$  for total number of movements).

The performance metrics used to evaluate the FLS intracorporeal suturing task correlate with other valid assessment tools for laparoscopic suturing. This finding supports the validity of the existing FLS metrics. These data support the design of a hybrid assessment tool including the FLS scores with any of the other available valid scores. Future research should evaluate the training potential of this approach and its impact on laparoscopic skills acquisition.

## 31

**Evaluation of surgical performance during laparoscopic incisional hernia repair: preliminary data.** *I. Ghaderi, L.S. Feldman, G. Sroka, P.A. Kaneva, G.M. Fried.* From the Steinberg-Bernstein Centre for Minimally Invasive Surgery, McGill University, Montréal, Que., and the University of Western Ontario, London, Ont.

Laparoscopic incisional hernia repair (LIHR) is a relatively common procedure, and it requires advanced surgical skills. There is no reliable or valid tool for objective assessment of surgical performance during this procedure. The aim of this study was to develop an assessment tool and to evaluate its reliability and validity.

The Global Operative Assessment of Laparoscopic Skills incisional hernia module (GOALS-IHM) is a Likert-based scale developed by content experts, it consists of 7 items evaluating the critical steps of LIHR (maximum possible score = 35). During LIHR, 10 subjects (4 experienced and 6 intermediate experienced surgeons, PGY 3–5) were evaluated by the attending, an observer and self-assessment using the GOALS-IHM, a separate and pre-

viously validated 5-item generic GOALS and visual analogue scales (VAS) for overall competency and case difficulty.

Inter-rater reliability for the total GOALS-IHM score was 0.86 (95% CI 0.55–0.96) between observer and attendings, 0.91 (95% CI 0.70–0.98) between participants and attendings and 0.90 (95% CI 0.66–0.97) between participants and observer (intraclass correlation coefficient). Internal consistency was excellent for each domain, with Cronbach's  $\alpha = 0.93$ . Concurrent validity was demonstrated between GOALS-IHM and generic GOALS,  $r = 0.93$ . See the table for construct validity.

**Table , abstract 31. Validity of evaluation tools for assessing performance during laparoscopic incisional hernia repair**

Evaluation tool	Surgeon experience; mean (SD)		
	Experienced ( $n = 4$ )	Intermediate experienced ( $n = 6$ )	$p$ value
GOALS-IHM	32.0 (2.9)	21.3 (3.9)	< 0.001
Generic GOALS	24.3 (0.9)	15.8 (2.5)	< 0.001
VAS competency	82.0 (10.8)	54.2 (20.3)	0.24

Generic GOALS = 5-item, generic Global Operative Assessment of Laparoscopic Skills; GOALS-IHM = 7-item Global Operative Assessment of Laparoscopic Skills—Incisional Hernia Module; SD = standard deviation; VAS = visual analogue scale.

This pilot study shows that LIHR performance can be assessed reliably using generic and procedure-specific global rating scales. Preliminary data provide evidence for construct and concurrent validity for this assessment tool. More data are needed to confirm these findings.

## 32

**Combined general surgery and radiology training: a novel hybrid residency program.** *E. Shlomovitz, R.K. Reznick, W. Kucharczyk.* From the Departments of Surgery and Diagnostic Imaging, University Health Network, University of Toronto, Toronto, Ont.

The incredible advancements in medical imaging and image-guided therapeutics have led to mounting pressures on the surgical specialties to deliver more precise diagnoses and targeted treatments. This increasing demand for innovative, image-guided and minimally invasive procedures has led surgeons onto a direct collision course with interventional radiologists. Turf wars over the control of the technology and ability to perform such procedures will only worsen as some of these techniques become the standard of care.

We present a novel hybrid residency program in general surgery and radiology. This 7-year program was recently approved by the Royal College of Physicians and Surgeons of Canada.

The combined residency consists of 1 year of junior surgical rotations followed by 4 years of radiology training and 2 years of senior resident surgery training. One year of radiology is nearly fully dedicated to interventional radiology rotations. At the conclusion of training, the resident is eligible to sit both on the radiology and general surgery board exams.

By providing a solid foundation in both surgical and image-guided techniques, this hybrid program is intended to prepare the resident for a career in minimally invasive and image-guided procedures. We propose that this approach is a possible solution to the concerns regarding turf wars and the comprehensive training necessary for this rapidly expanding field.

## 33

**Predictors of active extrasavation on mesenteric angiography for acute gastrointestinal hemorrhage. I. Lee, S. Iqbal, H. Barayan, Y. Lu, P. Fata, T. Razek, K. Khwaja. From the Departments of Surgery and Medicine, McGill University Health Centre, Montréal, Que.**

Surgeons are often challenged with ongoing gastrointestinal hemorrhage (GIH) following endoscopic therapy and the decision between mesenteric angiography or surgery. We sought to identify predictors of positive angiographic study (active extrasavation) and to characterize outcomes of embolization for acute GIH.

A retrospective analysis of angiographies for GIH at 2 university-affiliated hospitals from January 2005 to December 2008 was performed. Patient and clinical variables were compared between patients with active extrasavation and those without. We determined significance using  $\chi^2$  and the Wilcoxon rank sum and *t* tests ( $*p < 0.05$ ). A Cox proportional hazards model was used for multivariate analyses.

Of the 83 patients identified, 35% had upper GIH. Overall, 22% had active extrasavation on initial angiography and 30% were embolized. Patients with active extrasavation had more packed red blood cells (PRBC) (5 v. 2 units)\* and fresh frozen plasma (4 v. 0 units)\* transfusions 24 hours preangiography and were more likely to be hemodynamically unstable (67% v. 28%)\* at the time of the procedure compared with patients without active extrasavation. Each unit of PRBC transfused increased the risk of a positive study by 30% (HR 1.3, 95% CI 1.2–1.6 per unit of PRBC). Embolization did not decrease recurrent hemorrhage (48% v. 51%) or length of hospital stay (31 v. 28 d) but decreased emergency surgery (12% v. 26%) compared with the nonembolized group. Major complications (requiring intervention or resulting in death) occurred in 5% of patients. Empiric embolization (embolization without active extrasavation) was performed in 12% of patients. Notably, these patients had more upper GIH (80% v. 21%)\* and had longer stays in intensive care (12 v. 3 d)\* versus patients who had a negative study. Empiric embolization was found to be an independent predictor of death in patients without active extrasavation (HR 9.2, 95% CI 1.5–55.9).

The number of PRBCs transfused correlates with a higher likelihood of a positive study. There was a significant increase in mortality in patients who had empiric embolizations. Large prospective studies are needed to further characterize the indications for angiography and empiric embolization.

## 34

**Surgery 101: developing a podcast series to enhance undergraduate surgical education. P.S. Boora, J.S. White. From the Department of Surgery, University of Alberta, Edmonton, Alta.**

We set out to determine whether medical students would download and make use of a series of custom-made podcasts covering core general surgery topics. In addition, we wished to determine whether the students would find the podcasts to be useful adjuncts to their education, and in what way and in what environment the medical students listened to the podcasts.

A series of audio-only podcasts were produced using Apple's Garage Band software. Content was based on the educational objectives in undergraduate surgical education document of the Uni-

versity of Alberta Faculty of Medicine and Dentistry. Each podcast was scripted as a brief overview of a topic. Students were provided with surveys at the end of their rotation to collect data about the usage of the podcasts and the students' opinions regarding them.

Three cohorts of students have rotated through their general surgery clerkship since the podcasts were made available. Response rate has been 92% (44/48). The majority of students responding (37/44, 84%) downloaded and used the podcasts. Despite the majority of students (38/44, 86%) owning portable digital audio players, most students listened to the podcasts at home (29/37, 78%) during dedicated study time (25/37, 68%), although there was use of the podcasts in a more portable fashion as well. The majority (30/37, 81%) of students reported that the podcasts were useful in helping them learn the core topics in general surgery, and the majority of students (32/37, 86%) would like more podcasts produced on surgical topics.

Podcasts covering core topics in general surgery were widely used by medical students rotating through their general surgery clerkship, and the clear majority considered them useful adjuncts in their education.

## 35

**Outcomes of the implementation of a new trauma transfusion pathway in a Canadian lead trauma hospital. K.N. Vogt, T. Charyk-Stewart, L. Minuk, K. Eckert, I. Chin-Yee, D. Gray, N. Parry. From the Divisions of General Surgery and Hematology, Trauma Program, London Health Sciences Centre, London, Ont.**

The objective of this study was to describe clinical outcomes and blood product utilization after implementation of a new trauma transfusion pathway (TTP) in a lead trauma centre.

Our TTP was created based on published military experience, advocating for physiologic replacement of blood products early in trauma resuscitation (1:1:1 of packed red blood cells (PRBC): fresh frozen plasma (FFP): platelets). Analysis included all patients receiving massive transfusions (MT) of more than 10 units of PRBCs after severe trauma (ISS > 12) from April 2007 to September 2008. Comparison was made with a historic cohort of patients receiving MT before the implementation of the TTP.

Seventeen trauma patients who received MT via the TTP were compared with 17 pre-TTP controls, with no substantial difference in baseline characteristics. Five mortalities occurred in the TTP group, and 9 in the pre-TTP group ( $p = 0.16$ ). No difference in the amount of PRBCs, FFP, platelets and cryoprecipitate given was seen ( $p = 0.48$ ,  $p = 0.88$ ,  $p = 0.21$  and  $p = 0.20$ , respectively); however, the first unit of both PRBC and FFP were given significantly earlier in the TTP group ( $p = 0.03$  and  $p = 0.04$ , respectively). Though the initial international normalized ratio (INR) was not significantly different between groups ( $p = 0.22$ ), the peak INR in the initial 24 hours was significantly lower in the TTP group ( $p = 0.005$ ).

Early results from our TTP show a trend toward decreased mortality with no increase in blood product utilization. Blood products were delivered sooner to patients receiving the TTP. Patients receiving the TTP also had a lower peak INR over the initial 24 hours. These results suggest a TTP helps prevent the development of substantial coagulopathy and may improve mortality for severely injured trauma patients requiring massive transfusions.

36

**Feasibility of vesicoamniotic shunt insertion (VASI) in an inanimate model: comparison of fetoscopic and ultrasound-guided techniques.** *R.J. Humphrey, A. Bütter, J. Schmidt, T. Grieci, R. Gagnon, V. Han.* From the Departments of Surgery and Pediatrics, London Health Sciences Centre, University of Western Ontario, London, Ont.

Fetoscopic vesicoamniotic shunt insertion (F-VASI) for treatment of bladder outlet obstruction is hypothesized to produce more accurate shunt placement, reduced incidence of shunt migration and equivalent morbidity to ultrasound-guided VASI (US-VASI). The current study was designed to determine the feasibility of F-VASI in an inanimate model, and to compare it with US-VASI in terms of success of shunt insertion.

An inanimate second-trimester fetus with a reinflatable bladder was suspended in a pressurized water tank and US localized the fetus. Fetal position was randomized, and the operator was blinded. A 5-French Harrison shunt decompressed the bladder and 30 shunt insertions were performed in each group. In F-VASI, 3-mm fetoscopic instruments and 6-0 suture to secure the shunt were used. Measured outcomes included procedure time, distance from midline, bladder puncture, depth of shunt and overall success rate.

Procedure time was longer for F-VASI (15.0 v. 2.8 min,  $p < 0.05$ ), although it decreased with practice. Both F-VASI and US-VASI were similar for adequate depth of insertion (27/30 v. 27/30,  $p = 1.0$ ), placement within 1 cm of midline (27/30 v. 25/30,  $p = 0.42$ ), bladder puncture (28/30 v. 28/30,  $p = 1.0$ ) and overall success rate (27/30 v. 23/30,  $p = 0.3$ ).

Fetoscopic VASI is feasible in an inanimate model. The overall success rate was similar between groups, although procedure time was longer for F-VASI. Future study is required to investigate the morbidity and degree of shunt migration with F-VASI.

37

**A comprehensive residency orientation program for first-year general surgery residents at the University of Ottawa, Canada.** *S. Duhaime, D.F. Pitt.* From the University of Ottawa, Ottawa, Ont.

A formal orientation program for postgraduate year (PGY)-1 residents in general surgery was implemented in July and August 2008 with a written study guide, a series of interactive seminars and a social event. The objective was to alleviate what can be a difficult and prolonged transition to residency, improve residents' performance and reduce drop-out rates.

The methodology was a needs analysis survey of residents and faculty of the division of general surgery of the University of Ottawa hospital, a literature review, creation of a study guide, a series of seminars and a social event, implementation during July and August 2008 and evaluation. The evaluation was by survey of the PGY-1 residents immediately after each seminar and a repeat survey of PGY-1s in March 2009. Further evaluation will include analysis of the results of the PGY-1s 2009 CAGS MCQ and interviews with PGY-1s in April 2009.

The needs analysis indicated strong support for an orientation program with a 4.7 rating on a Likert scale of 0 to 5.0. The orientation program was successfully implemented in July and August 2008. There was strong support to repeat the orientation pro-

gram for the 2009 PGY-1s. The evaluation rating for some of the seminars changed from July and August to March after there was time for reflection. The analysis of the 2009 CAGS MCQ and the interviews with PGY-1s will be reported.

We conclude that a formal orientation program is beneficial for general surgery residents.

38

**Resident perceptions of advanced laparoscopic skills training.** *V. Palter, N. Orzech, R. Aggarwal, A. Okrainec, T.P. Grantcharov.* From the Departments of Surgery, St. Michael's Hospital, Toronto Western Hospital, Toronto, and Imperial College, London, Ont.

A descriptive, survey-based study was designed in order to explore surgical residents' perceptions regarding their current laparoscopic training and to determine their opinions regarding the current methods of teaching laparoscopic suturing in a surgical skills laboratory.

Fourteen senior general surgery residents who attended a workshop on advanced laparoscopic techniques participated in the study. Four training tools were used in the workshop course curriculum: The Fundamentals of Laparoscopic Surgery (FLS) black box suturing model, a synthetic Nissen fundoplication model, a virtual reality (VR) simulator suturing task and a porcine jejunojejunostomy model. After the workshop, residents were asked to complete a questionnaire relating to their experience with laparoscopic surgery and their opinions regarding the 4 training models. Descriptive statistics were used for data analysis.

The majority of the residents had observed and performed over 40 laparoscopic cases since the start of their surgical residency; however, half of the residents felt that their exposure to advanced laparoscopy was insufficient. The vast majority of residents felt that they had not received instruction in laparoscopic suturing (median 1 on a 5-point Likert scale) and did not feel proficient with this technique. At the end of the workshop, residents ranked the animal model as their preferred training tool for laparoscopic suturing, followed by the FLS black box, with the VR simulator task being the least preferred tool ( $p < 0.05$ ). When asked to rank each task individually, however, the majority of residents ranked each task as being "moderately helpful" or better (5-7 on a 7-point Likert scale).

Survey results indicate that training in advanced laparoscopic skills is still suboptimal and needs to be incorporated early in the residency curriculum. Future developments in VR simulation are necessary to provide a realistic experience with intracorporeal suturing.

39

**Impact of outpatient laparoscopic appendectomy protocol on length of stay, morbidity and postoperative visits to ER.** *L. Dubois, K.N. Vogt, W. Davies, C.M. Schlachta.* From the Department of Surgery, University of Western Ontario, London, Ont.

The objective of this study was to report the results of an outpatient appendectomy protocol developed at our institution to select patients for early discharge from the recovery room after emergent laparoscopic appendectomy for acute appendicitis.

All patients with acute appendicitis (study group) treated during the first year of this protocol, September 2006 to September 2007, were compared with a historical cohort of patients presenting in the immediate prior year (control group) to determine the impact on morbidity, length of stay and return visits to the emergency department.

A total of 161 patients underwent appendectomy under the study protocol. Of these, 109 (68%) patients were recruited into our protocol, with 72 discharged from the recovery room. Compared with the 156 patients in the control group, both cohorts were similar with respects to age, sex, body mass index, presence of comorbidities and proportion with perforated appendicitis. There was no difference in postoperative complications between the study and control cohorts (10.6% v. 13.5%,  $p = 0.49$ ) or visits to the emergency department (13.7% v. 15.4%,  $p = 0.66$ ). Median postoperative length of stay was significantly reduced in the study cohort (median 13.1 v. 29.7 h,  $p < 0.001$ ). The proportion of patients having a laparoscopic appendectomy was higher in the study cohort (85.7% v. 69.2%,  $p < 0.001$ ). Complication rate (4.2%), postdischarge visits to the emergency department (11.1%) and median postoperative length of stay (4.7 h) were low among the 72 patients who completed the protocol and were discharged from the recovery room.

Adoption of an outpatient appendectomy protocol to select patients for early discharge after laparoscopic appendectomy resulted in a significant decrease in postoperative length of stay and a 45% reduction in the need for inpatient beds. There was no impact on morbidity or postoperative visits to the emergency department.

#### 40

**Health technology assessment of laparoscopic sleeve gastrectomy versus gastric banding and Roux-en-Y gastric bypass for morbid obesity. X. Shi, D.W. Birch. From the Centre for the Advancement of Minimally Invasive Surgery, Edmonton, Alta.**

Laparoscopic sleeve gastrectomy (LSG) is an innovative approach to the surgical management of morbid obesity. Weight loss may be achieved by restrictive and endocrinological mechanisms. Early data suggest LSG may be an efficacious approach to morbid obesity management either as a staged procedure or as definitive treatment. A systematic review of the current literature analyzing clinical and operational outcomes was completed.

A systematic review of the literature identified 18 studies (938 patients). Data from LSGs were compared with benchmark clinical data and local operational data for laparoscopic adjustable gastric band (LAGB) and laparoscopic gastric bypass (LRYGB). The average percentage of excessive weight loss (%EWL) for LSG varied from 33% to 83% (6–36 mo follow-up) and appeared to be sustained up to 3 years. The average mortality rate was 0.39%, and major complications ranged from 0% to 29% (average 11%). Operative time ranged from 66 to 143 minutes (average 100 min). Hospital stay varied from 1.9 to 8 days (average 4.7 d). The operational impact of LSG has not been described in the literature. According to data from the Royal Alexandra Hospital, the estimated total cost of LSG is Can\$6922 as compared with LAGB (Can\$9151) and LRYGB (Can\$8228). These costs do not include further surgical interventions in patients with LSG.

Early, nonrandomized data suggest that LSG is efficacious in the surgical management of morbid obesity. It is not clear if weight loss after LSG is sustainable, and therefore it cannot be considered definitive management. The operational impacts of LSG as a staged or definitive procedure are poorly defined and must be analyzed further.

#### 41

**Are bowel sounds useful in assessing the abdomen? Y. Gu, M.A. Moser. From the Department of Surgery, University of Saskatchewan, Saskatoon, Sask.**

The purpose of our study was to determine the usefulness of bowel sounds, without any other cues, in the diagnosis of ileus and bowel obstruction.

Healthy volunteers ( $n = 10$ ) and patients with radiologically or laparotomy-confirmed small bowel obstruction ( $n = 9$ ) or ileus ( $n = 7$ ) were enrolled as study subjects. Two 30-second, unselected recordings of bowel sounds from each subject were obtained using an electronic stethoscope. Nineteen study physicians (observers) were then individually presented with 43 consecutive sound recordings and were asked whether each represented bowel obstruction, ileus or normal subjects. Data were analyzed using kappa statistics with weighted  $\kappa$  statistics and  $\chi^2$  tests used where appropriate.

Agreement when listening to the same clip at different times was very good (intra-observer variation,  $\kappa = 0.72$ , agreement 81.3%). There was also good agreement between answers given for the 2 sets of sounds recorded on each patient (intrasubject variation,  $\kappa = 0.63$ , agreement 78.7%). Overall, the test had an interobserver variation of  $\kappa = 0.57$  (moderate) and 67.1% agreement. Bowel sounds from subjects with ileus and normal bowel sounds were correctly identified most of the time (84.5% and 78.1%, respectively). However, bowel sounds from patients with bowel obstruction were correctly identified only 42.1% of the time.

Our results suggest that the auscultation of bowel sounds is still an important modality for patients with ileus, but not so much for patients with bowel obstruction. Further analysis is needed to delineate the specific sounds that are characteristic of small bowel obstruction.

#### 42

**A five-year Canadian laparoscopic adjustable gastric band experience. T.W. Swanson, D.F. Schaeffer, B.Q. Tang, C.H. Rusnak, B.J. Amson. From the Department of Surgery, Royal Jubilee Hospital, Victoria, BC, University of British Columbia, Vancouver, BC.**

Since 2004, laparoscopic adjustable gastric banding (LAGB) via the pars flaccida approach has been implemented at our major Canadian Bariatric Centre (Victoria, BC)

A retrospective review of all LAGB cases was performed in addition to a survey of these patients conducted in February of 2008 and March of 2009. Multidisciplinary team assessment and support group attendance is expected of all patients. Regular follow-up regarding diet and exercise modification and necessary band adjustments occurs.

Ninety patients had LAGB and all were followed. Eighty-six patients were surveyed. Mean follow-up was 17.5 months.

Average preoperative BMI was  $46.7 \pm 7.50$ . Weight loss averaged  $24.8 \pm 19.4$  kg. Overall weight loss was 2.68 kg/month and dropped to 1.50 kg/month over the last 10.7 months (range 1–13,  $n = 41$ ) of follow-up (nonsignificant drop,  $p = 0.16$ ). Excess body weight loss was  $27.5\% \pm 6.34\%$ ,  $39.1\% \pm 18.0\%$  and  $67.2\% \pm 31.3\%$  at 0–1, 1–2 and 2+ years, respectively. On average, patients had 4.14 adjustments of their band and vomited 2.13 times per week. The mortality rate was 0%. There were no band slippages, no band erosions and no mechanical failures. Two reservoir ports were repositioned under local anesthetic, and 1 patient underwent early laparoscopic reoperation for tube diaphragm irritation. Overall satisfaction was excellent or good in 87.5% of patients. Resolution or improvement occurred in 78.6% diabetes mellitus, 71.5% arthritis/joint pain, 63.3% hypertension, 62.9% dyslipidemia, 44.4% sleep apnea, 41.4% depression/anxiety, 40% polycystic ovarian disease and 56.3% gastroesophageal reflux disease. Gastroesophageal reflux disease worsened in 25% of patients.

Our weight loss and comorbidity results replicate the world literature. Our low complication rates (0% for both slippages and erosions) may be attributable to our use of a very pliable and wide band (Midband), surgical technique or close follow-up and band adjustments.

#### 43

**Diagnostic yield of imaging for patients presenting with suspected acute appendicitis. K.N. Vogt, L. Dubois, A. Hobbs, R. Etemad-Rezai, C.M. Schlachta. From the Divisions of General Surgery and Radiology, London Health Sciences Centre, London, Ont.**

The objective of this study was to describe the diagnostic outcomes of patients presenting with signs and symptoms suggestive of acute appendicitis.

All patients who presented to our emergency department with suspected acute appendicitis between October 2007 and September 2008 were identified using our prospectively collected radiology and operative databases. Demographic, imaging, operative, pathologic and readmission data were extracted from the electronic medical records of all identified patients.

Of 447 patients presenting with suspected appendicitis, 432 (97%) underwent imaging studies, whereas 15 (3%) were taken directly to surgery. Of those imaged, US was the most common imaging modality (65%) followed by CT (35%). Most USs were equivocal (196, 71%), whereas 51 (18%) were positive, and 31 (11%) were negative. Most patients with equivocal US were discharged without further workup (62%), whereas 53 had a CT, 16 were taken to surgery, and 5 were admitted with alternate diagnoses. Of all those imaged, 169 (39%) were discharged by the emergency physician without a surgery consult. A total of 141 appendectomies were performed, 7 of which were negative for acute appendicitis (negative appendectomy rate 5%). Initial use of US led to a treatment decision in 221 (79%), of whom 147 (67%) were discharged. There were no readmissions of discharged patients (false negatives). Sensitivity, specificity, positive and negative predictive values of US were 65%, 99%, 96% and 89%, respectively; of CT, they were 98%, 99%, 97% and 99%.

Nearly all patients presenting with suspected appendicitis underwent imaging. Although most USs were equivocal, they did not lead to further imaging in most cases, and patients were discharged appropriately with no repeat visits to the ER. Although

CT scans are highly accurate, most patients with suspected appendicitis can be appropriately worked-up with a combination of US and clinical assessment, thus minimizing the use of CT and radiation exposure.

#### 44

**The life and career of John Wishart (1850–1926), Western's first professor of surgery. E. Claydon, V. McAlister. From the Schulich School of Medicine and Dentistry, University of Western Ontario, London, Ont.**

The 1910 Flexner Report on Medical Education in the United States and Canada is often taken as the point when medical schools in North America took their modern form. However, many fundamental advances in surgical medicine, such as anesthesia and asepsis, predated the report by decades. To understand the contribution of educators in this earlier period, we investigated the forgotten career of Western's first professor of surgery, John Wishart. Archives at the University of Western Ontario (UWO), University of Toronto, London City Library and Wellington County Museum were searched for material about Wishart and his times.

A fragmented biography can be assembled from family notes and obituaries. Contemporary documents compiled by local medical historian Edwin Seaborn and notes written by Crane add to that biography and offer tantalizing details of Wishart's personal life. All evidence indicates that Wishart's surgical career was impressive; he assisted Abraham Groves in the first reported surgery to use aseptic technique (1874), and he claimed to have performed the first operation for appendicitis in North America (1886). A superb lecturer, Wishart was a founding member of the faculty of the medical school at Western University in 1881, initially as demonstrator of anatomy and subsequently as its first professor of clinical surgery, a post from which he resigned in 1910. The role of the Flexner Report in the termination of his professorship is hinted at in minutes of faculty of medicine meetings. Wishart went on to become one of the founding physicians of London's Catholic St. Joseph's Hospital, despite his own Protestant background.

Wishart's death in 1926 marked the passing of one of southwestern Ontario's medical pioneers, and consideration of his life and career today provides a fascinating glimpse into local medical history and the development of academic surgery at UWO in the pre-Flexner era.

#### 45

**Kidney transplantation in children weighing less than 15 kg: results from a single centre experience. J. Grushka, W. Sur, J.-M. Laberge, J. Tchervenkov, L. Bell, H. Flageole. From the Divisions of Pediatric Surgery and Nephrology, Department of Pediatrics, Montréal Children's Hospital, and the Department of Surgery, McGill University, Montréal, Que.**

Small patients remain a challenging population for organ transplantation. The aim of this study is to review our experience at the Montreal Children's Hospital with kidney transplantation in recipients weighing less than 15 kg. A retrospective chart review was conducted of all pediatric kidney transplant recipients weighing less than 15 kg who were hospitalized from January 2000 to



July 2008. During the study period, 11 of 65 pediatric kidney transplants were performed in children with a body weight of less than 15 kg. Median body weight was 11.4 (range 9.9–14.8) kg and median age was 2.1 (range 1.3–3.5) years. Preoperative dialysis was performed in 90% of cases (8 peritoneal dialysis and 2 hemodialysis). In 7 cases (64%), grafts came from living related donors (LRD) and in 4 cases (36%) from cadaveric (CAD) donors. Grafts were placed extraperitoneally to the iliac fossa ( $n = 10$ ) or transperitoneally via midline incision ( $n = 1$ ). Vascular anastomoses were performed to the aorta and vena cava ( $n = 9$ ) or the common iliac artery and common iliac vein ( $n = 2$ ). Overall patient survival was 100%, and overall graft survival was 91%. Median follow-up was 3.5 (range 1.3–8.3) years. The initial graft function rate was 100% for both LRD and CAD. The reason for the single graft loss was thrombosis of the donor renal vein. Kidney transplantation in children weighing less 15 kg is both technically feasible and safe. Extraperitoneal placement of the donor kidney appears to be the preferred method of graft placement in this population at our institution and to date has been associated with a favourable outcome.

#### 46

**Safe transition to laparoscopic gastric surgery: a laparoscopic surgeon's initial experience. S. Labidi, J.P. Gagné. From the Québec Centre for Minimally Invasive Surgery, Centre hospitalier universitaire de Québec, Québec, Que.**

The objective of this study was to review the perioperative outcome of patients who underwent partial or total laparoscopic gastrectomy by one laparoscopic surgeon in an academic health sciences centre. Data were collected from the surgeon's very first case and included demographics, comorbidities, diagnosis, operative parameters and postoperative outcome.

From March 2006 until March 2009, 18 patients (33% male) with a median age of 68 (45–83) years were included. Unless contraindicated, all candidates to a gastric procedure were offered a laparoscopic approach. Median BMI was 25. Fourteen patients had at least 1 comorbidity. Surgical indications were adenocarcinomas (10), gastrointestinal stromal tumour (4) and benign ulcer disease (4). Procedures were subtotal gastrectomies with reconstruction (12), wedge resections (4), total gastrectomy (1) and pyloroplasty (1). Vagotomy was done in 3 cases. Median blood loss and operative time were 100 mL and 270 (60–410) minutes, respectively. The conversion rate was 22% and was owing to bulky prepyloric lesions in 3 patients and difficult exposure in one. Complications occurred in 11 patients. There was no mortality. Median postoperative stay was 8 (3–75) days.

In experienced hands, safe transition to laparoscopic gastric surgery is feasible and safe. In such a setting, the learning curve appears negligible. Prepyloric lesions pose a higher technical challenge and might not be ideal as first cases. Adequate patient selection and long-term follow-up are paramount.

#### 47

Withdrawn

#### 50

**Outcomes and mortality associated with massive transfusion. R. Gowing, K. Kahn moui. From the Department of Surgery, McMaster University, Hamilton, Ont.**

Whereas massive transfusion has been studied in trauma victims, emergent and elective surgeries also require similar interventions. The purpose of this study was to define the epidemiology of this population and the mortality associated with massive transfusion in a tertiary hospital setting.

A retrospective chart review of 358 patients admitted to a tertiary academic centre who received a massive transfusion ( $\geq 10$  units of red blood cells within 24 hours of admission). Patients admitted primarily for trauma and medical bleeding not requiring surgery were excluded. Mortality rates were calculated based on patient demographics, delay, comorbidities, physiologic parameters, type of surgery and transfusion requirements.

In total, these patients used 7184 units of blood. Excluding trauma admissions, patients underwent emergent surgery ( $n = 97$ ) or elective ( $n = 75$ ) surgical procedures. The surgery types were primarily vascular surgery, general surgery and cardiac surgery. Comparing all urgent to elective cases, urgent cases required a greater number of transfusions overall (mean 16.9 v. 14.5,  $p < 0.05$ ) and had a greater mortality ( $p < 0.01$ ), even though there is no difference in the ages of the groups. Among the surgical subgroups of patients, the risk of mortality was greater with delay to surgery, low hematocrit at admission to the intensive care unit, acidosis, increased comorbidities and abnormal coagulation profile.

The surgical population requiring massive transfusion is a heterogeneous population with a high mortality. Mortality is significantly greater for specific types of surgery, urgent surgeries and physiologic derangements during transfusion.

#### 51

**Edward Farrell (1842–1901) and the development of modern surgery in Nova Scotia. C.C. McAlister, A. Marble. From the University of Toronto, Toronto, Ont., Dalhousie University, Halifax, NS.**

The invention of anesthesia and aseptic technique permitted the development of modern surgery. The role played locally by Canadian surgeons is not well known. We researched the life and career of Edward Farrell, the first professor of surgery in Halifax, to understand the development of surgery in this region.

Holdings of the Provincial Archives of Nova Scotia, Dalhousie University Library, Columbia University (New York), contemporary newspapers and medical literature were searched for information by and about Farrell.

Edward Farrell (1842–1901), son of Irish immigrants Mary and Dominick Farrell, grew up in Dartmouth, Nova Scotia. After apprenticing with Dr. W.J. Almon, Farrell attended the New York College of Physicians and Surgeons, where he trained under and alongside some of the surgical greats such as Dr. Henry B. Sands, the Mayo brothers and Dr. William Halsted. He dedicated his career to many different aspects of medicine, including medical education, research, politics and social clubs. He fought for a local medical school and became Dalhousie's first professor of anatomy and surgery and later dean of the faculty of medicine. He published frequently and edited a local medical journal, then the principle source of CME for practitioners in the maritimes. He was among the first surgeons to apply the concepts of aseptic technique, which he called surgical cleanliness, and whereas he incorporated some of Lister's principles, he did not accept Listerism, unlike some of his outspoken contemporaries. This was quite controversial during his time. He also contributed to areas of

research such as diphtheria, tuberculosis and cancer. He described transplantation of rabbit femur to treat fracture malunion in a young boy, the first described xenotransplantation in Canada. Farrell was active in provincial, federal and medical politics, achieving high elected office in all arenas. When he died in January 1901 from typhoid, his funeral was one of the largest ever held in Halifax.

The characterization of Farrell as a barrier to the development of surgery because of his opposition to Listerism is invalid. Farrell's message regarding surgical cleanliness remains relevant today in this era of antibiotic resistance. Our research shows Farrell to have been an innovative and thoughtful surgeon to whom modern surgery in the maritimes is indebted.

## 52

**The effect of pre-emptive local anesthesia on postoperative pain in laparoscopic surgery: a systematic review and meta-analysis.** *S. Coughlin, P. Karanicolas, H. Emmerton-Coughlin, B. Kanbur, S. Kanbur, P. Colquhoun.* From the University of Western Ontario, London, Ont.

Our objective was to determine the effect of local anesthesia administered before laparoscopic surgery (pre-emptive) on postoperative pain.

We searched MEDLINE, EMBASE, The Cochrane Central Register of Controlled Trials, as well as reference lists of textbooks and relevant articles and contacted experts in the field of anesthesia and laparoscopic surgery for randomized controlled trials (RCTs) comparing pre-emptive administration of local anesthesia at the incision site or intraperitoneally with postoperative administration or placebo. We systematically assessed trials for eligibility and validity, and extracted data in duplicate. We pooled data across studies using a random effects model.

Our initial search yielded 1161 citations, of which 30 RCTs ultimately met eligibility criteria. In the 5 studies comparing preincisional with postincisional local anesthetic, there was no difference in visual analogue (VAS) pain scores at 24 hours (weighted mean difference [WMD] -1.36 mm, 95% confidence interval [CI] -4.63 to 1.91) or in analgesic consumption (standardized mean difference [SMD] 0.38, 95% CI -0.51 to 1.26). In 4 studies comparing pre-emptive intraperitoneal local anesthetic with postoperative administration, pre-emptive infiltration reduced pain at 24 hours (-7.95 mm, 95% CI -12.33 to -3.56) but not analgesic consumption (SMD -0.35, 95% CI -1.02 to 0.33). When compared with placebo, local anesthesia at the incision site (12 studies) decreased VAS pain scores at 24 hours (-4.75 mm, 95% CI -8.9 to -0.60), whereas local infiltration intraperitoneally (9 studies) decreased both VAS pain scores at 24 hours (WMD -5.57, 95% CI -8.35 to -2.79) as well as analgesic consumption (SMD -0.56, 95% CI -1.11 to -0.01).

When compared with placebo, pre-emptive local anesthesia decreases postoperative pain scores. Pre-emptive local anesthetic at the incision site achieves similar postoperative pain reduction as postincisional infiltration, whereas intraperitoneal pre-emptive local anesthetic decreases pain scores at 24 hours compared with postoperative infiltration. Surgeons should infiltrate local anesthetic at the incision site or intraperitoneally in laparoscopic surgery to decrease postoperative pain; however, the timing of administration only seems to have an effect when given intraperitoneally.

## 53

**Predictors of mortality in laparoscopic foregut, hindgut and end-organ surgery.** *D.C. Trottier, S. Doucette, H. Huynh, C.M. Soto, E.C. Poulin, J. Mamazza, R.P. Boushey.* From the Department of Surgery, University of Ottawa, The Ottawa Hospital, Ottawa, Ont.

Several studies have identified predictors of perioperative mortality for open surgery, but these have yet to be defined for laparoscopy. This study aims to identify factors predictive of 30-day mortality in patients undergoing laparoscopic procedures.

A prospectively collected database of 2032 laparoscopic procedures was reviewed. Contributions from 5 surgeons working in 4 academic institutions were recorded from 1991 to 2008. All patients were offered a minimally invasive approach with no selection bias. The primary outcome was 30-day mortality. Interventions were divided into foregut (Nissen fundoplication, gastrectomy and Heller myotomy; 355 patients), hindgut (colectomy; 1375 patients) and end-organ procedures (adrenalectomy, nephrectomy, splenectomy and pulmonary lobectomy; 302 patients). Univariate regression analysis to identify predictors of mortality included diagnosis, medical comorbidities, operative time, intraoperative and postoperative complications.

There were 34 (1.7%) mortalities. Subgroup analysis revealed 2 deaths in the foregut category (0.6%), 27 deaths in the hindgut category (2%) and 5 deaths in the end-organ category (1.7%). Causes of death for foregut were duodenal stump leak (1) and esophageal perforation (1). In the hindgut group, they included cardiac arrest (9), leak (6), pulmonary embolus (3), stroke (2), hemorrhage (2), as well as various other rare causes. For end-organ interventions, deaths were limited to the splenectomy group and included sepsis, pancreatitis, intracranial hemorrhage and cardiac arrest. Age, perforation/leak, a past cardiac history as well as postoperative cardiac and pulmonary complications all increased a patient's chances of dying following surgery. For both foregut and hindgut categories, age and intestinal perforation/leak were the greatest predictors of death. The 30-day mortality in the end-organ category was greatest in patients with hematologic malignancies. Surgical experience was not a predictor.

The total number of mortalities in this cohort is small and provides insight into predictors of 30-day mortality. Preoperative identification of high-risk individuals permits potential optimization.

## 54

**Effect of the ACGME work-hour restrictions on surgical residents, faculty and patients: a systematic review.** *M.H. Jamal, M. Rousseau, S. Meterissian, L. Snell.* From the Centre for Medical Education, Division of General Surgery, 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 residents' education, especially their operative experience.

We searched for English- or French-language articles studying the impact of surgical residents' work hours on their well-being, learning, patient care and faculty. We used the following databases from 2000-2008: MEDLINE, EMBASE, The Cochrane

Central Register of Controlled Trials and ERIC. We retrieved 1048 abstracts and included every paper looking at the effect of the work-hour limits on surgical training. Surgical specialties were defined as any specialty with OR experience, e.g., general surgery, cardiothoracic surgery, neurosurgery, ear–nose–throat, orthopedics, ophthalmology and obstetrics and gynecology. Two investigators independently rated the quality of all papers. Positive and negative outcomes were extracted from all papers and subjected to a thematic analysis by 2 independent reviewers. Sixty studies were included. Positive and negative outcomes on resident education, resident lifestyle, patient care and surgical faculty were compiled. Overall, the effects were positive in the first 3 but negative for surgical faculty. The papers with the highest quality scores had 37 positive themes and 11 negative themes. Resident education in particular was not negatively affected by the work-hour limitations, particularly the operating exposure, where 15 papers reported positive or neutral effect on number of OR cases, and only 2 papers reporting a negative effect.

This is the largest and most current review of the literature addressing the effect of the ACGME work-hour limitations on surgical training. These limitations had a positive effect on residents and patients but a negative effect on faculty. Most importantly residents' OR experience was not adversely affected.

## 55

**Severe stricturing Crohn disease of the duodenum: a case report and review of surgical options. J.M. Racz, E. Davies. From the Department of Surgery, University of Western Ontario, London, Ont.**

Duodenal Crohn disease is a rare clinical entity that occurs in 0.5%–4.0% of patients with Crohn disease. Here we describe the unique case of a 41-year-old man with medically refractory Crohn disease of the upper gastrointestinal tract characterized by multiple strictures within the duodenum and proximal jejunum.

Imaging techniques such as computed axial tomography and barium swallow are important in planning surgical intervention; however, discovery of unexpected disease intraoperatively does occasionally occur, thereby requiring the surgeon to alter his or her original management plan.

Although a Whipple resection was initially considered as a form of operative intervention, given the extent of disease within the first, second and fourth portions of the duodenum, we were able to alleviate obstruction with a combination of surgical resection and bypass procedures. In this case, we were able to achieve resolution of symptoms with small bowel resection (third and fourth portions of the duodenum and proximal jejunum), duodenojejunostomy and gastrojejunostomy. A radiologically undetectable stricture within the distal jejunum was also discovered intraoperatively, which was addressed with strictureplasty.

Collectively, this combination of procedures maximized conservation of bowel while permitting complete alleviation of symptoms, both of which are fundamental to the surgical treatment of Crohn disease. A variety of operative techniques are currently described in the literature for the management of duodenal Crohn disease, each of which will be reviewed in this case report.

## 56

**Is the stress of surgical residents underestimated? N. Aminzadeh, F. Farrokhyar, S. Reid, A. Naeeni,**

**M. Naeeni, A. Kashfi, K. Kahnemoui. From the Department of Surgery, McMaster University, Hamilton, Ont.**

It is often believed that surgical residents are exposed to standard levels of stress during the course of their programs. The following study set out to investigate whether the stress levels of surgical residents are underestimated, to determine the major cause of their stress, as well as identify coping mechanisms.

A short web-based survey consisting of 37 questions in 3 categories (general, stress related and health related) was distributed to surgical residents across Canada.

Of 169 respondents, 31% of residents reported most days of the past year of residency as “quite to extremely stressful.” Other sources of stress that were reported as “quite to extremely stressful” included time pressure (74%), number of working hours (57%), residency program (42%) and working condition (41%).

Mental or emotional problems were higher in women ( $p = 0.006$ ) and financial stressors in men ( $p = 0.036$ ). Women were found to be more likely to seek help when needed ( $p = 0.026$ ). Foreign medical graduates reported more stress related to working conditions ( $p < 0.001$ ), residency program ( $p = 0.002$ ), caring for family members ( $p = 0.006$ ), discrimination ( $p < 0.001$ ) and personal and family safety ( $p = 0.001$ ) compared with Canadian medical graduates. The most common coping mechanisms used “sometimes to often” by at least two-thirds of the residents included staying optimistic (86%), engaging in enjoyable activities (83%), consulting others (75%) and exercising (69%).

A majority of the surgery residents experience degrees of stress on a daily basis. Female sex and being a graduate of a non-Canadian medical school are factors that were found to increase levels of stress in certain areas of residency. Various methods of reducing stress need to be implemented in surgical residency programs.

## 57

**Recurrent appendicitis secondary to appendiceal duplication: a case report and review of literature. K. Martin, M. Weir, B. Taylor. From the London Health Sciences Centre, London, Ont.**

Duplication of the appendix is rare, occurring in 0.004%–0.009% of the population. Failure to recognize a duplicate appendix during appendectomy may lead to recurrent appendicitis. We report the case of a 19-year-old man who presented to us with right lower quadrant peritonitis and septicemia 4 years after a laparoscopic appendectomy. The pathology report from 4 years ago showed an appendix with microscopic evidence of appendicitis. At our laparotomy, a perforated retrocecal appendix was removed with difficulty. Pathology confirmed appendicitis again. Surgeons must be aware of this clinical entity to prevent delay in diagnosis in patients who have already had their appendix removed.

## 58

**Patterns of drug use and toxicological screening in the pediatric trauma population at the Children's Hospital of Western Ontario. K.M. Martin, M.J. Girotti, N.G. Parry. From the London Health Sciences Centre, Children's Hospital of Western Ontario, London, Ont.**

A retrospective study was conducted to determine trends in drug

use and screening in the pediatric trauma population of south-western Ontario. A comprehensive database search and chart review was conducted of 799 patients to elicit age, sex, injury severity and results of drug testing. This demonstrated that screening is used with increased frequency in adolescents, who also demonstrated increased drug use. Children under the age of 3 are also often subjected to drug screening, frequently with positive results. Blood-alcohol concentration (BAC) is the most common drug test conducted, with screening for other drugs being done infrequently. No statistically significant difference was observed in BAC screening practices between sexes. In contrast, male patients were more often screened for other drug ingestions such as cannabinoids, opiates and benzodiazepines. Male and female patients demonstrated no significant difference in terms of drug test positivity. Injury severity did not correlate with screening trends or evidence of drug exposure. Drug ingestions do play a role in pediatric trauma. Further study employing a universal approach to testing may provide further information on the prevalence of drug exposure in this population, as well as identify predictors of drug exposure to create a systematic approach to toxicological screening in the pediatric trauma population.

## 59

**Treatment trajectories of elderly patients suffering from gallstone disease. W.C. Hanna, S. Fraser, I. Weissglas, G. Ghitulescu, A. Bilek, J. Marek, C. Galatas, S. Bergman. From the Department of Surgery, Jewish General Hospital, McGill University, Montréal, Que.**

The purpose of this study was to describe the treatment trajectory of elderly patients with calculous biliary disease.

We identified all patients 65 years and older having presented to a single institution with calculous biliary disease between April 2006 and April 2008. Previous and subsequent visits with this diagnosis were reviewed retrospectively. Patients were divided into 3 age groups (group 1 = 65–75 yr, group 2 = 75–85 yr, group 3 =  $\geq$  85 yr), and treatment modalities and outcomes were recorded. Two-tailed Student *t* tests and logistic regression were used to determine statistical significance.

A total of 235 patients presented with a diagnosis of biliary colic, cholecystitis, cholangitis or biliary pancreatitis: group 1 ( $n = 100$ , 161 visits), group 2 ( $n = 94$ , 143 visits) and group 3 ( $n = 41$ , 65 visits). The mean Charlson comorbidity index (CCI) was lower in group 1 compared with groups 2 and 3 (1.8 v. 2.6 v. 2.3, respectively,  $p < 0.01$ ). Cholecystostomy tubes were inserted in 13%, 16% and 27% of patients in groups 1, 2 and 3, respectively ( $p = 0.1$ ), and ERCP was performed in 20%, 28% and 18%, respectively ( $p = 0.01$ ). Finally, surgery was undertaken in 84%, 54% and 17% ( $p < 0.01$ ). This was done electively in 79%, 65% and 57% ( $p = 0.02$ ). Time to surgery was 84, 96 and 212 days in groups 1, 2 and 3, respectively ( $p = 0.4$ ). Average length of stay on a nonsurgical ward was 2, 10.9 and 9.7 days ( $p = 0.001$ ). In group 1, 10% of patients had complications, compared with 29% and 37% in groups 2 and 3 ( $p = 0.02$ ). Mortality was 9% and 10% in groups 2 and 3, respectively, but 0% in group 1 ( $p < 0.01$ ). Logistic regression demonstrated that CCI and age were both independent factors in the decision to offer surgery.

Patients with gallstone disease in the older age ranges of the geriatric spectrum more often undergo nonoperative treatment, and when treated surgically, this is less often performed elec-

tively. Although possibly explained by increased comorbidity, this is associated with greater complications and mortality.

## 60

**Single incision laparoscopic appendectomy in the community using conventional instruments: an initial experience. C.G. Chiu, N.H. Nguyen, S.W. Bloom. From the Richmond Hospital, Richmond, BC.**

A 5-month prospective study of 16 patients at a community hospital demonstrates that laparoscopic appendectomy performed through a single umbilical incision can be achieved using conventional laparoscopic instruments and is successful, safe and esthetic. The objectives of the study were to evaluate the feasibility, safety and cosmetic results of a single-incision approach for laparoscopic appendectomy.

Consecutive patients undergoing appendectomy for acute appendicitis were enrolled in the study. Appendectomy was carried out using 3 trocars and conventional laparoscopic instruments in a small umbilical incision (approximately 3 cm in length). The patients received standard postoperative care and were seen at 2–3 weeks follow-up. The average age of patients was 44 (range 19–83) years. There were 5 female and 11 male patients. Two patients were excluded: one for pregnancy at 26 weeks' gestation and the other for lack of equipment. Mean operative time for the successful single-incision group was 62 (range 45–75) minutes. Eleven of 14 attempted cases were achieved through a single incision port site. There were no operative complications. Average length of stay for the single-incision group was 1.9 (range 1–6) days. The operative scar was minimally visible at follow-up, and all patients reported a highly favourable cosmetic result. The results of the study demonstrate that laparoscopic appendectomy can be safely achieved with a single umbilical incision using conventional instruments at a community hospital.

## 61

**Starting a laparoscopic sleeve gastrectomy program: short-term outcomes. S. Wiebe, D. Klassen, J. Bonjer, D. Lawlor, J. Plowman, T. Ransom, M. Vallis, J. Ellsmere. From the Queen Elizabeth II Health Sciences Centre (QEIIHSC), Halifax, NS.**

Laparoscopic sleeve gastrectomy is a safe and effective primary weight loss procedure. We hypothesized that laparoscopic sleeve gastrectomy as part of a multidisciplinary weight loss program could be safely introduced with acceptable short-term results.

The first 21 consecutive patients undergoing laparoscopic sleeve gastrectomy at the QEIIHSC between December 2007 and September 2008 were reviewed. The study group had a mean age of 39.3 years and a mean preoperative BMI of 50.8 kg/m<sup>2</sup>. Mean operative time was 143.9 minutes; all procedures were completed laparoscopically. Mean length of stay was 3.2 days.

There were no mortalities. A single patient presented 4 months after surgery with an intra-abdominal abscess from a staple line leak; this was managed successfully with drainage and endoluminal stenting. Two patients developed symptomatic cholelithiasis within 6 months of surgery. Two sensory neuropathies were noted immediately postoperatively: a compression neuropathy of the gluteal region and a radial neuropathy related to arterial line placement.

Mean follow-up was 6.7 (range 1–12) months. Mean excess

weight loss was 17.7% at 1 month, 36.1% at 3 months, 47.8% at 6 months, 55.7% at 9 months and 66.8% at 1 year. A trend toward resolution of obesity-related comorbidities was noted.

Our initial patient series demonstrates weight loss outcomes consistent with published data. Most complications were minor; a single staple line leak presenting at 4 months is unique in the published literature for this procedure. Thus, laparoscopic sleeve gastrectomy as part of a multidisciplinary weight loss program can be safely introduced with short-term results consistent with the literature.

## 62

**The impact of preoperative weight loss in bariatric surgical patients: a systematic review.** *A.C. Menezes, S. Karmali, D.W. Birch.* From the Centre for the Advancement of Minimally Invasive Surgery (CAMIS), Alberta Health Services, Department of Surgery, University of Alberta, Edmonton, Alta.

The potential benefit of preoperative weight loss in patients undergoing bariatric surgery leads many bariatric surgeons to recommend an aggressive weight reducing regimen to their patients. Some surgeons may withhold bariatric surgery if a certain threshold of preoperative weight loss is not achieved. It is unclear whether this practice has a sound evidence base. Our study aimed to examine the current evidence dealing with this issue in a formal systematic review.

A systematic search of multiple databases including MEDLINE, Google Scholar, EMBASE, the Cochrane Library and conference proceedings yielded a final total of 29 papers. Overall, 7 prospective studies (1 randomized controlled trial, RCT), 15 retrospective studies, an editorial and a number of conference presentations were identified.

With regard to correlation between preoperative weight loss and postoperative excess weight loss, 11 (37.9%) of studies reported a positive correlation, whereas 10 (34%) reported no benefit of preoperative weight loss. Importantly, 10 studies involving a total of 2341 patients revealed no difference in complication rates or reduction of comorbidities between groups. The RCT showed an early benefit of preoperative weight loss with respect to rate of excess weight loss, but this difference was no longer apparent at 12 months. Three studies reported a reduction in operative time for weight-reduced patients in comparison with their counterparts; 1 large study demonstrated an increased operative time in preoperative weight-reduced patients.

This review suggests that the routine use of preoperative weight reduction in bariatric surgery is not supported by the best available evidence. Moreover, there is insufficient evidence to support withholding bariatric surgery in those patients who fail to lose weight preoperatively. A prospective, randomized controlled trial with adequate power is needed to clarify this important aspect of preoperative care.

## 63

**Quality of inguinal hernia operative reports: room for improvement.** *S.S. Forbes, C. Eskicioglu, F.D. Brenneman, R.S. McLeod.* From the Department of Surgery, University of Toronto, Toronto, Ont.

Operative reports are dictated narratives that serve as the official

documentation of an operation. They are important for patient care, research, quality improvement and medicolegal proceedings. The quality of narrative reports, however, has been shown to be poor, often lacking in key details. The purpose of this study was to audit the overall quality and completeness of inguinal hernia operative reports.

A standardized checklist for inguinal hernia repair consisting of 33 perioperative variables was developed by consensus method by 4 surgeons, including a high-volume hernia surgeon, 2 general surgeons and a surgical resident. Consecutive operative reports for patients undergoing open inguinal hernia repair at 6 academic hospitals were audited.

Data were abstracted from 159 inguinal hernia operative reports. Side of defect was uniformly reported (100%), although other perioperative variables including operative urgency and the use of surgical site infection and deep vein thrombosis prophylaxis were not reported in 69.8%, 85.5% and 98.7% of operative reports, respectively. Intraoperative variables including the type of defect, identification of the ilioinguinal nerve and identification and protection of the critical cord structures were not reported in 16.3%, 44.7% and 51.8% of operative reports, respectively. Tension-free repairs were most common (76.1%), with the plug-and-patch technique most frequently used (40.9% of all repairs). However, specific elements pertaining to the repair were reported with varying frequency: plug sutured in place (89.1%), patch sutured to tubercle (79%), recreation of internal ring (45%) and type of suture material used (89.3%).

The completeness of operative reports varied with the specific elements appraised. The poor recording of some key criteria suggests that there is an opportunity for improvement including implementation of a standardized synoptic operative report.

## 64

**Splenectomy for hematologic disease: an institutional review.** *S.A. Fraser, S. Bergman, J. Garzon.* From the Department of General Surgery, Sir Mortimer B. Davis Jewish General Hospital, McGill University, Montréal, Que.

The purpose of this study was to compare our institution's experience with splenectomy for benign and malignant hematologic disease since the introduction of laparoscopic splenectomy (LS) at our institution.

This is a single-institution retrospective chart review of consecutive splenectomies for hematologic disease performed by a single surgeon between 1996 and 2008. The primary outcomes were conversions and complications, which were compared between disease types: benign or malignant. The learning curve for LS was evaluated using cumulative sum analysis.

A total of 123 splenectomies were performed for benign (51.2%) or malignant (48.7%) hematologic disease. Fifty-eight percent of patients underwent planned LS, with a 21% conversion rate. The surgeon's learning curve for LS for malignant disease was maintained within acceptable conversion thresholds; however, it crossed an unacceptable conversion threshold (conversion rate > 10%) for benign disease at case 23. With additional experience, the curve again approached the acceptable conversion threshold. Compared with patients with benign hematologic disease, patients with malignant disease were significantly older (61 [SD 14.3] v. 49 [SD 21.3] yr,  $p < 0.0004$ ), had larger spleens

(1357.7 [SD 1746.2] v. 598.5 [SD 855] g,  $p < 0.0004$ ), (47 cases of splenomegaly), were more likely to undergo open splenectomy (61% v. 24%,  $p < 0.001$ ; 23 malignant cases attempted LS, 69.6% success rate) and had longer lengths of stay (14.6 [SD 26.5] v. 5.7 [SD 6.7] d,  $p < 0.01$ ). However, there was no significant difference in operative time, transfusion requirements, morbidity or mortality rates between patients with benign and malignant disease.

Laparoscopic splenectomy is feasible for both benign and malignant hematologic disease. However, both are associated with a significant learning curve. Careful patient selection is essential when introducing this new technique.

## 65

**Trauma triage and interfacility transfer processes in Ontario. D. Gomez, B. Lawless, B. Haas, A.B. Nathens. From the Department of Surgery, St. Michael's Hospital, University of Toronto, Toronto, Ont.**

Care in designated trauma centres is associated with substantially lower risk of death among the severely injured. However, given the geographic expanse of the province of Ontario, more than half of severely injured patients receive initial care at non-designated facilities. We sought to characterize the processes by which these facilities identify and transfer trauma patients to a higher level of care.

A Ministry of Health and Long-Term Care database was analyzed to evaluate resources and processes relevant to trauma triage and transfer in all acute-care facilities in the province of Ontario. Descriptive statistics were used to analyze responses.

A total of 147 acute-care hospitals were identified. Sixty-three percent of centres use the generic Canadian Triage and Acuity Scale (CTAS) to identify high-risk trauma patients in the emergency department. Thirty-three percent of centres use locally developed criteria, and 5% currently have no criteria to identify high-risk patients. Similarly, 63% use CTAS with or without pediatric modifiers to identify high-risk pediatric trauma patients, and 12% use locally defined pediatric triage criteria. Fifteen percent of centres have no specific pediatric trauma triage criteria. Only 56% of centres have identified criteria for transfer of severely injured adult patients to a higher level of care. Furthermore, only 33% of centres report having policies related to interfacility transfer of pediatric patients. Finally, only 73% of centres report they consistently use the province's centralized emergency referral service to facilitate transfer.

Triage and interfacility transfer protocols are essential to ensure optimal, equitable and accessible care for all trauma patients. Most centres do not have injury-specific triage criteria to assure the right personnel are present to receive the patient and to identify who must be transferred to a higher level of care. Our study suggests the presence of significant opportunities for improvement in these critical components of Ontario's trauma system.

## 66

**Equine-related trauma in southwestern Ontario: a 10-year review K.J. Lumb, L. Harkness, J. Williamson, T. Charyk-Stewart, D. Gray, R.A. Malthaner. From the Department of Surgery, Trauma Program, London Health Sciences Centre, London, Ont.**

The purpose of this study was to identify the incidence and pat-

terns of injury, as well as operative interventions associated with severe equestrian trauma.

A retrospective review of all patients with major equestrian-related injuries with an Injury Severity Score (ISS) greater than 12 admitted to London Health Sciences Centre (LHSC) between Apr. 1, 1998, and Mar. 31, 2008, was undertaken. Summary statistics were calculated on data from the LHSC trauma database. Data collected included demographics, mechanism of injury, protective device use, injury type and severity, surgery, duration of hospital and ICU stay and mortality.

A total of 4674 trauma patients were admitted during the study period with an ISS greater than 12, and 68 (2%) were associated with horses. Overall, 53% of patients were male, and 22% were age 14 or younger. The mean ISS was 22, with an overall mortality rate of 9%. All mortalities were secondary to catastrophic head trauma, with only 9% of patients wearing helmets. The most common injuries were to the head (41%), chest (41%) and abdomen (40%). Of the 68 patients, 30 (44%) required surgery. The most common surgical interventions were pelvic repairs (27%), abdominal procedures (17%), spine repairs (17%), extremity fracture repairs (13%), facial fracture repairs (10%), chest tubes (10%), diagnostic peritoneal lavage (1%) and pericardiocentesis (1%).

Head injuries are the most common cause of equine-related injuries and deaths; however, chest and abdominal injuries are just as prevalent in our patient population in southwestern Ontario. Pelvic repairs and abdominal surgical procedures were frequently required. Prevention strategies should be developed including mandatory helmet use, in addition to the use of torso protectors. A high level of suspicion for thoracic and abdominal injuries in this population must be maintained.

## 67

Withdrawn

## 68

**Massive transfusion in civilian trauma: a review of transfusion pathways to optimize survival. J.A. Van Koughnett, K.N. Vogt, D.K. Gray, N.G. Parry. From the Division of General Surgery, University of Western Ontario, London, Ont.**

Massive transfusion is defined as the transfusion of 10 or more units of packed red blood cells within the first 24 hours post-trauma. The massively transfused trauma population has an associated mortality of up to 60%. Military literature has suggested blood component replacement in the ratio of 1 unit packed red blood cells (PRBC) to 1 unit fresh frozen plasma (FFP) to improving outcomes. The role of such replacement in civilian trauma is unclear. Many centres use trauma transfusion protocols; however, they vary between centres. The objective of this study was to assess published transfusion protocols in civilian trauma for recommended PRBC:FFP ratios and the impact of transfusions on mortality.

A database search of MEDLINE and EMBASE was conducted to identify potential studies. Studies presenting trauma transfusion protocols, mortality and outcomes data were included. Articles were independently assessed by 2 reviewers for validity and separated into those assessing a transfusion protocol and those reporting on outcomes.

Twelve studies met the inclusion criteria, with a validity  $\kappa$  of

1.0. Four studies investigated a new transfusion protocol, with 3 reporting a significantly reduced mortality after the introduction of the protocol. Protocols were also associated with less multiorgan failure and infection and fewer blood products transfused. Five studies compared high PRBC:FFP ratios to low ratios. Three of these reported significantly reduced mortality in the low-ratio patients, and all showed outcomes benefits in low-ratio patients and favoured ratios nearing 1:1. Survival studies were conflicted on the influence of a low PRBC:FFP ratio on mortality.

A low PRBC:FFP ratio, nearing 1:1, in the setting of massive transfusion in civilian trauma appears to provide mortality benefit. One means of achieving an overall low ratio and improved mortality is the early activation of a transfusion protocol implementing aggressive administration of FFP.

## 69

**Hybrid NOTES laparoscopic sleeve gastrectomy.** *B. Teague, M. Cadeddu, M. Anvari, M. Misra, S. Pooler, S. Malik, P. Swain.* From the Centre for Minimal Access Surgery, St. Joseph's Healthcare, McMaster University, Hamilton, Ont.

An animal model for hybrid natural orifice transluminal endoscopy surgery (NOTES) and laparoscopic sleeve gastrectomy was developed using no abdominal incisions greater than 5 mm and a 15-mm transvaginal port for stapler placement and specimen extraction.

The procedure was performed in 3 pigs in a nonsurvival experiment. Pneumoperitoneum was established using a standard Veress needle technique. A 5-mm periumbilical laparoscopic port was placed for a 5-mm 30° laparoscope. A 15-mm port was placed transvaginally under direct vision with guidance of a dual-channel gastroscope and the peritoneum opened with a needle knife. Four additional 5-mm laparoscopic ports were placed. The short gastric vessels were divided in a standard laparoscopic fashion. A prototype laparoscopic linear stapler cutter device was placed via the transvaginal port, and the stomach was divided with multiple fires of the device. The gastric specimen was extracted via the transvaginal port. The colpotomy was closed without complication. Postmortem examination confirmed an adequate sleeve gastrectomy and no vaginal injuries in all cases.

The hybrid NOTES/laparoscopic approach allows safe completion of a sleeve gastrectomy with low abdominal-wall trauma with the potential benefits of minimizing postoperative pain and reduced risk of port-site hernia.

## 70

**Radiation dose associated with computed tomography for appendicitis.** *S. Chackungal, K.N. Vogt, C. Yoshy, R. Etemad-Rezai, I. Cunningham, L. Dubois, C.M. Schlachta, L. Scott, C. Vinden.* From the Division of General Surgery, Department of Radiology, Lawson Health Research Institute, London Health Sciences Centre, University of Western Ontario, London, Ont.

This study aims to look at the effective dose of radiation received in a cohort of adult patients from a single academic emergency department undergoing CT scans for the presumptive diagnosis of appendicitis.

All adult patients presenting to our emergency department

with signs and symptoms suspicious for acute appendicitis between October 2007 and September 2008 were identified using our prospectively collected radiology database. Demographic, imaging, operative and pathologic data were extracted from the electronic medical records of all identified patients. Scan parameters and dose length product (DLP) were determined from the dose report of each CT scan, and in combination with published conversion factors, effective radiation dose was calculated.

Overall, 447 patients presented to our emergency department with suspected acute appendicitis over the study period. Of those patients, 211 received CT scans. The sensitivity and specificity of CT were 98% and 99%, respectively. The mean age of patients receiving CT scans was 45 years, with no statistical difference in effective radiation dose with respect to age ( $p = 0.26$ ). The mean effective dose for all patients was 16.26 mSv ( $\pm 7.38$ ). This corresponds with a  $6.5 \times 10^{-4}$  risk of lifetime fatal malignancy per scan, with each 1545 scans resulting in 1 excess fatal malignancy.

Although CT scans offer greater accuracy in diagnosing acute appendicitis, it is also associated with a population-wide increased risk for malignancy; therefore caution should be exercised in its use.

## 71

**Telesimulation in Africa: an effective method of teaching the Fundamentals of Laparoscopic Surgery in developing countries.** *A. Okrainec, O. Henao, G. Azzie.* From the Toronto Western Hospital, University Health Network, Hospital for Sick Children, University of Toronto, Toronto, Ont.

Several challenges exist with laparoscopic skills training in developing countries, including long travel distances required by mentors for onsite teaching. Telesimulation (TS) is a novel concept that uses the internet to link simulators between an instructor and a trainee in different locations. The purpose of this study was to determine the effectiveness of telesimulation for teaching the Fundamentals of Laparoscopic Surgery (FLS) course to surgeons in Africa.

A total of 16 surgeons from 2 centres in Botswana participated in this 10-week study. Telesimulation was setup using a previously described platform for 8 surgeons in the TS group. A standard FLS simulator was available for the 8 surgeons in the self-practice (SP) group. Pretest FLS scores were obtained during an initial trip to Botswana. Participants in the TS group had 1 training session per week with an FLS proctor at the University of Toronto who provided feedback and demonstrated proper technique. Participants in the SP group had access to the FLS DVD and were instructed to train on FLS at least once per week. Post-test FLS scores were obtained in Botswana by a trained FLS proctor at the conclusion of the study.

Pretest FLS scores were the same in both groups. Participants in the telesimulation group had a significantly higher post-test FLS score than those in the self-practice group (86 [SD 8] v. 52 [SD 15],  $p = 0.001$ ). One-hundred percent of trainees in the telesimulation group achieved an FLS simulator certification passing score, compared with only 25% in the self-practice group ( $p = 0.002$ ).

We have shown that remote telesimulation is an effective method for teaching the Fundamentals of Laparoscopic Surgery course in Africa, achieving a 100% FLS skills pass rate. This training platform provides a cost-effective method of teaching in

developing countries and could be used to teach laparoscopic skills anywhere in the world with internet access.

72

**Understanding and evaluating resident teaching skills: developing a teaching skills training course for the future.** *S. Deen, M. Hameed.* From the Department of Surgery, Vancouver General Hospital, University of British Columbia, Vancouver, BC.

The purpose of this study was to evaluate residents' previous teaching skills experience and training, and to assess their perceived competence in core teaching abilities. This study also looked at what specific teaching skills residents would like to see included in a teaching skills training course, and if there was any interest in participating in such a course if it was available.

A short online survey was administered to the general surgery residents across Canada. The survey was composed of 4 major sections that assessed the residents' prior teaching skills training, teaching skills training during residency, confidence and competence in core teaching skills and additional demographic information. Statistical analysis was performed using SPSS version 15 (SPSS Inc.).

Overall, 103 residents responded to the survey. Throughout medical school, 76.7% of the residents rarely or never had any teaching skills training, and 58.2% of the residents rarely or never had any teaching skills training during their residency. With respect to teaching, 46.6% of the respondents spent at least 1–2 hours teaching medical students/week, whereas 28.2% taught for 3–4 hours/week. When rating their perceived competence in core teaching skills, "bedside teaching," "giving feedback" and "giving lectures" rated the lowest with 21.3%, 26.2% and 23.3% of the residents, respectively, stating that their skills in each category were fair or needed improvement. Some examples of teaching skills residents would like to see included in a future course included: giving feedback, teaching the unmotivated student and finding time to teach. Finally, 22.4% of the residents were dissatisfied or very dissatisfied with their current level of teaching ability, and 76.6% were interested or very interested in participating in a future teaching skills training course.

Very few residents have received any formal training in teaching skills before or during their residency. In addition, a large percentage of residents is dissatisfied or very dissatisfied with their current level of teaching ability and would like to take part in a future teaching skills training course if one was made available to them. The results of this survey can be used to help create a teaching skills training course for future residents that will address the specific needs of general surgery residents and medical students.

73

**Developing a synoptic clinical note: a surgical journey.** *V. Ramirez, C. Veillette, P. Bray, M. Jewett, A. Okrainec.* From the University Health Network, University of Toronto, Toronto, Ont.

Nationwide, there is growing interest in developing and using clinical documentation tools that are integrated with a hospital's electronic patient record. The purpose of this project was to develop a synoptic web-based tool for a large tertiary care hospi-

tal's surgery department, allowing surgeons to capture consultation and progress notes in discrete, structured formats at the point of care. The use of synoptic data will allow us to streamline processes, reduce errors and provide data for research.

In May 2008, the University Health Network's information technology (IT) teams partnered with 4 surgical divisions (General Surgery, Orthopaedics, Urology and Plastic Surgery) to initiate an enhanced surgical documentation project. After extensive planning and deliberation, we developed standardized templates to capture core data elements for each patient visit, including visit information, chief complaint/reason for referral, past medical history, physical assessment, impression and plan and medications/allergies. We developed a web-based system for capturing information in the standard templates and used tablet computers for point-of-care data entry.

During development, we required approximately 5000 hours of dedicated IT effort and 120 hours of physician time to create standardized templates for 65 diagnoses and 61 chief complaints/reasons for referral representing the 4 pilot specialties. We used Systematized Nomenclature of Medicine, Clinical Terms (SNOMED CT) to code medical terms, storing the terms in a searchable database. The system is launching in June 2009.

Many surgeons are eager to adopt electronic documentation tools. Although systems have improved incrementally, hospitals still need tools that are sufficiently comprehensive, mimic surgeons' workflow and incorporate best practices to successfully capture patient, diagnostic and treatment information in one system. This system has these attributes using a web-based tool that can be extended to other services or hospitals with minimal customization.

74

**Acute care general surgery in Canada: a national survey.** *G. Pagliarello, F. Brenneman, A. Buczkowski, A. Nathens, T. Razek, S. Widder, I. Anderson, D. Klassen, R. Saadia, A. Johner, S.M. Hameed.* From the Departments of Surgery, University of British Columbia, Vancouver, BC, University of Alberta, Edmonton, University of Calgary, Calgary, Alta, University of Toronto, Toronto, Ont., McGill University, Montréal, Que, Dalhousie University, CAGS Committee on Acute Surgery and Critical Care, Halifax, NS.

Acute care in general surgery has increasingly been provided by dedicated services at teaching hospitals across Canada. These services, which manage acute and complex surgical conditions, have had a profound but as yet unmeasured effect on patient care and surgical education, and create important opportunities for research and quality improvement.

Acute general surgical services in Canada were identified through a survey of national general surgery residency program directors and members of relevant national committees. Service chiefs were asked to participate in written and telephone surveys measuring case-mix, volume, academic and quality improvement initiatives, strengths, weaknesses and implementation experiences of their services.

Ten acute general surgery services were identified. Organizational structures were variable and dependent on local resources. Among the 7 acute services for which complete data are available to date, 4 have been created in the past 2 years and 4 of 7 also care for trauma patients. All provide comprehensive and universal



care to patients presenting with acute general surgical conditions. All of them are resident teaching services, and 6 of 7 have goals, objectives and educational curricula in place. Four services also train or plan to train surgical fellows. Five out of 7 services have already initiated research and quality improvement projects. Four out of 7 have protected operating room time in the day and provide service contracts for staff surgeons. Participation by general surgeons varies from 50% to 100%, but most services have near universal staff surgeon participation. The creation of acute services is widely considered to improve patient care and to provide important avenues for clinical research. Service chiefs expressed strong support for a national agenda for acute care general surgery and have begun to cooperate to develop clinical, research and educational guidelines and protocols.

Acute care general surgery services are a major force in Canadian general surgery. Careful development of these services will have important implications for patient care and safety, surgical education and research and surgeon practice patterns.

## 75

**Minimally invasive surgery (MIS) training in Canada: a national survey of general surgery residents. A.P. Qureshi, A. Vergis, C.M. Jimenez, J. Green, A.D. Pryor, C.M. Schlachta, A. Okrainec. From the Division of General Surgery, University of Toronto, University Health Network, Toronto Western Hospital, Toronto, the Departments of Surgery and Oncology, University of Western Ontario, London, Ont., and Duke University Medical Center, Durham, NC.**

General surgery trainees' perceptions regarding their own laparoscopic training remains poorly defined. The objective of this sur-

vey was to identify and evaluate learner experiences with laparoscopic procedures in general surgical programs on a national level.

A total of 284 residents were identified and contacted at English-speaking general surgery programs across Canada. Each was asked to complete a web- or paper-based survey regarding their demographics, experiences with basic and advanced MIS procedures, and perceived barriers to training.

Of the 284 residents surveyed, 252 (89%) responded. Eighty-seven percent of residents had access to a skills laboratory that taught MIS techniques; however, standardized MIS curricula were implemented 53% of the time. Eighty percent of residents felt skills laboratory training translated to improved performance in the operating room. Although 90% of residents felt they would be comfortable performing basic laparoscopic procedures, only 8% stated they would be comfortable performing advanced procedures at the end of their training. Whereas 90% of general surgery residents felt that it was the academic surgical department's responsibility to teach advanced procedures, only 35% felt their surgical program was meeting this requirement. Fifty percent of residents felt they had limited opportunity to be primary surgeon because an MIS fellow was present.

There exists a wide disparity between the expectations of residents and their actual experience. The majority of residents are concerned that they will not acquire sufficient laparoscopic skills during their training to perform advanced cases in practice. Additionally, the role between resident- and fellow-level cases needs to be more clearly defined as the majority of respondents identified the presence of an MIS fellow as a negative learning influence. Finally, although most centres had a surgical skills laboratory, the perception of most respondents that standardized curricula are not available should be addressed.

# Canadian Association of Thoracic Surgeons Association canadienne des chirurgiens thoraciques

76

**New tactile sensing system helps to locate occult tumours during video-assisted thoracoscopic surgery (VATS).** *M.T. Perri, A.L. Trejos, M.D. Naish, R.V. Patel, R.A. Malthaner.* From CSTAR, Division of Thoracic Surgery, University of Western Ontario, London, Ont.

A hand-held minimally invasive probe was developed to help locate occult tumours during video-assisted thoracoscopic surgery (VATS). This tactile sensing system (TSS) includes a probe in combination with newly developed software that presents a real-time colour-contour pressure map of the contact surface.

We compared the performance of the TSS with a standard minimally invasive surgery (MIS) grasper, ultrasound and manual palpation when attempting to locate 10-mm hemispherical agar phantom tumours in an idealistic tissue model (ex vivo bovine liver). The TSS performance was also tested using a realistic tissue model (ex vivo porcine lung). The samples were placed in a thoracoscopic training box, and the working field was viewed via an endoscopic camera and monitor. Participants included 1 surgical consultant and 3 surgical residents. Performance assessment was based on the maximum pressure applied, the average distance between instrument location and tumour location, sensitivity, specificity and accuracy.

**Table, abstract 76. Performance of standard minimally invasive surgery tools and the tactile sensing system in a test model to locating occult tumours during video-assisted thoracoscopic surgery**

Tools	Measure; mean (SD)		Measure; %			Positive likelihood ratio	p value*
	Maximum pressure, N/cm <sup>2</sup>	Average distance, cm	Acc.	Sens.	Spec.		
<b>MIS</b>							
Manual	N/A	0.33 (0.2)	88	88	89	7.88	< 0.01
Grasper	7.2 (2.8)	0.47 (0.3)	51	67	29	0.94	0.79
Ultrasound	1.6 (0.8)	0.68 (0.4)	58	67	42	1.14	0.62
<b>TSS</b>							
Liver	2.1 (0.8)†	0.46 (0.2)	61	81	29	1.14	0.29
Lung	2.5 (1.0)‡	0.64 (0.4)§	57	66	33	0.98	0.95

Acc. = accuracy; MIS = minimally invasive surgery; Sens. = sensitivity; Spec. = specificity; TSS = tactile sensing system.

\*Pearson  $\chi^2$  (2-sided).

†p < 0.01 determined by one-way analysis of variance.

‡p = 0.13 determined by an independent samples t test (unequal variances) when compared with TSS using liver.

§p = 0.06 determined as above.

The TSS was more accurate than the ultrasound (3%) and the grasper (10%) in detecting hidden tumours in ex vivo livers. When tested using a realistic tissue model, the TSS was able to maintain its performance in collapsed ex vivo porcine lungs. The TSS improves the surgeon's ability to locate occult tumours during VATS procedures.

77

**Clinical and pathologic characteristics of patients with esophageal and gastroesophageal tumours in northern Alberta: a clinical application of gene expression profiles.** *J. Stanger, K. Stewart, Y. Yasui, C. Cass, S. Damaraju, K. Graham.* From the Department of Surgery, Cross Cancer Institute, University of Alberta, Edmonton, Alta.

A retrospective study was conducted to identify clinical and pathologic factors that are correlated with outcome in patients presenting with cancer of the esophagus and gastroesophageal junction. These factors were combined in a multivariable model to help predict patient outcome. This model was further strengthened by the incorporation of gene expression profiles.

Patients presenting with tumours of the esophagus and gastroesophageal junction between July 2002 and July 2007 were identified from the Alberta Cancer Registry. Patient medical records were reviewed for clinical, pathologic and treatment variables of interest. The primary outcome was mortality from esophageal cancer. Concurrently, tumours were prospectively collected from patients undergoing surgical resection for esophageal tumours. The tumours were analyzed using DNA microarray in order to generate gene expression profiles. Both clinical and genetic data were analyzed to identify prognostic features in these patients.

Over 550 patients were diagnosed with tumours of the esophagus or gastroesophageal junction between 2002 and 2007, of whom 484 received treatment of surgery, chemotherapy and/or radiation therapy. Seventy-nine percent of all patients were male, and over 70% of tumours were adenocarcinoma. Thirty-eight percent of patients underwent curative-intent surgery, either alone or in combination with chemotherapy or radiation therapy. Tumour differentiation was strongly associated with outcome ( $p < 0.05$ ) as was presence of lymphovascular invasion ( $p < 0.05$ ). Gene expression profiles were available on 32 patients. Forty-one thousand genetic points were identified and their expression analyzed with several phenotypic characteristics including tumour type, tumour differentiation, lymph node status and outcome.

Tumour differentiation and lymphovascular invasion were significant in predicting decreased survival in this patient population. Further work will expand the phenotypic assessment of these patients, increase the number of gene expression profiles available and allow maturity of the outcome data.

78

**Classical lung donor allocation criteria for transplantation result in increased mortality in patients with idiopathic pulmonary fibrosis.** *S. Bharadwaj, S. Srinathan, L. Tan, H. Unruh.* From the Department of Surgery, University of Manitoba, Winnipeg, Man.

We undertook a 5-year retrospective review of the Transplant Manitoba lung wait list to assess trends in outcome that might be

incorporated into future organ allocation strategies. Allocation was based on the standard allocation: blood group, size of lungs and length of time on the wait list. We looked at 2 outcomes on the wait list that occurred between 2003 and 2008, either transplantation or death in 4 groups of patients: cystic fibrosis (CF), chronic obstructive lung disease (COPD), idiopathic pulmonary fibrosis (IPF) and primary pulmonary hypertension (PPH). The average wait time among 32 transplanted patients was 20.2 months, whereas the average time to death for 18 patients on the wait list was 13.1 months. The ratio of transplantation to death for each group was: CF 3.0, COPD 4.0 and IPF 0.9. The average times to transplant were 22.3, 23.7 and 10 months, respectively. The relative risk of dying on the wait list for a diagnosis of IPF versus non-IPF was 1.94 (95% CI 0.94–3.43, Fisher exact test 2-tailed  $p < 0.12$ , 1-tailed  $p < 0.07$ ). The odds ratio was 3.0 (95% CI 0.91 to 9.88, Pearson uncorrected  $\chi^2$ ,  $p < 0.07$ ). Though the relative risk of dying on the wait list with a diagnosis of IPF did not reach statistical significance, it was substantially higher compared with non-IPF patients. This occurred in spite of a time to transplant that was greater than 50% shorter for patients with IPF versus other groups of patients. Future lung donor organ allocation strategies must give weight to additional factors including the specific diagnosis at the time of listing to ensure equitable access for all patients listed for transplantation.

## 79

**Treatment choices and outcomes of patients with manometrically diagnosed achalasia. C. Finley, L. Miller, L.E. Ferri, D.R. Urbach, G. Darling. From the Division of Thoracic Surgery, Department of Surgery, University of Toronto, Toronto, Ont.**

This prospective study was designed to evaluate treatment choices in patients with manometrically diagnosed achalasia and their outcomes.

In this research ethics board-approved study, consenting patients referred to the Toronto General Hospital esophageal function laboratory were enrolled after manometric diagnosis of achalasia. Patients completed an initial validated questionnaire on their symptom severity, duration, treatment prediagnosis and medical outcomes study 36-item Short-Form survey. Subsequent treatment was left to the referring physician, and patients were mailed a questionnaire every 3 months for 1 year.

Between January 2004 and January 2005, 86 patients were enrolled, with a median symptom duration of 2–5 years. Heller myotomy was performed on 31 (36.0%) patients, 3 (3.6%) received botulinum toxin injections, and 25 (29.1%) patients received 29 dilatations, whereas 25 (29.1%) patients did not have any invasive treatment. Following treatment, patients treated with surgery, dilatation, botulinum toxin and no treatment had an average improvement in achalasia symptom score of 23 (SD 12.2), 17 (SD 10.9), 9 (SD 14) and –3.5 (SD 11.4), respectively. Surgery and dilation resulted in significant improvement ( $p < 0.01$ ) relative to no treatment. In univariate logistic regression, the symptom severity score (OR 1.04, 95% CI 1.00–1.08), sphincter tone (1.04, 95% CI 1.00–1.09), difficulty swallowing liquids (OR 3.21, 95% CI 1.15–8.99), waking from sleep (OR 2.75, 95% CI 1.00–7.61) and weight loss (OR 5.99, 95% CI 1.93–18.58), were all significant in predicting which patients would have treatment. In the multivariate analysis, increasing age (OR 1.05, 95%

CI 1.01–1.09) and weight loss (OR 3.94 95% CI 1.02–15.2) were statistically significant for undergoing treatment.

This study shows that almost one-third of patients with manometrically diagnosed achalasia do not undergo treatment within 1 year. Patients who are more symptomatic appear to be more likely to undergo treatment in univariate analysis. In multivariate analysis, increasing age and weight loss are predictive of those who will undergo treatment, with weight loss having the greatest influence.

## 80

**Predictors for anastomotic leak following esophagectomy: highlighting the importance of the learning curve. J. Spicer, S. Ergun, B. McDonald, M. Rousseau, P. Kaneva, L.E. Ferri. From the Division of Thoracic Surgery, McGill University Health Centre, Montréal, Que.**

Anastomotic leakage (AL) is a devastating complications following esophagectomy. Despite the complexity of the operation, the influence of the learning curve on AL has not been extensively studied. We sought to determine predictors of esophageal AL with a focus on the learning curve.

A prospective clinical database identified the first 100 esophagectomy patients by a single surgeon from July 2005 to September 2008. Patient and tumour characteristics and operative variables were assessed for predictors of AL. Fisher or Mann-Whitney  $U$  tests determined significance ( $*p < 0.05$ ). Multivariate logistic regression determined independent predictors. Cumulative sum (CUSUM) analysis was used to generate a learning curve with unacceptable/acceptable leak rates set at 30%/10% and type I/II error at 0.05/0.20.

A total of 92 malignant and 8 benign conditions were treated. Anastomotic leakage was present in 14 of 100 and was more likely in the first 30 cases (8/30 v. 6/70),\* cervical anastomosis (8/28 v. 6/73),\* tube jejunostomy insertion (6/25 v. 7/74,  $p = 0.08$ ), immediate postoperative vasopressor use (4/16 v. 6/75,  $p = 0.07$ ) and absence of anastomotic re-enforcement with pleura and omentum (14/82 v. 0/14,  $p = 0.09$ ). Extent of resection (en-bloc 7/59 [12%] v. standard 7/41 [17%]), anastomotic technique (hand-sewn 10/85 [12%] v. stapled 4/15 [27%]), lymphadenectomy (D2 9/75 [12%] v. D1 5/25 [25%]) or prior radiotherapy (3/10 [30%] v. 11/90 [12%]) had no significant influence on AL. Independent predictors of AL included cervical anastomosis\* and early surgeon experience (first 30 cases).\* The point of inflection of the CUSUM analysis curve was at the 34th case, after which the rate of anastomotic leak diminished substantially.

Surgeon experience is a major predictor of AL following esophagectomy and represents an accumulation of technical refinements and postoperative management. By the 34th case of this complex procedure, an acceptable leak rate can be achieved by a dedicated esophageal program.

## 81

**Is intraoperative consultation with frozen section necessary for the resection of foregut adenocarcinoma? J. Spicer, A. Andalib, C. Benay, M. Rousseau, Y. Kushner, V. Marcus, L.E. Ferri. From the Division of Thoracic Surgery, Department of Pathology, McGill University Health Centre, Montréal, Que.**

A microscopically positive margin is one of the strongest predictors

of poor survival after resection of foregut adenocarcinoma (ADC). Intraoperative pathology consultation with frozen section of margins can predict final permanent section pathology. Frozen section accuracy in upper gastrointestinal cancers has not been extensively studied. We sought to determine predictors of incomplete resection in foregut ADC and the utility of frozen section.

Patients with resection of foregut ADC at a single centre from 1991 to 2007 were identified. Clinicopathologic data were collected. Patients with positive margins by permanent section (R1) or frozen section were compared by univariate and multivariate analyses with those with negative margins on permanent section (R0). Frozen section results were compared with permanent section assessment, and sensitivity, specificity, positive (PPV) and negative predictive (NPV) values were generated. Chi-square and Mann-Whitney *U* tests determined significance ( $*p < 0.05$ ).

Of 220 patients with resected foregut ADC, 28 (13%) had microscopically positive margins at the time of initial resection, and 18 (8%) ultimately had an R1 resection. Independent predictors of positive margins were lymph node positivity,\* poorly differentiated ADC\* and signet ring cell morphology\* (see Table). Intraoperative pathology consultation was performed on 122 of 220 patients (55%). Eighty-one (37%) had an intraoperative pathology consultation and frozen section resulting in 18 positive results, of which 5 were false negatives. Signet ring cells were associated with 4 of 5 false negatives. Fifty percent (9/18) of patients with positive margins at frozen section were converted to R0 resections. The diagnostic accuracy of frozen section was 94% with a sensitivity of 72%, specificity of 100%, PPV of 100% and NPV of 93%.

Positive frozen section findings are highly specific, whereas negative results require greater caution, particularly in the setting of signet ring cells. Patients with positive lymph nodes, poorly differentiated ADC and signet ring cells are more likely to have incomplete resections. In gastric and esophageal ADC, frozen section may increase the rate of complete resection and hence survival.

**Table, abstract 81. Predictors of poor survival after resection of foregut adenocarcinoma**

Predictor	Odds ratio	95% CI	<i>p</i> value
Lymph node positive	4.310	1.351–13.748	0.014
Poorly differentiated adenocarcinoma	4.763	1.289–17.595	0.019
Signet ring cell morphology	3.462	1.324–9.055	0.011

## 82

**Cost equivalence when comparing video-assisted thorascopic (VATS) lobectomy and thoracotomy lobectomy. I. Hunt, S. Gazala, R. Razzak, A. Chuck, A. Valji, K. Stewart, R. Tsuyuki, E.L.R. Bédard. From the Division of Thoracic Surgery, Departments of Surgery and Cardiology, University of Alberta, Institute of Health Economics, Edmonton, Alta.**

A retrospective analysis of hospital costs including bed occupancy demonstrated no overall difference between 283 VATS lobectomies and 50 thoracotomy lobectomies over a 3-year period.

In a single centre (2006–2008), clinical demographics and costs incurred in the 283 VATS lobectomies performed was analyzed retrospectively. Cost of 24-hour bed occupancy was obtained, and

patients requiring ICU postsurgery were excluded. In total, 252 VATS procedures and 45 thoracotomy lobectomy patients were included. Capital costs of VATS equipment were not included in the analysis as no additional equipment was required.

The demographics of the 252 VATS lobectomy and 45 open lobectomy patients who underwent surgery over a similar time period were matched, with little difference in terms of age, health status, TNM classification or significant postoperative complications. A VATS lobectomy on average was twice as expensive as an open lobectomy (Can\$2810 v. Can\$1425) based on intraoperative costs alone and with greater cost variability for a VATS procedure. The average overall length of hospital stay for VATS lobectomy was 4.9 days and was 6.2 days for an open case. Overall length of hospital stay was 1.3 days shorter than with open cases. Based on an analysis of overall costs, a VATS lobectomy is equal or slightly less expensive than an open lobectomy (Can\$8573 v. Can\$8673).

Despite the number of VATS lobectomies continuing to increase, its cost impact remains poorly studied. Provided a true advantage in recovery time and shorter length of hospital stay is demonstrated, VATS lobectomy is equal to open resection in terms of cost. This will have important health resource implications for thoracic surgery centres supporting or preparing to adopt a VATS lobectomy program.

## 83

**Quantification of the visco-elastic properties of human lung tissue in the development of a tissue mimicking phantom for applications in thoracic and robot-assisted surgical simulation. D.A. Bottoni, G. Campbell, R.A. Malthaner. From the Division of Thoracic Surgery, London Health Sciences Centre, University of Western Ontario, London, Ont.**

Surgical simulation permits the adoption of new skills and enables the development of new procedures and instrumentation. Essential to surgical simulation are materials with realistic imaging and force feedback properties that accurately simulate tissue behaviour. The visco-elastic properties of human lung tissue were quantified for the development of a tissue mimicking lung phantom for thoracic and robot-assisted surgical simulation. We set out to determine if the mechanical properties of human lung tissue can be determined using a simple instrument.

A small, free-standing desktop instrument capable of employing and quantifying a normal indentation to a target tissue was developed and validated against the gold standard of compression testing. Six separate lung and tumour specimens were subjected to repeated cycles of indentation testing immediately after surgical resection. Each specimen was indented with an incremental indentation stress ranging from 0.01 to 0.1 Newtons (N). A force (N) versus displacement (mm) curve was generated as a reflection of the indentation data. The pooled data generated statistically distinct curves for the tumour and lung specimens. The resulting curve for the indentation of the resected lung specimens is defined by the equation  $y = 0.0863 \times -0.0267$  ( $R^2 = 0.996$ ), and the indentation curve for the tumour specimens is defined by  $y = 0.1554 \times -0.0024$  ( $R^2 = 1$ ).

The mechanical properties of human lung tissue can be determined using a simple tissue indenter. To our knowledge, this is the first description and quantification of the visco-elastic properties of lung tissue. These data have been used to generate a

prototype of an anatomically and mechanically accurate tissue-mimicking phantom.

#### 84

**The management of dysphagia in esophageal cancer patients undergoing neoadjuvant chemotherapy: Is invasive tube feeding required?** *M. Rousseau, P. Guevremont, M. Chasen, J. Spicer, E. Eckert, T. Alcindor, S. Ades, L.E. Ferri.* From the McGill University Health Centre, Montréal, Que.

The dysphagia commonly associated with esophageal cancer often interferes with patient tolerance of neoadjuvant chemotherapy. Surgical or endoscopic invasive tube feeding (ITF, gastrostomy/jejunostomy/stent) is a commonly employed strategy to maintain nutritional support; however, it can cause significant morbidity in its own right. We sought to determine if a strategy of careful dietary counselling and appropriately timed neoadjuvant chemotherapy could obviate the need for ITF.

Patients undergoing neoadjuvant chemotherapy (TAX/CDDP/5-FU Q3 weeks  $\times$  3) for esophageal or GEJ adenocarcinoma at a single institution from March 2007 to July 2008 were identified from a prospective database. All received dietary counselling and were closely monitored for signs/symptoms of malnutrition with serial (baseline, after first cycle, presurgery) body mass index (BMI), albumin, dysphagia scores (0 best – 4 worse) and quality of life (Functional Assessment of Cancer Therapy, Esophageal, FACT-E). We assessed the response of dysphagia and nutritional status to neoadjuvant treatment and the need for ITF. Data are presented as median (range) or mean (SD); paired *t* test or Wilcoxon signed rank test determined significance ( $*p < 0.05$ ).

Twenty-five patients received neoadjuvant chemotherapy, and significant dysphagia (score 2–4) was found in 14. Dysphagia scores improved in all 14 (all results in the Table), and 10 of 13 improved after the first cycle. No patient required ITF. Quality of life as assessed by the FACT-E improved in 13 of 14 patients. A small decrease in BMI was noted; however, serum albumin did not significantly decrease.

**Table, abstract 84. Response of dysphagia and nutritional status to neoadjuvant treatment of esophageal cancer**

Monitoring measure	Time; mean (SD)*		
	Baseline	After first cycle	Presurgery
Dysphagia score (range)	3.5 (2–4)	0 (0–3)†	0 (0–1)†
FACT-E	123 (19)	137 (23)	147 (20)†
Albumin, g/L	39.7 (3.7)	36.9 (2.7)†	38.2 (5.0)
BMI	28.0 (6.9)	25.8 (4.5)†	27.4 (5.5)†

BMI = body mass index; FACT-E = Functional Assessment of Cancer Therapy—Esophageal.  
\*Unless otherwise indicated.  
† $p < 0.05$ .

Appropriately timed neoadjuvant chemotherapy with a highly effective regimen rapidly restores normal swallowing, maintains nutritional status and obviates the need for ITF in patient with substantial dysphagia from esophageal adenocarcinoma.

#### 85

**The role of computed tomography (CT) scanning in the**

**investigation of suspected esophageal perforation.** *R. McGory, D. Nagpal, D. Fortin, R.I. Inculet, R.A. Malthaner.* From the Division of Thoracic Surgery, London Health Sciences Centre, London, Ont.

We evaluated the utility of CT scans with oral contrast in the diagnosis and management of esophageal perforations. We prospectively studied all consecutive patients who presented from July 2007 to March 2009 who were suspected of having an esophageal perforation. All patients received an initial thoracic CT scan with oral water-soluble contrast, and the results were confirmed by operative thoracotomy, fluoroscopic barium swallows (BS) and/or clinical follow-up as indicated. The CT scans and the fluoroscopic barium swallows were read by independent radiologists unaware of the clinical outcomes.

Twenty-eight patients were evaluated by the thoracic surgical service for a possible esophageal perforation. Sixteen patients had negative CT scans: 13 were confirmed with BS, 2 did not receive BS and did well clinically and 1 patient demonstrated a leak on follow-up BS and at thoracotomy (false negative). Twelve patients were thought to have perforations on CT: 3 were confirmed by BS and thoracotomy, 4 were confirmed at thoracotomy, 1 had a normal BS but a perforation was found at thoracotomy, 2 patients were treated conservatively for contained leaks and 1 patient was stented for a metastatic malignant perforation; no perforation could be found at thoracotomy in 1 patient (false positive). The sensitivity of CT for detecting suspected esophageal perforation was 92% with a specificity of 94%. The likelihood ratio for a positive result was 15.3 and for a negative result was 0.09. Additional pathology was detected by CT in 25% of patients.

Thoracic CT with water-soluble oral contrast appears to be an excellent initial diagnostic test in the evaluation of patients with suspected esophageal perforation.

#### 86

**The Nuss procedure in adults: a preliminary Canadian experience.** *M. Ko, Y. Shargall, C. Compeau.* From the Division of Thoracic Surgery, St. Joseph's Health Centre, University of Toronto, Toronto, Ont.

The Nuss procedure is the treatment of choice for surgical correction of pectus excavatum in children. This technique has also been adapted to adults; however, there have been few published reports. We describe our initial experience with pectus repair via bilateral thoracoscopic Nuss bar insertion in 29 adults at a single Canadian institution.

Between May 9, 2006, and Feb. 4, 2009, 29 adult patients (25 men, 4 women) with a mean age of 22 ( $\pm$  5.7, range 14–35) years were included in this retrospective analysis. The mean length of follow-up was 168 (range 14–727) days. Twenty-six patients (90%) had 1 bar placed, and 3 patients (10%) had 2 bars. The mean length of hospital stay was 5.1 ( $\pm$  1.2, range 4–8) days, and the mean length of epidural use was 3.1 ( $\pm$  1.3, range 2–4) days. There was 1 postoperative pneumothorax requiring tube thoracostomy drainage and 1 delayed pericardial effusion not requiring drainage. There were 8 reoperations in 7 patients. Two patients had redo surgery for unsatisfactory cosmetic results (7%), 2 for early bar displacement (7%), 3 had premature bar removal for intractable thoracic pain (10%) and 1 had bar removal for superficial infection (3%). All of the reoperations for bar displacement occurred early in the

experience, prior to the routine use of metal wire transfixion to the ribs. There was no mortality. In general, patient satisfaction with the cosmetic result was high.

The Nuss procedure can be safely performed in adults with acceptable results. Adequate perioperative analgesia and bar fixation are important factors to ensure success. Long-term follow-up will be needed to confirm sustained results after bar removal.

**87**

**Analysis of pain management after video-assisted thoracic surgery (VATS) lobectomy: Is there a role for extrapleural catheters?** R. Razzak, S. Gazala, I. Hunt, J. Veenstra, A. Valji, K. Stewart, E.L.R. Bédard. From the Division of Thoracic Surgery, University of Alberta, Edmonton, Alta.

As part of a pilot study to assess the role of extrapleural catheters, we prospectively measured pain scores and compared method of pain management in 70 patients undergoing video-assisted thoracic surgery (VATS) lobectomy.

Over 16 months, pain scores and method of pain management was prospectively recorded in 69 patients undergoing VATS lobectomy performed by 3 surgeons at a single surgical centre. Comprehensive patient demographics were recorded. Pain management included PRN morphine, patient-controlled analgesia (PCA), epidural and extrapleural catheter. Patients were assessed at day 1 through to discharge using a visual analogue scale. Subsequent total analgesia requirements and equivalencies were calculated where possible.

**Table 1, abstract 87. Assessment of pain management after video-assisted thoracic surgical lobectomy**

Day	Method of pain management; median VAS pain score (parenteral morphine equivalent, mg)*			
	PRN morphine (n = 37)	PCA (n = 10)	Epidural (n = 11)	Extrapleural catheter (n = 12)
1	4.0 (17.19)	4.25 (23.08)	3.0	3.0 (12.79)
2	4.0 (30.51)	3.75 (31.36)	3.5	2.0 (35.13)
3	3.0 (17.03)	2.5 (22.22)	2.0	2.0 (21.78)
4	0.0 (8.98)	2.0 (11.73)	3.0	1.0 (14.22)
5	0.5 (9.01)	0.5 (16.40)	1.5	3.0 (13.61)
6	0.0 (5.69)	0.0 (25.57)	0.0	0.0 (5.00)
7	0.0 (5.00)	0.0 (3.34)	2.0	—

PCA = patient-controlled analgesia; PRN = as-needed; VAS = visual analogue scale.  
\*The VAS measured pain on a 10-point scale.

**Table 2, abstract 87. Length of hospital stay (LOS) after video-assisted thoracic surgical lobectomy according to method of pain management**

Method of pain management	LOS, mean (SD) d
Pleural catheter	4.36 (0.58)
As-needed morphine	6.35 (1.71)
Patient-controlled analgesia	5.50 (0.89)
Epidural	6.45 (2.46)

A significant difference in mean length of stay was found when comparing the pleural catheter group with the PRN and PCA groups ( $p = 0.019$  and  $0.027$ , respectively). No difference was

appreciated between the pleural catheter group and the epidural group ( $p = 0.075$ ).

Overall, the results do not appear to support an advantage for one method of analgesia, at least in terms of patients' perception of pain. Extrapleural catheters seem to support an overall decrease in length of stay.

**88**

**Are first rib fractures and sternal fractures always associated with mediastinal injury? A retrospective analysis from a community hospital.** P.J. Davis, M. Mancuso, A.A. Mujoomdar. From the Division of General Surgery, Department of Surgery, The Moncton Hospital, Moncton, NB, and Dalhousie University, Halifax, NS.

The aim of this study was to determine the incidence of sternal and first rib fracture associated with mediastinal injury after a motor vehicle collision (MVC).

Following ethics approval, we identified all MVC-related traumas presenting to the Moncton Hospital (Moncton, NB) between October 2003 and October 2008 using ICD-10 codes (V01-V99). We performed a chart review using the electronic medical record system (MediTech) to obtain demographic data, length of stay, details of the accident and thoracic imaging studies. If no thoracic imaging was performed, the chart was excluded from the review. Data were compiled, and descriptive and non-parametric statistics were performed.

In all, 988 patients were identified. Of these, 108 were excluded. Of the remaining 880 charts, 23 patients (2.6%) sustained a sternal fracture, 24 patients (2.7%) sustained a first rib fracture, whereas 20 (2.3%) sustained a mediastinal injury. Five patients sustained either a sternal fracture (4 patients, 17.4% of sternal fractures) or first rib fracture (1 patient, 4.2% of first rib fractures) with associated mediastinal injury.

First rib fracture, sternal fracture and mediastinal injury are rare injuries associated with blunt thoracic trauma. The incidence of mediastinal injury associated with first rib or sternal fracture is far less than traditionally believed.

**89**

**Conversions in anatomic video-assisted thoracoscopic surgery (VATS) lung resection: a method of assessing reasons for conversion.** S. Gazala, E.L.R. Bédard. From the University of Alberta, Edmonton, Alta.

Video-assisted thoracoscopic surgery (VATS) offers an alternative to open thoracotomy for anatomic lung resection. An analysis of rates of and reasons for conversion has not been previously published. Clinical data of 493 consecutive patients who underwent lung resection for tumours were collected retrospectively. Patients who underwent a thoracotomy were excluded from the study. The remaining patients were considered for further analysis. A total of 285 consecutive VATS lobectomy cases were analyzed. The overall conversion rate was 13.7% over 3 years. Conversions were classified according to whether conversion was owing to vascular (V), anatomic (A), lymph node-related (L) or technical problems (T) and whether opening was elective, controlled or uncontrolled (VALT open). Four out of 5 cases converted through extension of the transaxillary port (anterolateral thoracotomy). One out of 5 cases required a posterolateral

thoracotomy via separate incision. Conversion rates decreased over the first 3 years despite a substantial increase in VATS cases. Reductions in the number and nature of conversions reflect appropriate development in surgical experience and patient selection while implementing a minimally invasive thoracic procedure. The VALT open classification system allowed qualification of reason for and controlled nature of conversion to an open case. It can be used as a quality assurance tool in monitoring development of a VATS lobectomy program.

## 90

**The use of pleural-based surgical adjuncts to prevent prolonged air leak after lung resection. L. Lee, J. Spicer, C. Robineau, C. Sirois, D. Mulder, L.E. Ferri. From the Division of Thoracic Surgery, McGill University Health Centre, Montréal, Que.**

The high rate of prolonged air leak (PAL) after lung resection has prompted interest in surgical adjuncts designed to prevent this complication. We sought to identify predictors and consequences of PAL, as well as to determine the effectiveness of pleural-based surgical adjuncts to prevent PAL.

All pulmonary resections (excluding bleb/pneumonectomy) at a single institution from July 2002 to March 2007 were identified from a prospective database. Patient and operative variables and outcomes were compared between patients with PAL (> 7 d) and those without. The effect of pleural-based surgical adjuncts (pleural abrasion, pleurectomy, pleural tent) on outcomes including PAL was assessed. Data are presented as mean (SD); the Fisher exact or Mann-Whitney *U* test determined significance ( $*p < 0.05$ ). Multivariate regression identified independent predictors.

A PAL was present in 82 of 580 (14%) resections. Predictors of PAL included anatomic resection (OR 6.2, 95% CI 2.6–15) and predicted FEV<sub>1</sub> less than 70% (OR 4.0, 95% CI 2.2–7.0). Patients with PAL had increased non-PAL complications (31/82, 37.8% v. 65/498, 13.1%)\* and length of hospital stay (LOS; 14 [SD 10] v. 5 [SD 2] d).\* Surgical adjuncts were used in 113 of 580 (19%) patients but did not reduce PAL. Rather, surgical adjuncts resulted in increased chest tube duration, LOS and non-PAL pulmonary complications (Table).

**Table, abstract 90. Use and impact of surgical adjuncts to prevent prolonged air leak after lung resection**

Variable	Surgical adjunct; proportion (%)*		
	Yes (n = 113)	No (n = 467)	p value
Male sex	62/113 (55)	223/467 (50)	NS
Age, mean (SD) yr	65.6 (11.7)	62.4 (12.6)	0.011
Anatomic resection	102/113 (90)	290/467 (62)	< 0.001
Predicted FEV <sub>1</sub> < 70%	32/98 (33)	71/353 (20)	0.014
Predicted DLCO < 70%	38/97 (39)	94/336 (28)	0.045
Prolonged air leak	22/113 (20)	60/467 (13)	0.073
Chest tube duration, mean (SD) d	7.0 (4.6)	5.0 (4.0)	< 0.001
Any non-PAL complication	26/113 (23)	70/467 (15)	0.048
Non-PAL pulmonary complication	19/113 (17)	28/467 (6)	0.001
Length of stay, mean (SD) d	8.6 (5.7)	6.6 (5.4)	< 0.001

DLCO = carbon monoxide lung diffusion capacity; FEV<sub>1</sub> = forced expiratory volume in 1 second; PAL = prolonged air leak; SD = standard deviation.

\*Unless otherwise indicated.

The use of surgical adjuncts should be abandoned, as they do not reduce the incidence of PAL and are associated with increased morbidity.

## 91

**Characterization of eosinophilic infiltration in patients with achalasia. J. Cools-Lartigue, S.-Y. Chang, S. Mayrand, V. Marcus, G.M. Fried, L.E. Ferri. From the Departments of Surgery, Pathology and Medicine, McGill University, Montréal, Que.**

Eosinophilic esophagitis, now recognized as a common cause of dysphagia, has been reported in numerous conditions including gastroesophageal reflux (GERD) and achalasia. The significance of eosinophilic infiltration in achalasia is poorly documented. We sought to characterize this histologic finding in patients undergoing Heller myotomy (HM) for achalasia.

Ninety-six patients undergoing laparoscopic HM for primary achalasia between 1999 and 2008 were identified from a prospective database. Serial mid and distal perendoscopic esophageal biopsies taken from patients before and after surgery were assessed for the presence of intraepithelial eosinophils (EOS). Slides from patients with reports suggestive of EOS were reviewed independently by 2 pathologists, and the highest EOS count/high-power field (hpf) was recorded. Dysphagia scores (0 best – 4 worse) were compared before and 3 months after surgery. We related the highest EOS count to the symptoms and response to HM. Data are presented as median (range). The Wilcoxon signed ranks test determined significance ( $*p < 0.05$ ).

Of 96 patients with achalasia, 50 had pre-HM biopsies, 9 (18%) of which revealed EOS with a median of 3 EOS/hpf (1–21). One patient demonstrated superimposed esophageal candidiasis. Seven out of 9 had postoperative biopsies. A decrease in EOS was found in 4 of 7 patients (57%) from 7/hpf (6–21) to 0.5/hpf (0–3). An increase in EOS was found in 2 of 7 patients (28.5%) from 1.5/hpf (1–2) to 6.5/hpf (5–8). Postoperative EOS count did not change in 1 of 7 patients (4.3%). Dysphagia scores improved in 6 of 7 patients: 4 (0–4) to 0 (0–3).\* No difference in clinical response to HM was detected between patients with preoperative EOS (4 [0–4] to 0 [0–3]) compared with patients with no EOS (3 [0–4] to 0 [0–2]).

A significant number of patients (18%) with achalasia demonstrate esophageal eosinophilic infiltration. This does not represent a distinct clinical entity. The presence of esophageal eosinophils in patients with dysphagia should not preclude further workup for other etiologies, including achalasia.

## 92

**Incidental head and neck fluorodeoxyglucose positron emission tomography (FDG-PET) findings during non-small cell lung cancer staging: Are further investigations necessary? T. Perry, I. Hunt, M. Allegretto, C. Maguire, J. Abele, D. Williams, K. Stewart, E.L.R. Bédard. From the Departments of Surgery and Diagnostic Imaging, University of Alberta, Edmonton, Alta.**

The goal of this study is to review the management of incidental nonthyroidal head and neck findings on PET/PET-computed tomography (CT) in patients with non-small cell lung cancer (NSCLC) and to determine impact on definitive treatment of NSCLC.

All initial PET scans for lung cancer staging performed at our institution from October 2002 to May 2008 were reviewed. Those with unexpected nonthyroidal head and neck findings and biopsy-proven NSCLC were identified. In this group, clinical and pathological courses were followed. Data collected included demographics, location of PET findings, clinical presentation, investigations and time to definitive treatment for NSCLC.

In all, 1520 PET/PET-CT scans were reviewed. Of those, 31 (2%) scans demonstrated incidental nonthyroidal head and neck findings, and 22 were in patients who had proven NSCLC. Six of the 22 went on to have a biopsy. Two patients were shown to have a squamous cell carcinoma of the head and neck, 1 of which was a recurrence of a previously treated squamous cell carcinoma (SCC). The other patient with SCC had frank clinical evidence of a head and neck tumour. There was a significant increase ( $p < 0.01$ ) in time to treatment for NSCLC in those patients with incidental head and neck PET findings compared with patients who had no incidental findings. Mean time to treatment after PET in these 2 groups was 99.6 and 52.1 days, respectively.

Incidental nonthyroidal head and neck findings on PET/PET-CT are rare. Of those found, there is a high false positive rate. Whereas they should be followed up with a thorough history and physical exam, investigations for these incidental findings should not take precedence over treatment for a known NSCLC.

### 93

**Video-assisted thoracoscopic surgery (VATS) lobectomy: a study of the learning curve.** *H.S. Grover, S. Basi, P. Chiasson, S. Basi. W. Gregory, K. Irshad.* From the Division of Thoracic Surgery, Department of Surgery, William Osler Health Centre, Brampton, McMaster University, Hamilton, Ont.

Fewer than 10% of pulmonary lobectomies are performed using a minimally invasive approach owing to the perceived challenges associated with learning this procedure. This study reviews our initial experience with video-assisted thoracoscopic surgery (VATS) lobectomies and attempts to quantify the learning curve associated with this technique.

We conducted a single-centre retrospective chart review of patients who underwent a VATS lobectomy between June 2006 and December 2008; VATS segmentectomies and pneumonectomies were excluded from analysis. Patients were divided into chronological groups of 20 (A through D). Operative times, complication rates and conversions to open thoracotomy were measured. These variables were also compared between the 2 primary surgeons: 1 with minimally invasive surgery fellowship training, the other without.

Eighty-four VATS lobectomies were performed in 47 men (56%) and 37 women (44%), with a mean age of 67.8 years. Patients were most frequently discharged on postoperative day 3. There was 1 mortality. Four patients (4.8%) were converted to an open thoracotomy; however, 2 of these conversions occurred within the first 3 cases. Mean operative times in minutes by group

were: A = 205, B = 159, C = 153 and D = 130. A statistically significant decline in operative time was noted between all groups ( $p < 0.01$ , analysis of variance). An inverse relation was noted between the number of procedures performed and operative time (Pearson correlation coefficient  $-0.452$ ,  $p < 0.01$ ). The complication rates across all groups were similar. Lowest mean operative times were observed for right middle lobectomies (136 min) and longest for right lower lobectomies (181 min). Although longer, mean operative times initially occurred with the non-fellowship trained surgeon (192 v. 150 min,  $p < 0.01$ ); after 20 cases, operative times were similar between both surgeons (133 v. 148 min,  $p > 0.05$ ).

As the number of VATS lobectomies performed increased, operative time continued to decline, whereas complication rates were unchanged. Significantly improved operative times were achieved after 20 cases.

### 127

**Can preoperative computed tomography of the chest predict completeness of the major pulmonary fissure at surgery?** *C. Schieman, J.H. MacGregor, E. Kelly, G. Gelfand, A.J. Graham, S.P. McFadden, S.C. Grondin.* From the Division of Thoracic Surgery, Departments of Surgery and Diagnostic Imaging, University of Calgary, Calgary, Alta.

An incomplete major pulmonary fissure will often make anatomic lung resection technically more difficult and may increase the likelihood of developing complications such as prolonged postoperative air leak. The objective of this study was to determine if preoperative computed tomography (CT) of the chest could accurately predict the completeness of the major pulmonary fissure (CF) observed at surgery.

From October 2008 to March 2009, patients at a single institution were enrolled if they underwent surgery for a pulmonary nodule, mass or cancer. Patients were excluded if they had pleural thickening or effusion. At the time of surgery, CF was graded 1 if pulmonary lobes were entirely separate, 2 if the visceral cleft was complete with an exposed pulmonary artery at the base with some parenchymal fusion, 3 if the visceral cleft was only evident for part of the fissure without a visible pulmonary artery and 4 if the fissure was absent. The preoperative CT scan of each patient was graded by a single, blinded chest radiologist using the same scale. The Pearson  $\chi^2$  test, with 2-tailed significance, was used to test the independence of the operative and radiologic grading.

Preliminary data on 38 patients were analyzed. In 50% of the cases (19/38), the radiologic and operative grading were the same. Of those graded differently, 17 of 19 were within 1 grade. No statistically significant association was observed between the operative and radiologic grade ( $p = 0.369$ ).

The major fissure can often be well visualized on preoperative CT scan, but preoperative CT cannot accurately predict the intraoperative grading of CF. The statistical correlation between radiologic and intraoperative grading may improve with ongoing accrual of patients.



# Canadian Hepato-Pancreato-Biliary Society

## Canadian Hepato-Pancreato-Biliary Society

29

**Increasing time delay from presentation until referral to tertiary care surgeons for hepatobiliary (HPB) malignancies.** *K.P. Croome, R. Chudzinski, D.W. Hanto.* From the Department of General Surgery, University of Western Ontario, London, Ont., Center for Transplant Outcomes and Quality Improvement, The Transplant Institute, Beth Israel Deaconess Medical Center, and the Department of Epidemiology, Harvard University, Boston, Mass.

Studies have shown that delayed treatment of many hepatobiliary (HPB) malignancies is associated with adverse effects on disease progression and survival. It has been our impression that there has been an increase in the time from patients' initial presentation to referral to a HPB surgeon.

We performed a retrospective review of patients referred to hepatobiliary/transplant surgeons at Beth Israel Deaconess Medical Center (BIDMC) for hepatobiliary cancer over a 7-year period (2002–2008). The primary outcome were the time delays in patient workup. Time delays were divided into 3 intervals: time from presentation until referral (TD1), time from referral until seen by HPB surgeon (TD2) and time from being seen by HPB surgeon until surgery (TD3).

A total of 350 patients with hepatobiliary cancer were referred to hepatobiliary/transplant surgeons. Multivariate-adjusted linear regression showed a significant increase in time from presentation until referral to a HPB surgeon (TD1) over the 7-year period ( $p = 0.001$ ). The time delays (TD1) by year can be seen in the Table.

**Table, abstract 29. Delays from presentation to referral to hepatobiliary/transplant surgeons for hepatobiliary cancer at Beth Israel Deaconess Medical Center**

Year	No. patients	Mean wait, d	Median wait, d
< 2002	7	59	14
2002	40	46.175	19
2003	54	52.13	24.5
2004	43	48.53	20
2005	44	98.98	40
2006	42	106.52	48
2007	54	101.61	68
2008	26	64.23	39
Total		72.69	33

Significant predictors of differences in TD1 included African American and Latino race ( $p < 0.05$ ). There were no differences in time delay by sex, age or education level. Patients presenting to a family doctor had a longer time delay; however, this association was not statistically significant. There was no change in delay from referral until being seen by HPB surgeon (TD2) and delay from being seen by HPB surgeon until surgery (TD3) from 2002–2008. Multivariate-adjusted linear regression showed a significant trend of increasing number of imaging tests performed

before referral (CT, MRI, positron emission tomography, ultrasound/endoscopic ultrasound) from 2002 to 2008 ( $p < 0.001$ ).

We have shown a significant increase in the time from initial presentation until referral to a HPB surgeon over the last 7 years. There has been a concomitant increase in the number of imaging tests before referral. Whereas it is necessary to perform investigations to adequately assess presence and stage of hepatobiliary cancer, these tests should not delay referral to HPB surgeons so that access to potentially curative procedures can be performed.

48

**Palliation of pancreatic adenocarcinoma: To stent or to bypass?** *M.H. Jamal, S.A. Doi, J.S. Barkun.* From the Department of Surgery, McGill University Health Centre, Montréal, Que., School of Population Health, University of Queensland, Brisbane, Australia.

The choice of endoscopic versus surgical methods of palliation in unresectable pancreatic adenocarcinoma (UPA) is controversial. If the anticipated survival is longer, surgery is thought to be a better strategy than endoscopy. The purpose of this study was to identify simple clinical tumour and patient factors that are associated with longer survival in UPA patients.

We conducted a retrospective study of 112 patients diagnosed with UPA from 2000 to 2007. We obtained complete follow-up until death in all patients. The median survival was 9 months, with a median of 11.5 months for patients with locally advanced disease and 5.3 months for patients with distant metastasis. Based on this information, as well as clinical validation, we sought to identify clinical predictors of survival. We therefore generated a symptom score based on factors that had been documented at diagnosis. These were dichotomously coded and entered as variables in a forward stepwise Cox proportional hazards model. The outcome was time to cancer-specific death. Weight loss greater than 10%, pain, jaundice and smoking were selected. An individual score was assigned to the presence of each symptom based on the  $\beta$  coefficient (weight loss > 10% = 8, pain = 5, jaundice = 4, smoker = 4, absence of any of these = 0) and summed for the symptom score. Patients were then divided into those with lower intensity scores (LIS, score 0–9) and higher intensity scores (HIS, score 12–21). The median survival for patients in the LIS group was 14.6 months and 6.3 months in the HIS group. In the LIS group, 69% of patients survived at 9 months, whereas only 34% of patients in the HIS group survived at 9 months.

Based on these results, we would recommend a surgical bypass in patients in the LIS group in the absence of distant metastasis.

94

**Radiation and low dose steroid treatment of inflammatory myofibroblastic tumour (IMT) of the pancreas with long-term survival: a case report.** *S.L. Wong, A.H.L. Kwan.* From the Department of Surgery, Health Science Centre, St. John's, NL.

Inflammatory myofibroblastic tumour (IMT) in the pancreas is rare and is composed of myofibroblastic mesenchymal cells and inflammatory infiltrates. We report the case of a 49-year-old man who presented with jaundice and cholangitis. Further investigations revealed a 6.8-cm mass in the head of pancreas. At laparotomy, the tumour was found to involve the portal vein, hepatic artery and the transverse mesocolon. A cholecystojejunostomy was performed. Pathology was subsequently confirmed by external consultation. Postoperatively, the patient was treated with radiation therapy and low-dose steroids. He did well for 5 years and returned with progressive jaundice. Further investigations showed cholelithiasis and choledocholithiasis. The tumour mass remained unchanged. A Roux-en-Y choledochojejunostomy was performed. One year after the second surgery, he remained asymptomatic. In the literature, previously reported cases have described complete surgical excision as the treatment of choice as well as for definitive tissue diagnosis. We present a case where complete excision was unattainable, and long-term symptom-free disease stability was achieved by a combination of radiation and low-dose steroid therapy.

96

**Treatment of hepatic metastases from colorectal cancer in the elderly patient: a Markov decision analysis model. S. Yang, C. Law. From the Sunnybrook Health Sciences Centre, Toronto, Ont.**

The Canadian population is aging rapidly, and the incidence of liver metastases (LM) from colorectal cancer (CRC) is on the rise. When invasive strategies are considered, elderly patients are frequently subject to undertreatment both owing to the perceived risks of therapy and their under-representation in clinical trials. Recent evidence has shown hepatic resection (HR) to be a safe and effective option for elderly patients with LM. Commonly employed alternative strategies to surgery are best supportive care (BSC), systemic chemotherapy (SC) and radiofrequency ablation (RFA).

A Markov decision model was built to examine the effect on life expectancy of 4 strategies: BSC, SC, RFA and HR. The baseline cohort included 70-year-old patients presenting with surgically resectable LM following primary resection for CRC. Transition probabilities including postprocedural complications, tumour recurrence and disease-specific and overall mortality were derived from a systematic review of the literature. Sensitivity analyses were performed on all study variables within plausible ranges to assess the strength of the model.

In the base case analysis, BSC, SC, RFA and HR yielded life expectancies of 10.5, 22.1, 29.0 and 38.9 months, respectively. The model predicts 5-year overall survival estimates of 0%, 4.7%, 7.4% and 21.3%; these are consistent with survival results from previous studies. In the sensitivity analysis, the model was robust to variations in all model parameters.

The present model suggests that hepatic resection is the best treatment strategy for elderly patients with liver metastases. Compared with the next best strategy, radiofrequency ablation, surgery provides a clinically significant incremental life-expectancy gain of 10 months.

97

**Attempts to prolonging survival after liver resection for**

**cancer. Y. Luo, J. Spiers, A. Forse, W. Taylor. From the Hôtel-Dieu Grace Hospital, Windsor, Ont.**

In order to achieve longer survival in patients with liver malignancies, 28 radical liver resection patients with an average age of 67.5 (45–85) years, 8 hepatocellular carcinoma and 20 metastatic colon cancer, were analyzed in 4 groups: (1) liver resection directly without any other preoperative intervention ( $n = 10$ ), (2) systemic chemotherapy preoperatively ( $n = 8$ ), (3) selective hepatic artery embolization before liver resection ( $n = 6$ ) and (4) radiofrequency ablation or hepatic artery embolization before extended lobectomy ( $n = 4$ ). All patients survived the surgery in years up to 2 (0.5–2), 3 (0.5–3), 4.5 (0.25–4.5) and 3.5 (1.5–3.5), respectively for each group. There was no significant complication with preoperative interventions that would prevent scheduled surgery. There was no operative mortality. Postoperative complications happened minimally, with no difference in each group. Average postoperative hospital stay was 7–9 days. Intrahepatic recurrence happened in most patients who died. There was no intrahepatic recurrence in the longest survivors, even though they might have had resectable lung metastasis. Enhanced preoperative interventions may help to prolong postoperative long-term survival in patients with radical liver resection.

98

**Surveillance for hepatocellular carcinoma in cirrhotic patients: barriers to appropriate screening intervals. I. Apriasz, B. Mysliwiec, N. Sarin, J. Gregor. From the Departments of General Surgery and Gastroenterology, London Health Sciences Centre, University of Western Ontario, London, Ont.**

The objective of this study was to determine if the surveillance for hepatocellular carcinoma (HCC) is properly applied at our centre.

Using standardized diagnostic criteria, 133 patients were identified in a general gastroenterology practice. After applying exclusion criteria, 90 patients (56 male, 34 female) were analyzed in regard to proper surveillance for HCC. The mean follow-up time was  $44 \pm 35$  months. A retrospective chart review with the primary outcome of hepatoma screening via ultrasound was performed.

Our cohort had a mean age of  $59 \pm 13$  years. Child–Pugh classification calculation revealed that 35 patients (39%) were class A, 36 (40%) were class B and 19 (21%) were class C. The most common etiologies of cirrhosis were alcohol (45 patients), hepatitis C (18 patients), NASH (10 patients) and other (26 patients). Twenty-two out of 90 patients (24%) had ultrasound examination every 6 months, and 64 patients (71%) had the ultrasound done every 12 months. Thirty-seven patients (41%) missed their follow-up visit, and 23 (25%) missed scheduled ultrasound examinations.

In our gastroenterology practice, surveillance abdominal ultrasound is ordered at appropriate intervals for the majority of patients. The major factor affecting proper surveillance appears to be patient compliance in a substantial number of patients. Investigation into the reasons for such noncompliance and potential strategies for improvement are required.

99

**Pushing the envelope for liver resection of colorectal cancer metastases: Are we consistent? C.E. Moulton,**

**R.S. McLeod, H. Barnett, C. Nhan, S. Gallinger. From Cancer Care Ontario HPB Surgical Oncology Community of Practice, Department of Surgery, University of Toronto, Surgical Oncology Program, Cancer Care Ontario, Toronto, Ont.**

Advances in surgical techniques and chemotherapeutic options have resulted in expanded indications for patients with metastatic colorectal cancer. Our objective was to study the approaches of Ontario hepatobiliary (HPB) surgeons to the management of patients with colorectal cancer liver metastases.

We administered by email a 10-question online survey describing clinical scenarios to 37 Ontario surgeons who constitute the Cancer Care Ontario HPB surgical oncology community of practice. Two email reminders were sent before the response deadline, and 1 phone call followed for those who did not meet the deadline. The scenarios included patients with both limited unilobar and multiple bilobar metastatic disease. Complex cases including patients with unresectable but downstageable metastases, cases with limited extrahepatic disease and patients with

synchronous primary and secondary disease were included.

Twenty-two (59%) surgeons responded to the survey. Most (86%) respondents favoured neoadjuvant chemotherapy for patients with multiple, synchronous and unilobar disease; only 40% favoured neoadjuvant chemotherapy for patients with a single, synchronous metastasis. Over 80% of surgeons would perform a liver and pulmonary resection for patients with multiple, unilobar lung metastases, and none would offer liver resection for cases with multiple retroperitoneal nodes. There was considerable heterogeneity of responses for liver resection in those with other extrahepatic disease sites, including local recurrences and portal lymphadenopathy. Most (77%) surgeons advocated hepatic resection of residual resectable disease following downstaging chemotherapy, with a varied approach to ghosts. Preoperative portal vein embolisation was favoured over radiofrequency ablation for a patient with a small metastasis and inadequate functional hepatic volume. Although most surgeons in the HPB community of practice advocated an aggressive resectional approach for colorectal cancer liver metastases, considerable variability was observed in more complex cases.

# Canadian Society of Surgical Oncology Société canadienne d'oncologie chirurgicale

28

**Laparoscopic adrenalectomy for pheochromocytoma: Just like any other adrenal? S.V. Demyttenaere, P. Nau, P. Muscarella, W.S. Melvin, E.C. Ellison. From the Department of Surgery, Ohio State University Medical Centre, Columbus, Ohio.**

Laparoscopic adrenalectomy (LA) has become the standard approach for most adrenalectomies, although LA for pheochromocytoma (PHE) is still questioned owing to concerns of increased morbidity and hemodynamic changes. The purpose of this study was to compare the outcomes of LA for PHE with results of LA for other adrenal pathologies.

A single-institution, retrospective chart review was performed between July 1997 and December 2008. Patient demographics, perioperative data and outcomes were recorded. Statistical analyses included unpaired Student *t* tests for continuous variables and  $\chi^2$  for noncontinuous variables ( $p < 0.05$  significant).

A total of 102 LAs were completed in 95 patients. Data from 33 PHE were compared with 69 non-PHE (adenoma 26, aldosteronoma 14, cortisol-secreting tumour 5, multinodular hyperplasia 5 and other 19). Five LA were converted to open (4 in patients with PHE,  $p = 0.02$ ). Comparing PHE with non-PHE patients, there was no difference in the mean estimated blood loss (320 v. 150 mL,  $p = 0.2$ ) operative time (142 v. 127 min,  $p = 0.1$ ) or complication rate (7.5% v. 6.9%,  $p = 0.9$ ). Patients with PHE had significantly increased postoperative (3.6 v. 2.3 d,  $p = 0.0005$ ) and overall hospital stays (4.9 v. 2.6 d,  $p = 0.0001$ ), as well as time in intensive care (1.1 v. 0.1 d,  $p = 0.0001$ ) and time until oral intake (1.5 v. 1.0 d,  $p = 0.002$ ). There was 1 death in the PHE group secondary to congestive heart failure.

Patients who undergo LA for PHE tend to have a longer hospital stay and a trend to increased blood loss. Although overall complication rates and operative times were similar, there were more conversions in the PHE group. Therefore, LA for PHE can be performed with similar morbidity but with a higher conversion rate when compared with other adrenal pathology.

49

**Thyroidectomy with harmonic scalpel versus conventional hemostasis: a meta-analysis. S.M. Wiseman, A.L. Melick. From St. Paul's Hospital, Department of Surgery, University of British Columbia, Vancouver, BC.**

Several randomized clinical trials (RCTs) report shorter operative times with the harmonic scalpel (HS) in thyroid surgery compared with conventional hemostasis (CH). However, given the low incidence of postoperative complications, such as transient recurrent laryngeal nerve dysfunction (RLND) and hypocalcemia, almost no study has been able to demonstrate significant differences between the 2 techniques.

The purpose of this study was to determine whether CH or the HS result in shorter operative times for thyroidectomy and to

evaluate the incidence of postoperative complications with each approach.

A systematic search of the literature (MEDLINE, EMBASE, CENTRAL) was conducted from study inception to Sep. 30, 2008. Studies included in the meta-analysis were RCTs wherein patients undergoing thyroidectomy were randomized to either CH or HS. Reporting of postoperative transient RLND and hypocalcemia was necessary for inclusion.

Nine RCTs were incorporated into the meta-analysis. Compared with CH, the use of the HS reduced operative time for thyroidectomy (total or subtotal) by 23.1 minutes (95% CI 13.8–32.33). There was no difference in the incidence of postoperative transient RLND (RR 1.25, 95% CI 0.56–2.76), but there was a lower rate of transient hypocalcemia with the use of the HS (RR 0.69, 95% CI 0.51–0.92).

The use of HS in thyroidectomy significantly reduces operative time compared with CH. In addition, its utilization is associated with a reduction in postoperative hypocalcemia when compared with CH.

95

**Qualitative assessment of patient experiences following sacrectomy. K. M. Davidge, C. Eskicioglu, J. Lipa, P. Ferguson, C.J. Swallow, F.C. Wright. From the Divisions of Plastic, Orthopedic, and General Surgery, University of Toronto, Toronto, Ont.**

Removal of the sacrum as a component of curative surgical resection for advanced rectal cancers and soft-tissue and bone sarcomas may be associated with unique long-term functional challenges. The primary objective of this study was to investigate patient experiences of having a sacrectomy as part of a pelvic operation. Institutional research ethics board approval was secured for this study. A semistructured interview guide was generated and piloted. The interview guide was then appropriately adjusted to ensure all areas of interest were addressed. Patients who had undergone sacrectomy for pelvic neoplasms were contacted and interviewed (by K.M.D. or C.E.) until saturation was reached. The interviews were transcribed verbatim, analyzed using standard qualitative research methodology, and common themes were identified by 3 separate readers (K.M.D., C.E., F.C.W.). Consensus was reached on all themes. Grounded theory guided the generation of the interview guide and analysis. Clinical information was obtained by retrospective chart review. Twelve patients were interviewed (6 female, 32–82 years old). The mean interview time was 34 (range 15–51) minutes. Five themes were identified; these included: (1) the life-changing impact of surgery, including sacrectomy, on both patients' and their family's lives; (2) patient satisfaction with immediate care in hospital; (3) significant chronic pain related to sacrectomy; (4) patients' need for additional information regarding long-term recovery; and (5) patients' gratitude to be alive. Collectively, patient experiences highlight the important contribution of sacrectomy to subsequent quality of life. Patients

undergoing sacrectomy need further information regarding the long-term consequences of this procedure. This should be emphasized both in preoperative multidisciplinary consultations and at follow-up visits.

#### 100

**Meta-analytic comparison of randomized and nonrandomized studies in breast cancer surgery. J.P. Edwards, E.J. Kelly, Y. Lin, T. Lenders, W.A. Ghali, A. Graham. From the Department of Surgery, Medicine, Community Health Sciences, Health Information Network Calgary, Centre for Health Policy Studies, University of Calgary, Calgary, Alta.**

This study examined the effect estimates of randomized controlled trials (RCTs) comparing 2 surgical procedures in breast cancer surgery relative to those of corresponding nonrandomized studies (non-RCTs) assessing the same surgical procedures.

A systematic approach was used to identify RCTs comparing 2 surgical procedures in breast cancer surgery from 2003 to 2008. Non-RCTs comparing the same 2 procedures were identified using the National Library of Medicine's "related articles" function and reference lists. A pooled relative risk (RR) from each of the RCTs and non-RCTs was generated using random effects meta-analysis. The effect estimates from RCTs and non-RCTs were compared using the frequency of discrepancies greater than 2-fold in the RR and greater than 50% differences in natural logarithms of the RR as markers of clinically significant differences in the magnitude of effect estimates. Statistical significance was assessed using the Z score.

Seven comparisons in breast cancer surgery were selected for detailed analysis. Z scores were not statistically significant for 7 of 7 topics. The pooled effect estimates for RCTs versus non-RCTs differed by more than 2-fold in 2 of 7 topic areas, and there was a greater than 50% difference in natural logarithms of the RR for 6 of 7 topics.

Although the differences did not reach conventional levels of statistical significance, RCTs comparing 2 surgical procedures in the treatment of breast cancer frequently demonstrated clinically relevant differences in the magnitude of effect estimates relative to those generated by non-RCTs. These findings underline the importance of continuing to pursue, wherever possible, the conduct of surgical RCTs.

#### 101

**Primary tumour and patient characteristics in breast cancer as predictors of adjuvant chemotherapy regimen: a regression model. V. Francescutti, F. Farrokhyar, R. Tozer, B. Heller, P. Lovrics, G. Jansz, K. Kahnemoui. From the Division of General Surgery, Department of Medical Oncology, McMaster University, Hamilton, Ont.**

Adjuvant chemotherapy is used to reduce the risk of recurrence of operable breast cancer. This study was undertaken to determine which patient and tumour characteristics are important in guiding choice of adjuvant chemotherapy.

A retrospective review was completed of breast cancer patients (stages I-III) at a regional cancer centre from 2004 to 2007. Patient and tumour characteristics and chemotherapy regimens were assessed. Binary logistic regression analysis was performed

to the choice of fluorouracil, epirubicin and cyclophosphamide plus docetaxel (FEC/D), cyclophosphamide, epirubicin and fluorouracil (CEF), doxorubicin and cyclophosphamide plus paclitaxel or docetaxel (AC/T) or dose dense AC/T (ddAC/T) against AC or CMF, or the choice of any regimen to hormonal therapy. Univariate analysis was used to select factors ( $p < 0.1$ ) for entry into a multivariate stepwise logistic regression model using the forward method. Odds ratios with 95% CI were calculated. A  $p < 0.05$  was considered significant and statistical comparisons were 2-tailed.

Model 1 ( $n = 867$ ) included regimen (AC or CMF v. aggressive regimen) as the dependant variable. Indicators of choice of aggressive regimen were higher stage [OR 3.57 (CI 2.4, 5.4)], positive nodes [2.8 (1.8, 4.3)], tumour size [1.2 (1.1, 1.5)], younger age [0.91 (0.89, 0.93)], and positive PR [0.4 (0.3, 0.6)]. Model 2 ( $n = 636$ ) involved any regimen (chemotherapy v. hormonal) as the dependant variable. Indicators of choice of chemotherapy were higher stage [12.2 (5.4, 27.9)], higher grade [6.7 (3.2, 13.9)], younger age [0.85 (0.81, 0.90)], and ER negativity [0.04 (0.004, 0.390)]. Factors not significant in both models included: family history, comorbidities (renal/hepatic dysfunction, diabetes, cardiac, or neuropathy), treating oncologist, histology, Her2/neu, > 3 positive nodes, positive/total nodal ratio, multicentricity, multifocality, and positive margins.

This study verifies known factors for choice of chemotherapy regimen as found in guidelines, quantifies effects at our centre, and excludes others thought to be important. Further studies of behaviour and decision making are required to compare these models elsewhere, where risk stratification may be different.

#### 102

**Physicians' awareness of cytoreductive surgery and intraperitoneal chemotherapy for colorectal carcinomatosis. G. Spiegler, S. Schmocker, H. Huang, C. Victor, C. Law, E.D. Kennedy, J.A. McCart. From the Department of Surgery, Toronto General Hospital, Sunnybrook Health Science Centre, Mount Sinai Hospital, University of Toronto, Toronto, Ont.**

Recent controlled trials have shown that cytoreductive surgery and heated intraperitoneal chemotherapy (HIPEC) for colorectal cancer (CRC) carcinomatosis leads to 5-year disease-free survival rates of over 30%. In January 2007, an international consensus statement recommended HIPEC as the treatment of choice for selected patients with CRC carcinomatosis.

Since these data represent a substantial shift from the traditional treatment paradigm, the objectives of this study were to determine: physicians' awareness of HIPEC and physician characteristics predictive of awareness of HIPEC for the treatment of CRC carcinomatosis.

This study was a mailed, cross-sectional survey of general surgeons (GS) and medical oncologists (MO) in Ontario. The survey consisted of 17 items evaluated on a categorical scale.

The overall response rate was 40.5% (257/635). The majority of respondents were male, less than 50 years and in practice less than 10 years. There was a fairly even split between respondents working at academic and community hospitals. Overall, 78% of the respondents reported consultations with fewer than 5 of these patients/year, and overall only 41% of respondents would consider HIPEC as a treatment option for CRC carcinomatosis. General surgeons tended to be more likely than MOs to consider

HIPEC as a treatment option (43% v. 34%,  $p = \text{NS}$ ). Similarly, multivariate analysis did not show any physician factors to be predictive of awareness of HIPEC.

Physician awareness of HIPEC for the treatment of CRC carcinomatosis in the province of Ontario is low. This has considerable implications for health care delivery in the province, as many eligible patients may not be referred for HIPEC, resulting in substantial consequences with respect to patient outcome. Therefore, strategies to improve physician knowledge about HIPEC are important to ensure appropriate and timely treatment for patients with CRC carcinomatosis in Ontario.

### 103

**Factors that determine whether a patient receives completion axillary lymph node dissection after a positive sentinel lymph node biopsy in breast cancer in British Columbia.** *N. Aslani, T. Swanson, H. Kennecke, R. Woods, N. Davis.* From the British Columbia Cancer Agency, Vancouver, BC.

Completion axillary lymph node dissection (CALND) is recommended in the setting of positive sentinel lymph node biopsy (SLNBx). The morbidity associated with CALND deters many patients when the probability of ongoing lymph node involvement is low (e.g., micrometastasis).

This study used a prospectively collected database (British Columbia Cancer Breast Outcomes database) and retrospective chart review to determine the factors that influenced when positive SLNBx patients received CALND. We identified all stage 1–2 breast cancer patients with positive SLNBx from 2003 to 2006. Patient and tumour characteristics were compared between those receiving CALND and not.

Patients who did not receive CALND were older ( $p < 0.029$ ), had more nodes removed on SLNBx ( $p < 0.005$ ), had a lower percentage of positive sentinel lymph nodes ( $p < 0.0003$ ) and had a lower pathological N stage ( $p < 0.04$ ). Size of the breast lesion, size of the largest sentinel lymph node, estrogen receptor status, grade, lymphovascular invasion, histology and multifocality were not significantly different between groups. The probability of spread to additional lymph nodes as calculated by the Van Zee nomogram was not significantly different between groups. Sixty-two percent of women without CALND received radiation to the axilla. Complication rates (including lymphedema) were higher in the CALND group (20%) compared with the SLNBx alone group (6%). The rates of locoregional recurrence (1% v. 2%) and systemic metastases (8% v. 10%) were similar between the CALND and SLNBx groups at 36 months follow-up.

In BC, patients who do not receive CALND are older women who have 3 or more nodes removed on SLNBx with less than 50% node positivity. A majority of these women receive radiation therapy to the axilla and have recurrence rates that are comparable to those of patients with CALND.

### 111

**Reporting of malignant colorectal polyps.** *A.E. Klevan, 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 adequacy of pathol-

ogy reports in reporting prognostic factors for malignant colorectal polyps.

The laboratory database of a single pathology department within a large multicentre tertiary hospital was searched for all pathology reports with keywords carcinoma, adenoma and/or polyp. The laboratory database included 3 tertiary sites as well as a single local community hospital. The search encompassed a 6-year period from Jan. 1, 2002, to Dec. 31, 2007. Specimens included in the study demonstrated an invasive carcinoma (to submucosa) within a polyp excised by endoscopic polypectomy. Exclusion criteria included nonpolypectomy biopsies, polyps demonstrating high-grade dysplasia without invasive carcinoma and specimens retrieved through nonendoscopic (i.e., surgical or transanal) resections. The synopses of pathological reports for malignant colorectal polyps were retrospectively reviewed for the reporting of prognostic factors.

The search yielded a database of 223 individual patient pathology reports, 27 of which had multiple polyps for a total of 251 potential polyp specimens. Sixty percent of the pathology specimens were reported as polypectomies and 40% as biopsies. Thirty-nine polypectomy specimens of malignant colorectal polyps that met the study's inclusion and exclusion criteria were subsequently analyzed. The mean patient age was 72.2 years, and the male-to-female ratio was 2.3:1. Prognostic variables of malignant polypectomy specimens were reported as follows: tumour differentiation 19/39 (48.7%), lymphovascular invasion 23/39 (59.0%), margin status 31/39 (79.5%) and stalk invasion 6/39 (15.4%). Haggitt level was not recorded in any of the specimens.

The use of checklists in the synopsis of pathology reports for malignant colorectal polyps may increase reporting of relevant prognostic factors and thus improve the subsequent clinical management and outcomes of patients.

### 113

**Is the sphincter preservation rate after rectal cancer surgery an appropriate indicator of quality of care?** *M. Smith, M. Plourde, P.M. Johnson.* From the Division of General Surgery, Dalhousie University, Halifax, NS.

The treatment of rectal cancer is complex and may have significant functional implications, including a permanent stoma. The rate of sphincter preservation after rectal cancer surgery has been proposed as one of many potential indicators of quality of care. Previous research has suggested that rectal cancer care in North America is associated with high stoma rates. The purpose of this study was to determine if there were appropriate indications for creating a stoma in patients with rectal cancer who received a permanent colostomy.

All patients who underwent elective radical excision for rectal cancer at a tertiary care hospital between January 2000 and June 2006 were retrospectively identified. Medical records were reviewed to determine the reason for creation of a permanent stoma.

During the study period, 150 patients underwent radical excision for rectal cancer. Thirty-seven patients had a permanent stoma created; 29 patients had an abdominoperineal resection, 7 patients had a Hartmann-type resection, and 1 patient had a total proctocolectomy. The rate of sphincter preservation was 75%. An appropriate indication for creation of a permanent stoma was identified for 33 of 37 patients (92%). Tumour

invasion of the anal sphincter was the most common indication (68%) followed by patient preference (5%) and advanced age (5%). During the study period, the annual sphincter preservation rate for patients with rectal cancer varied from 56% to 100%.

The overall rate of sphincter preservation during the study period was high, and the majority of patients who had a permanent stoma had a clear indication for it. However, there was considerable variability in the sphincter preservation rate from year to year, and this could lead to incorrect conclusions regarding quality of care. The sphincter preservation rate should only be used as an indicator of quality care if details regarding patient and tumour factors are available.

## 128

**The phytochemical piperine inhibits human colorectal cancer cell growth. P. Yaffe, M. Walsh, D. Hoskin. From the Departments of Medical Sciences, Surgery, Pathology, and Microbiology and Immunology, Dalhousie University, Halifax, NS.**

A number of plant-derived compounds (phytochemicals) exhibit potent anticancer activity as a result of their actions on molecular targets involved in carcinogenesis and tumour progression. Piperine, an alkaloid present in the fruit of black and long pepper plants (*Piper nigrum* and *Piper longum*) is an antioxidant that has antimutagenic and tumour growth-inhibitory activities. However, much remains to be determined regarding the molecular basis for the anticancer activity of piperine. In this study, human colon (HT-29) and rectal (HRT-18) adenocarcinoma cell lines were used to investigate the mechanisms underlying the tumour

cell-killing activity of piperine.

Experimental determinations of the dose-dependent effects of piperine on colorectal adenocarcinoma cell proliferation, cell cycle progression, cell viability, apoptosis induction and the production of reactive oxygen species (superoxide anions and hydroxyl radicals) were performed.

Piperine exhibited a dose-dependent inhibitory effect on the proliferation of HT-29 and HRT-18 cell lines in Oregon Green 488 staining assays. Flow cytometric analysis of propidium iodide (PI)-stained colorectal cancer cells showed that piperine caused a dose-dependent arrest in the G<sub>1</sub> phase of the cell cycle. Growth inhibition was attributed to a cytotoxic effect by piperine on HT-29 and HRT-18 cells, as evidenced by a time- and dose-dependent reduction in colorectal cancer cell viability in MTT assays. Annexin-V-FLUOS and PI staining of colorectal adenocarcinoma cells showed dose-dependent induction of apoptosis by piperine. Flow cytometric analysis of dihydroethidium-stained colorectal cancer cells revealed that exposure to piperine was not associated with a significant increase in superoxide anion production. In contrast, flow cytometric analysis of 2',7' dichlorofluorescein diacetate-stained colorectal cancer cells showed that exposure to piperine was associated with a substantial increase in hydroxyl radical production, which was reduced in the presence of exogenous glutathione. Moreover, piperine-induced apoptosis in colorectal adenocarcinoma cells was also reduced in the presence of exogenous glutathione.

Piperine exerts an antiproliferative effect on colorectal carcinoma cells that is associated with G<sub>1</sub> phase arrest of the cell cycle and subsequent dose-dependent cytotoxicity due to apoptosis, which is triggered by the generation of hydroxyl radicals.

# Canadian Society of Colon and Rectal Surgeons Société canadienne des chirurgiens du côlon et du rectum

104

**Ziploc bags: A cost-effective method to protect extraction sites in laparoscopic colorectal procedures?** *H.P. Huynh, D.C. Trottier, C. Soto, R. Auer, E.C. Poulin, J. Mamazza, R.P. Boushey, H. Moloo.* From the Minimally Invasive Surgery Research Group, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.

The aim of this study was to review the surgical site infection (SSI) and retrieval site tumour recurrence rates in laparoscopic colorectal procedures when a Ziploc bag was used as a wound protector.

A prospectively collected laparoscopic colorectal database involving 5 surgeons in 5 academic centres between 1991 and 2008 was reviewed. Surgical site infections and tumour recurrences were documented in the database and verified through chart review by 2 physicians. All patients who had a Ziploc bag used as a wound protector at the extraction site were included. All bags were sterilized before use; the bottom was cut off to create a conduit to deliver the specimen, with the ridged edge placed in the abdominal cavity. Conversions and procedures where use of a wound protector was not specified were excluded. Chi-square testing was used to compare frequencies of SSI between groups. Costing data were obtained from the operating room supplies department.

In total, 1389 laparoscopic colorectal procedures were identified, with 936 cases meeting the inclusion criteria. The diagnoses included adenocarcinoma (50.6%), diverticular disease (18.3%), inflammatory bowel disease (15.3%), adenoma (10.1%) and other (5.7%). Of these 936 cases, 51 had an SSI (5.45%). There were no significant differences in SSI rate when comparing groups based on procedure type, diagnosis or type of wound protector used. The retrieval-site tumour recurrence rate was 0.22% (1/457 adenocarcinoma cases). The cost of the Ziploc bag including sterilization varied (\$0.25–\$3), depending on the institution.

The use of a Ziploc bag as a wound protector in laparoscopic colorectal procedures has low SSI and retrieval-site tumour recurrence rates in this large series. The use of a Ziploc bag in our series has results that compare favourably to published data and is cost-effective when compared with other available devices.

105

**Adverse events associated with laparoscopic colostomy reversal following Hartmann procedure: a multi-institutional study.** *H.P. Huynh, D.C. Trottier, C. Soto, H. Moloo, E.C. Poulin, J. Mamazza, R.P. Boushey.* From the Minimally Invasive Surgery Research Group, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.

Open restoration of bowel continuity after Hartmann procedure has been associated with significant morbidity, including anastomotic leak, incisional hernia, inability to re-establish intestinal continuity and wound infections. Few studies have examined the

role of laparoscopy in performing Hartmann reversal. The aim of this study was to review our experience with laparoscopic colostomy reversal after Hartmann procedure with an emphasis on intra- and postoperative adverse events.

A prospectively collected laparoscopic colorectal database involving 3 surgeons in 4 academic centres between 1991 and 2008 was reviewed. All patients underwent a laparoscopic approach, and there was no patient selection during this time interval. Factors evaluated were patient demographics, diagnosis, operative time, intra- and postoperative complications, recovery of bowel function and hospitalization length.

Twenty-eight consecutive patients (13 men), mean age 61.1 ± 15.3 years, mean weight 72.3 ± 20.1 kg, underwent laparoscopic Hartmann reversal. The diagnosis at initial surgery was complicated diverticulitis in 19 patients (67.9%), cancer in 6 patients (21.4%) and other in 3 patients (10.7%). The median operative time was 166.2 ± 74.4 minutes, and the mean incision length was 4.5 ± 1.9 cm. There were no conversions. There was 1 major intraoperative complication (bleeding) (3.6%). There were 3 postoperative complications (10.7%): 1 abscess, 1 prolonged ileus and 1 wound hematoma. Only 1 patient with an abscess required readmission, and there were no observed clinical anastomotic leaks. All patients underwent successful reanastomosis. The median time to bowel function return was 4 days (3–4) (interquartile range). The median hospitalization length was 5 days (3.5–6) (interquartile range). There was no mortality.

Laparoscopic colostomy reversal after Hartmann procedure is safe and feasible in experienced hands. It is associated with low morbidity, quick return of bowel function and short hospitalization.

106

**Colorectal cancer (CRC) surgery and pathology listserv: a clinical practice guideline (CPG), knowledge-exchange strategy.** *C. Nhan, D.K. Driman, A.J. Smith, A. Hunter, R.S. McLeod.* From the Surgical Oncology Program, Cancer Care Ontario, the Department of Surgery, University of Toronto, Toronto, and the Department of Pathology, University of Western Ontario, London, Ont.

Cancer Care Ontario's Surgical Oncology Program launched the CRC Surgery and Pathology List Serv as a knowledge-exchange strategy for the recently released CRC CPG. The listserv provided an online multidisciplinary platform for physicians to improve their knowledge in the management of CRC by discussing quality issues related to the CPG. The objective of this study was to report physician knowledge awareness and satisfaction with the listserv.

From September 2008 to March 2009, 6 clinical scenarios were posted. Participants from various disciplines involved in the care of CRC patients were invited to participate. There were 253 participants (127 surgeons, 33 pathologists, 6 radiation oncologists,



11 radiologists, 6 medical oncologists, 40 surgery and pathology trainees and 30 administrators). All 14 regions of the province were represented. An average of 34 comments was posted for each scenario. Listserv discussions generated general agreement on guideline recommendations. Based on a qualitative analysis, salient issues identified included importance of preoperative imaging of colon cancer, staging of rectal cancer, role of neoadjuvant therapy and the Quirke method of processing specimens. Satisfaction with the overall listserv initiative, format (i.e., email) and case presentations were reported by respondents as 78.3%, 69.6% and 73.9%, respectively. Improved culture of collaboration between various disciplines (85.1%) and awareness of new/different practices in Ontario (74.5%) were some of the benefits cited by listserv participants. Participants also reported they shared comments with colleagues on the listserv (73.5%) and incorporated input into clinical practice (95.9%). A majority stated the listserv increased their knowledge of the surgery (75.0%) and pathology (85.4%) guideline recommendations. The CRC listserv is a feasible knowledge-exchange strategy with high physician satisfaction and knowledge awareness. Further research is required to determine its impact on patient care.

#### 107

**Practices and beliefs about mechanical bowel preparation among general surgeons in Canada. C. Eskicioglu, D.S. Fenech, C. Victor, R.S. McLeod. From the Division of General Surgery, University of Toronto, Toronto, Ont.**

Mechanical bowel preparation (MBP) before colorectal surgery has been a cornerstone of perioperative care. Level-I evidence has shown that MBP is not necessary to reduce the rate of postoperative complications. Despite this, a survey of American colorectal surgeons published in 2003 revealed that 99% of surgeons prescribed MBP. The primary goal of this study was to ascertain recent MBP practices and beliefs. Members of the Canadian Association of General Surgeons were surveyed with a postal questionnaire regarding their MBP practices. In total, 566 (61%) of 924 questionnaires were returned. Nine percent of respondents had completed fellowship training in colorectal surgery. Colorectal surgery comprised less than 25% of practice for more than half of responding surgeons, and 40% of respondents practiced in an academic centre. Furthermore, 84% of surgeons reported that they would use MBP in some surgical scenarios. Its use varied according to type of surgery, with 44% of surgeons using MBP for right hemicolectomies and 74% using MBP for low or ultra-low anterior resections. Those surgeons who did not use MBP in any situation were significantly more likely to agree with statements that MBP use increases the rates of anastomotic leak, superficial surgical site infection and intra-abdominal infection ( $p < 0.001$ ). Surgeons who used MBP were significantly more likely to agree that omitting MBP increases fecal contamination and makes it difficult to identify lesions ( $p < 0.001$ ). Also, surgeons who prescribe MBP were more likely to report that surgical factors such as location of the anastomosis and type of surgery were important factors influencing their decisions. Despite level-I evidence supporting the omission of MBP in most patients, it is still prescribed by a large proportion of surgeons. Further knowledge-translation strategies must be used to increase awareness and agreement to the evidence and adoption of changes in MBP practices.

#### 108

**A comparison of open and laparoscopic resections for rectal cancer based on the proposed Clinical Outcomes of Surgical Therapy Study group (COST II) outcome measures. D.C. Trottier, H. Huynh, E. Sabri, C. Soto, A. Scheer, S. Zolfaghari, H. Moloo, J. Mamazza, E.C. Poulin, R.P. Boushey. From the Department of Surgery, University of Ottawa, The Ottawa Hospital, Ottawa, Ont.**

This study compared laparoscopic (L) and open (O) surgery in patients with rectal carcinomas below 15 cm from the anal verge (AV), using similar outcomes established by the Clinical Outcomes of Surgical Therapy Study group (COST II).

Demographics, tumour characteristics, adequacy of oncologic resection, short-term outcomes and survival data were analyzed from a prospectively collected database from 1991 to 2008.

A total of 433 patients underwent resection of a rectal carcinoma (L 228 v. O 205). Age, BMI, ASA and pathologic TNM staging were comparable between both groups. A similar number of patients received neoadjuvant therapy (NA) in both arms (L 33% v. O 34%). Operative times were longer for the laparoscopic approach (236 v. 166 min,  $p = 0.0001$ ) and the overall conversion rate was 16%. Rates of abdominoperineal resections were higher in the laparoscopic group (27% v. 7%), with a greater proportion of distal tumours in the laparoscopic group (22% v. 13%). The use of ileostomies was comparable (L 12.5% v. O 19.0%). Patients undergoing laparoscopic resection had a lower incidence of ileus and a decreased length of stay (2.3% v. 17.9%,  $p = 0.03$  and 6 v. 8 d,  $p = 0.002$ , respectively). There were no 30-day mortalities. No significant differences were seen with regard to surrogates of adequate oncologic resection. Specifically, the total number of harvested lymph nodes was similar (L 11.4 [9.8 NA, 12.9 noNA] v. O 11.7 [12.7 NA, 12 noNA]), and an equal proportion of patients in both groups had distal margins greater than 2 cm and radial margins greater than 0.1 cm. Three patients in the open group (2.1%) had positive radial margins. Average follow-up was 21 months with no difference in survival.

Laparoscopy for rectal cancer is equivalent to open resection based on oncologic end points proposed by the COST II trial, with a lower incidence of ileus and a shorter length of stay. Overall survival rates are similar between both groups.

#### 109

**Stents for the treatment of colonic obstruction: Is urgent surgery becoming obsolete? A review of 24 cases. J. Hallet, M. Guénette-Lemieux, A. Bouchard, R.C. Grégoire, C. Thibault, G. Dionne, F. Côté, P. Langis, 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 the use of colonic stents in palliative and curative settings in an academic health sciences centre.

We reviewed the charts of all patients in whom a colonic stent was placed between May 2003 and September 2008. Data included demographics, diagnosis, technical and clinical success, complications and surgical procedures.

Twenty-eight stents were placed in 24 patients. The mean patient age was 68 (51–92) years. Nine stents (32%) were placed

for complete obstruction. Twenty-two patients (92%) were found to have colon cancer, of whom 16 were at stage IV. Other diagnoses included diverticular stenosis with colovesical fistula (1) and ischemic stenosis (1). Site of obstruction was left colon (17), rectum (6) and right colon (1). Fifteen procedures (63%) were palliative and 9 (37%) used as a bridge to surgery. The median delay before first stent placement was 2 (0–18) days. Technical and clinical successes were 89% and 82%, respectively, with a mean time to relief of symptoms of 24 hours. There was 1 death secondary to aspiration pneumonia. Elective surgical procedures were 6 laparoscopic resections (2 conversions) and 2 open resections. Urgent procedures were 1 open resection owing to perforation in a patient with stage-IV disease and 1 cecostomy. In the palliative group, 2 migrations and 2 obstructions related to cancer growth occurred. All 4 were successfully managed with a second stent.

Colonic stenting is an effective option for colonic obstruction in both palliative and curative settings, obviating the need for stoma in most cases. Perforation remains an issue.

#### 110

**Submucosal anal canal injection of Solesta bulking agent for fecal incontinence: results in 12 patients. M.J. Raval, P.T. Phang, C.J. Brown, A. Kuzmanovic. From the Department of Surgery, St. Paul's Hospital and University of British Columbia, Vancouver, BC.**

This study evaluates the bulking agent Solesta, injected into the submucosal space of the anal canal, in the treatment of fecal incontinence.

Twelve patients with fecal incontinence (ages 37–74 yr, 11 female) took part in this study at our centre. Inclusion criteria included a predefined threshold of fecal incontinence severity and failure of conservative therapy. Exclusion criteria included complete external sphincter disruption on EAUS, concurrent anal or rectal pathology, previous pelvic radiation, previous low rectal anastomosis and recent anorectal surgery or hemorrhoid banding. One mL of Solesta was injected into the submucosal space in 4 quadrants, 5 mm above the dentate line, and took place without local anesthetic in an outpatient clinic, with an option for a second injection 4–6 weeks later. Efficacy was measured by number of predefined fecal incontinence episodes before and after injection, as recorded by the patient in a diary over 28 days and by the Cleveland Clinic Fecal Incontinence Score (CCFIS). Patients were assessed prior to injection and 6 months after injection. Planned follow-up was up to 24 months. Adverse events were recorded. This study was sponsored by Q-Med, Inc. (Uppsala, Sweden), manufacturer of Solesta.

Follow-up was complete in all 12 patients. The mean number of fecal incontinence episodes (over 28 days) dropped from 22.5 (4–48) prior to injection to 6.5 (0–47) 6 months after injection ( $p = 0.002$ ). The mean CCFIS score was 14.25 (10–18) preinjection and 9 (1 to 18) after injection ( $p = 0.003$ ). Six adverse events (no mortality) were observed, including abscess formation (1, spontaneous drainage), rectal bleeding (2, self-limited, no transfusion), pain (2, self-limited, nonprescription analgesics) and mucus leakage (1, self-limited). No patients required operation.

In this open, noncomparative study, Solesta was found to be a safe, effective, outpatient-based treatment for patients with fecal incontinence, with effects lasting at 6 months after injection.

#### 112

**Transanal endoscopic microsurgery: impact on fecal incontinence and quality of life. A. Planting, M.J. Raval, P.T. Phang, C.J. Brown. From the Department of Colorectal Surgery, St. Paul's Hospital, University of British Columbia, Vancouver, BC.**

Anal dilatation during tumour excision with transanal endoscopic microsurgery (TEM) has caused concerns regarding postoperative anal function. This retrospective cohort study aims to investigate pre- and postoperative fecal incontinence and quality of life in patients treated with TEM.

All patients undergoing TEM at St. Paul's Hospital between March 2007 and December 2008 were considered for inclusion. We excluded patients who were treated with subsequent radical resection, unavailable for interview or deceased. In February, 2009, patients were interviewed by phone to measure the pre- and postoperative function using the European Organization for the Research and Treatment of Cancer core (QLQ C30) and colorectal cancer-specific (QLQ CR38) quality of life instruments, the Fecal Incontinence Severity Index (FISI) and the Fecal Incontinence Quality of Life (FIQL) questionnaires. Statistical analysis was performed using the Wilcoxon signed rank test and Spearman rank correlation coefficient for nonparametric data.

Between March 2007 and December 2008, 40 patients were treated with TEM at St. Paul's Hospital. Thirty patients met all inclusion criteria and agreed to participate. The median age was 70 (42–93) years, and the median follow-up time between the interview and the operation was 365 (55–712) days. Tumours excised included adenoma (19), carcinoma (8) and carcinoid tumour (3). The median tumour distance from the anal verge was 6.5 (range 2–13) cm. The median length of stay was 1 day (0–12 d). For most aspects of quality of life, there were no detectable differences after surgery. The FIQL coping scale showed a significant improvement after surgery (3.28 v. 3.78,  $p = 0.03$ ). There was a trend in improvement in FIQL scores (3.67 v. 3.78,  $p = 0.08$ ). There was no difference in pre- versus postoperative FISI scores (8.03 v. 7.2,  $p = 0.57$ ).

Despite a large operating anoscope, TEM does not have a negative impact on fecal incontinence and may improve fecal incontinence-related quality of life.

#### 114

**Can a rectal tube be an alternative to diverting stoma following pouch surgery? H.P. Huynh, D.C. Trottier, H. Moloo, E.C. Poulin, J. Mamazza, M. Friedlich, H.S. Stern, R.P. Boushey. From the Minimally Invasive Surgery Research Group, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.**

To determine the potential role of a rectal tube in reducing pelvic sepsis following ileal pouch anal anastomosis (IPAA) and colonic J-pouch.

A prospectively collected colorectal database involving consecutive patients at the same institution from January 2000 to July 2006 was reviewed. Inclusion criteria included IPAA for chronic ulcerative colitis and colonic-J pouch for mid- and distal rectal cancers. To reduce pelvic septic complications following low rectal anastomosis, patients received a rectal tube (RT), ileostomy or combined RT and ileostomy. Patients were analyzed with respect

to demographics, neoadjuvant therapy, steroid use, anastomosis characteristics, clinical anastomotic leaks and need for reoperation.

In all, 112 pouch procedures were identified: 69 IPAA and 43 colonic J-pouches. Of these, 97.3% of procedures were open, and over 80% were performed by 2 surgeons. In the IPAA group, 44 were treated with RT and 25 without RT. Both groups were comparable, notably steroid use and anastomosis difficulty. All patients with a positive air leak test had an ileostomy (3 RT v. 4 no RT). In patients with a negative air leak test, 40 of 41 (97.6%) received RT without an ileostomy and 20 of 21 (95.2%) received an ileostomy without RT. The clinical anastomotic leak rate was similar in both groups (1 leak each), 2.5% versus 5.0%. All leaks were managed conservatively. There were no clinical leaks in the 4 patients who had both RT and a diverting ileostomy. In the cohort of patients receiving colonic J-pouches, neoadjuvant radiotherapy was more prevalent in the RT group (18/23, 78.3% v. 10/20, 50.0%). The majority of patients (21/23, 92.3%) had RT without an ileostomy, and only 6 of 20 (30.0%) had a diverting ileostomy without RT. Anastomosis characteristics were comparable, and all immersion tests were negative. The clinical leak rates were similar in both groups (1 leak each), but reoperation was required in the RT without ileostomy patient.

In both colonic J-pouch and IPAA procedures, RT may be an acceptable alternative to diverting stoma in reducing pelvic septic complications. Selective use of RT is associated with a low leak rate and morbidity and may avoid the potential complications associated with a stoma.

#### 115

**A comparison of lateral to medial versus medial to lateral approach in laparoscopic right hemicolectomy.** *B.Q. Tang.* From the Department of Surgery, Division of General Surgery, Royal Jubilee Hospital, Vancouver Island Health Authority, Victoria, BC.

A retrospective chart review of 59 laparoscopic right hemicolectomies for benign and cancer cases was conducted from a single surgeon's practice in a community hospital from Dec. 21, 2004, to Nov. 5, 2008. There were 38 cases performed with the lateral-to-medial approach in the early series, and 21 cases were performed with the medial-to-lateral approach in the later series. Primary outcome measures were length of OR times, pathological results (for cancer cases) and conversion and complication rates. Secondary outcome measures were direct OR costs and length of hospital stay.

The demographic data of the 2 groups were similar. There were no perioperative deaths and no anastomotic leaks in both groups. The mean OR time, conversion rate to open and mean number of lymph nodes resected (for cancer cases) were 179 minutes, 16% and 18 lymph nodes for the lateral-to-medial group, and 156 minutes, 5% and 23 lymph nodes for the medial-to-lateral group, respectively. The complication rates were 16% and 14% for the lateral-to-medial and medial-to-lateral groups, respectively. The median lengths of hospital stay were 3 days for the lateral-to-medial group and 4 days for the medial-to-lateral group. The mean direct OR costs was \$512.14 higher in the medial-to-lateral group when compared with the lateral-to-medial group.

This study showed that the medial-to-lateral approach seems to be a better approach in performing laparoscopic right hemi-

colectomy. However, the direct OR costs is higher when compared with the lateral-to-medial group.

#### 116

**The lift procedure: a new approach to complex anal fistulas.** *H. Moloo, J. Bleier, S.M. Goldberg.* From the Department of Colorectal Surgery, University of Minnesota, Minneapolis, Minn., the Department of Surgery, University of Ottawa, Ottawa, Ont., and the Department of Colorectal Surgery, University of Pennsylvania, Philadelphia, Pa.

This study reports the initial experience using a novel technique, the ligation of intersphincteric fistula tract (LIFT) procedure in the treatment of transsphincteric fistula.

A review of a prospectively collected computerized database was done between July 2007 and December 2008. Demographics and past medical history were collected especially pertaining to the type and number of previous fistula repairs. Types of fistulas were documented in addition to postoperative complications, continence, length of follow-up and evidence of recurrence.

Thirty-nine patients were identified, 20 of whom were male, with a median age of 49 years. Eleven surgeons at 3 centres were involved in the study. There was a median of 3 (range 0–9) previous surgeries specific to the fistula in ano with a median of 2 previous failed repairs (range 0–6) in 29 (74%) patients having a previous repair attempted. Types of previous failed surgeries included setons, plugs, fibrin glue and advancement flaps. There were 28 transsphincteric, 7 transsphincteric horseshoe, 2 rectovaginal, 1 intersphincteric and 1 suprasphincteric fistula. Follow-up was obtained in 90% (35/39) of patients, with a median follow-up of 20 (range 0–58) weeks and a success rate of 57% (20/35). Median time to failure of the repair was 10 (range 2–38) weeks. There were no major intra or postoperative complications. Two minor postoperative complications (anal fissure, persistent anal pain) were observed. There were no reports of incontinence.

The LIFT procedure represents a safe, simple and inexpensive approach to complex anal fistulas. In this series, there was a reasonable success rate of 57%. Thus far, it appears to be a sphincter-sparing procedure. Further research is needed — a randomized controlled trial has been designed and registered with identifier NCT00830661 at clinicaltrials.gov.

#### 117

**Impact of age on the short-term outcomes of laparoscopic colorectal surgery: implications for clinical pathways.** *J. Alsharif, G. Martel, A. Bouchard, E. Sabri, C.R. Ramsay, J. Mamazza, E.C. Poulin, R.P. Boushey.* From the Minimally Invasive Surgery Research Group, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.

The objective of this study was to evaluate whether the outcomes of laparoscopic colorectal surgery are comparable among elderly and younger patients.

Consecutive patients undergoing laparoscopic colorectal procedures from 1991 to 2007 were analyzed from a prospectively collected database. Patients were separated into 3 age groups: 1 (< 50 yr), 2 (50–70 yr) and 3 (> 70 yr). Summary statistics and univariate analyses were performed. Multiple logistic regression analysis was used to identify factors associated with

an increased risk of postoperative complications.

A total of 1070 colectomies were analyzed, including 279 patients in group 1 (median age 37 yr), 450 in group 2 (median age 62 yr) and 341 in group 3 (median age 78 yr). The age groups were found to be significantly different in terms of cardiac comorbidities (1% v. 18% v. 39%,  $p < 0.0001$ ), pulmonary comorbidities (6% v. 10% v. 17%,  $p < 0.0001$ ), steroid use (16% v. 5% v. 3%,  $p < 0.0001$ ) and previous abdominal surgery (16% v. 25% v. 35%,  $p < 0.0001$ ). Operative time and the rate of intraoperative complications were not significantly different across age groups. In contrast, rates of conversion to laparotomy (8% v. 11% v. 17%,  $p = 0.001$ ), postoperative complications (16% v. 22% v. 36%,  $p < 0.0001$ ) and 30-day mortality (0.4% v. 1.1% v. 5.3%,  $p < 0.0001$ ) were significantly more common among older patients. As a consequence, the time required to resume a normal diet and to discharge from hospital were both significantly prolonged among older patients. On multivariate analysis, age greater than 70 years was the single most important factor associated with the occurrence of a postoperative complication (group 3 v. group 1, OR 2.3, 95% CI 1.4–3.7,  $p = 0.0005$ ). Cardiac and pulmonary comorbidities, as well as the type of colorectal resection, were also significantly associated with postoperative complications.

Compared with younger patients undergoing laparoscopic colectomy, those aged greater than 70 years had a greater risk of morbidity and mortality, as well as an increased length of stay in hospital. Patients enrolled in clinical pathways and fast-track protocols may have to be stratified on the basis of age to account for these findings.

#### 118

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

The treatment of rectal cancer is complex and associated with higher rates of local recurrence and functional disturbances compared with colon cancer. It is unknown how much variability exists in the delivery of rectal cancer care. The purpose of this study was to examine the self-reported practice patterns of general surgeons who treat patients with rectal cancer. A questionnaire was mailed to all practicing general surgeons in the 4 Atlantic provinces. Data were collected regarding clinical practice patterns and knowledge of rectal cancer care.

Questionnaires were mailed to 172 general surgeons, and 92 were returned (53.5%). Of surgeons who responded, 63% reported that they treated patients with rectal cancer. With regards to the preoperative care of rectal cancer patients, over 90% of respondents indicated they would routinely obtain preoperative imaging of the chest, abdomen and pelvis and perform a colonoscopy, in keeping with current guidelines. However, 30% of surgeons indicated that routine postoperative CT imaging of the abdomen and pelvis was not indicated after potentially curative treatment of stage-II and -III rectal cancer, and 21% of surgeons indicated that they would perform annual colonoscopy for 5 years after surgery. There was disagreement among respondents regarding the number of lymph nodes required for adequate pathological staging, with responses ranging from 4 to 25 (median of 12). Given a scenario with a 55-year-old otherwise healthy woman with a T2N0 rectal cancer (by endorectal ultra-

sound) palpable at the fingertip, the majority of surgeons indicated that they would perform a radical resection. However, 16.5% of surgeons reported that they would perform a transanal excision.

There is variation in the self-reported delivery of rectal cancer care in Atlantic Canada. Many responses were not in keeping with current practice guidelines. This may have important implications for rectal cancer outcomes in this region of Canada.

#### 119

**Extent of resection for curable colorectal cancer in young patients: a 27-year experience at a tertiary care centre.**  
*E. Al-Sukhni, P.F. Ridgway, B. O'Connor, R.S. McLeod, C.J. Swallow. From the Mount Sinai Hospital, University of Toronto, Toronto, Ont.*

Patients diagnosed with colorectal cancer (CRC) under the age of 50 have an increased lifetime risk of developing metachronous primary tumours. Some familial GI cancer experts have recommended that younger patients with curable CRC undergo definitive subtotal colectomy at initial presentation. We sought to determine compliance with these recommendations at our institution, the factors predictive of subtotal/total colectomy and the influence of resection extent on survival.

A case-control study used a prospective CRC database at Mount Sinai Hospital, Toronto. All patients under 50 who underwent initial resection of CRC with curative intent from 1979 to 2007 were included. Patients 50 years or over were identified as controls. Type of resection was classified as complete (total/subtotal colectomy, proctocolectomy) or segmental.

From the database of over 1400 CRC cases, 201 patients were under age 50. One thousand one hundred eighty-two controls were identified. The young patients had significantly higher rates of identifiable risk factors for CRC (IBD, FAP/HNPCC, family history of cancer) and were significantly more likely to undergo complete resection (23.38% v. 6.01%, OR 4.78). Interestingly, rectum was the primary site in 54.73% of young patients. Factors contributing to complete resection were site of disease (colon), inflammatory bowel disease and family history of CRC. Four patients (2.6%) who underwent segmental resection developed metachronous disease at a median of 51.69 months postresection. No significant change in practice was noted over time.

The majority of young patients with curable CRC underwent segmental resection only. Factors predictive of a complete

**Table, abstract 119. Extent of resection for curable colorectal cancer in young patients according to risk factor**

Risk factor	Complete resection, proportion (%)
All	47/201 (23.38)
Inflammatory bowel disease	25/32 (78.13)*
FAP/HNPCC	7/17 (41.18)
Family history of cancer	21/89 (23.60)
Family history of colorectal cancer	17/47 (36.17)*
Tumour site, colon	33/69 (47.83)*
Female sex	17/92 (18.48)
Emergency surgery	2/7 (28.57)
Second primary	5/7 (71.43)

FAP/HNPCC = familial adenomatous polyposis/hereditary nonpolyposis colorectal cancer.  
\*Statistically significant.

resection included inflammatory bowel disease, family history of CRC and colonic primary site. Overall survival was not influenced by extent of resection. The authors support this pragmatic approach while more sophisticated estimates of tumour biology are being developed to guide the decision for more extensive prophylactic resection.

## 120

**Long-term outcomes in young adult survivors of colorectal cancer (CRC): a population-based study.** *S.S. Forbes, D.R. Urbach, R. Sutradhar, L. Paszat, L. Rabeneck, N.N. Baxter.* From the Department of Surgery, University of Toronto, Toronto, Ont.

The incidence of CRC in young adults is increasing while survival is improving. There is limited information, however, on long-term outcomes in this population. This study was designed to evaluate long-term outcomes including survival and development of acute illnesses in CRC survivors.

A population-based cohort study was conducted using cancer registry and administrative data. Persons aged 20–44 years who received a diagnosis of CRC from 1992 to 1999 and survived at least 5 years were identified using the Ontario Cancer Registry. Survivors were matched 1:5 to randomly selected controls (who were cancer-free at the corresponding date of diagnosis) using the Registered Persons Database of Ontario based on age, sex and geographic location (Local Health Integration Network). Outcomes including death and admission to hospital for acute illness (determined by record linkage to the Canadian Institute of Health Information Discharge Abstract Database) were compared between survivors and controls using Cox and negative binomial regression, respectively.

In all, 917 survivors and 4585 controls were identified. Median follow-up (after achieving 5-year survivor status) was 6.2 years; 9.5% (87) CRC survivors died compared with 1.2% (56) controls ( $p < 0.0001$ ). Eighty-two percent of deaths in the survivor population were attributed to malignant disease. Survivors were significantly more likely to die over time than controls (HR 8.2, 95% CI 5.8–11.6,  $p < 0.0001$ ). Survivors were also 3.4 times more likely to require any admission to hospital for acute illness than controls (95% CI 2.9–4.1,  $p < 0.0001$ ). After correction for multiple comparisons, survivors were more likely to be admitted for gastrointestinal disorders (OR 4.4, 95% CI 3.4–5.6,  $p < 0.0001$ ), trauma/injury (OR 2.1, 95% CI 1.5–3.0,  $p < 0.0001$ ) and neoplasms (OR 3.9, 95% CI 2.9–5.0,  $p < 0.0001$ ) than controls.

Five-year survivors of CRC remain at a higher risk of long-term death and illness than controls. Aggressive surveillance for malignant disease beyond 5 years after diagnosis is necessary to mitigate risk of death.

## 121

**Outcomes of anal fistula surgery in patients with inflammatory bowel disease.** *W. Chung, D. Ko, C. Sun, C.J. Brown, M. Raval, P.T. Phang.* From the Division of General Surgery, St. Paul's Hospital, University of British Columbia, Vancouver, BC.

A retrospective cohort study of patients with inflammatory bowel disease treated for high trans-sphincteric anal fistulas was performed. Our primary outcome was full healing at 12 weeks post-

operatively in patients treated with the anal fistula plug, fibrin glue, advancement flap closure or seton drain insertion.

Between 1997 and 2008, 57 patients with anal fistulas and inflammatory bowel disease as a comorbidity were identified in the St. Paul's Hospital Anal Fistula Database. Postoperative healing rates at 12 weeks follow-up for the fistula plug, fibrin glue, flap advancement and seton drain groups were 80%, 0%, 20% and 24.4%, respectively.

Closure of the primary fistula opening in patients with inflammatory bowel disease using a biologic anal fistula plug yields superior healing rates when compared with fibrin glue, seton drain and flap advancement. Given the low morbidity and relative simplicity of the procedure, the anal fistula plug is a viable alternative treatment for high trans-sphincteric anal fistulas in patients with inflammatory bowel disease.

## 122

**A population-based study of trends and outcomes in patients with rectal cancer treated with abdominoperineal resection in British Columbia between 2000 and 2006.** *J.S. Pao, R. Woods, M.J. Raval, P.T. Phang, C.J. Brown.* From the Department of Surgery, St. Paul's Hospital, BC Cancer Agency, Vancouver, BC.

Our objective was to assess the utilization and outcomes of abdominoperineal resection (APR) in patients with rectal cancer in the province of British Columbia (BC) over the past 7 years.

This is a population-based study of all patients referred to the BC Cancer Agency and maintained in the Colorectal Cancer Outcomes Unit (CRCOU) database. All patients with rectal cancer who were treated by APR between 2000 and 2006 were identified. Demographics, operative details, pathologic variables and site of surgery were assessed. Temporal trends, institutional variability and oncologic outcomes were analyzed.

There were 624 patients with rectal cancer treated with APR in BC from 2000 to 2006. The proportion of all patients with rectal cancer treated with APR decreased during the study period (46.6% v. 35.2%,  $p = 0.0031$ ). The majority of patients were treated with adjuvant radiotherapy (90.1%, 517/574), usually administered preoperatively (79.9%, 413/517). Mid or high rectal cancers accounted for 35.3% of APRs performed. Most patients had complete resection of tumour (83.6%, 480/574). However, there was a high rate of positive circumferential margins (18.8%, 96/511). The 5-year overall survivals for stage I, II and III rectal carcinoma were 85.9, 67.0 and 51.4%, respectively. The median number of APRs performed in different institutions in BC was 13 (interquartile range 3–24).

Between 2000 and 2006, the overall proportion of patients with rectal cancer treated with APR has decreased. However, there is a considerable geographic variability in the proportion of patients treated with sphincter-sparing techniques. Furthermore, there is a high rate of positive circumferential margins in patients treated with APR. Strategies to improve surgical technique and knowledge translation are needed to improve surgical outcomes in patients with very low rectal cancers in BC.

## 123

**Follow-up of colon cancer patients post-curative resection: a review of current practices and introduction of a quality improvement initiative.** *A Power, V. Francescutti,*

**D. Ramsey, S. Kelly, W. Stephen. From the Department of Surgery, McMaster University, Hamilton, Ont.**

Our primary aim was to determine how well patients with curatively resected colorectal cancer (CRC) were followed-up according to guidelines. Our secondary aim was to propose a quality-improvement initiative to assist in the follow-up (F/U) of CRC patients. A retrospective review was completed of patients with curatively resected CRC (stages I–III) by 2 specialist colorectal surgeons from January 2004 to December 2005. Regional guidelines (Cancer Care Ontario) and individual surgeon F/U guidelines were used to determine if F/U targets were met. Carcinoembryonic antigen (CEA) levels, imaging and colonoscopies were reviewed in all patients. A total of 106 patients were studied, with a median F/U time of 42.3 months. According to regional guidelines, F/U targets were met for 59.4% of CEA levels, 86.8% of imaging and 87.9% of colonoscopies ( $p < 0.0001$ ). According to individual surgeon guidelines, F/U targets for surgeon 1 were met for 84.1% of imaging and 83.7% of colonoscopies ( $p < 0.0001$ ). Surgeon 1 did not routinely measure CEA levels. Follow-up targets for surgeon 2 were met for 70.1% of CEA levels, 77.1% of imaging and 91.4% of colonoscopies ( $p < 0.0001$ ). Overall, only 22 of 106 (20.7%) patients and 26 of 106 (24.5%) patients had all of their targets met according to regional and individual surgeon guidelines, respectively. In conclusion, a substantial number of patients with CRC did not have all of their F/U targets met according to guidelines, with CEA levels being the variable least adhered to. We believe a better system for following curatively resected CRC patients needs to be implemented at our centre. We propose the creation and implementation of a novel computer software program to help improve the quality of current F/U processes.

#### 124

**Final results of the cluster-randomized Quality Initiative in Rectal Cancer (QIRC) trial: evaluating a knowledge translation strategy in surgery. M. Simunovic, A. Coates, C.H. Goldsmith, L. Thabane, D. Reeson, A.J. Smith, R.S. McLeod, F. DeNardi, T.J. Whelan, M.N. Levine. From the Department of Surgery, Clinical Epidemiology and Biostatistics, Hamilton Health Sciences, McMaster University, Hamilton, Ont.**

Two unfortunate outcomes for patients following rectal cancer surgery are placement of a permanent colostomy and local tumour recurrence. We tested if the QIRC knowledge-translation strategy could improve these outcomes by optimizing surgical techniques.

The trial took place at 16 hospitals in Ontario, Canada. Patients with primary rectal cancer underwent major surgery from May 2002 to December 2004. Hospitals and their surgeons were cluster-randomized to the QIRC strategy or the normal environment. Strategy interventions included workshops, opinion leaders, operative demonstrations, postoperative questionnaires, audit and feedback. For the demonstrations, a participating surgeon invited an operative demonstrator to assist with a case of rectal cancer surgery. Primary outcomes were hospital rates of permanent colostomy at 12 months and hospital rates of local tumour recurrence at a minimum follow-up of 30 months.

The trial involved 105 surgeons. There were 558 experimental- and 457 control-arm patients. The median patient follow-up was 3.6 years. In the experimental arm, 39 of 56 surgeons (70%) participated in an intraoperative demonstration, and these surgeons treated 86% of experimental-arm patients. For experimental and control arms, respectively, rates of permanent colostomy were 39% and 41% ( $p = 0.88$ ), whereas rates of local tumour recurrence were 6% and 6% ( $p = 0.88$ ). Using multivariable models, outcomes between the experimental and control arms were not statistically different.

Despite high rates of participation by surgeons, the resource-intensive QIRC strategy did not improve hospital rates of permanent colostomy and local recurrence. More effective methods of surgical quality improvement are needed.

Trial registration ISRCTN 78363167. Trial funding from the Canadian Institutes of Health Information (MCT-50013).

#### 125

**Effect of insulin-like growth factor (IGF-1) administration on colonic anastomosis in a hypoxic rat model. K.A. Al-Khayal, W.D. Buie, L. Wallace, D. Sigalef. From the Department of Surgery, University of Calgary, Calgary, Alta.**

The aim of this study was to investigate the effect of insulin-like growth factor (IGF-1) on colonic healing under hypoxic conditions in an experimental laboratory setting. Thirty-two juvenile male Sprague–Dawley rats underwent laparotomy with colonic transection and anastomosis. Rats were divided into 4 groups with 8 rats in each group. Normoxic control group rats (NC) were placed in a normoxic environment (FiO<sub>2</sub> 21%) and were given intraperitoneal saline injections, 2 mg/kg at days 0, 2, 4 and 6. Hypoxic control group rats (HC) were placed in a hypoxic environment (FiO<sub>2</sub> 11%) and were given intraperitoneal saline injection at same dose and days interval as the NC group. Normoxic treatment rats (NT) were placed in a normoxic environment and were given intraperitoneal IGF-1 injection at a dose of 2 mg/kg at days 0, 2, 4 and 6. Hypoxic treatment rats (HT) were placed at a hypoxic environment and were given IGF-1 treatment at same days and dose as the NT group. Animals received identical nutrient input. All rats were sacrificed on day 7; end points were the gross morphology of the intestine, weight, bursting pressure and analysis of the anastomotic tissue for histology and cytokine content.

IGF-1 treatment resulted in a significant increase in overall intestinal weight and length, increase weight in normoxic group and a significant decrease in the rate of weight loss in the hypoxic group. Anastomotic bursting pressure, collagen I expression, MMP-13, tissue IGF-1 and vascular endothelial growth factor (VEGF) mRNA expression were increased in the IGF-1 treated group. No significant changes occurred to the inflammatory mediators IL-1B, IL-4, IL-12 and INF- $\gamma$ . A decrease in the inhibitory cytokines IL-10 and TNF- $\alpha$  were noted (by assessment of protein using enzyme-linked immunosorbent assay). All comparisons were  $p < 0.05$  by Student  $t$  test.

When given intraperitoneally, IGF-1 stimulates the healing of colonic anastomosis under hypoxic settings. There is an associated increase in factors promoting neoangiogenesis, collagen deposition and the paracrine expression of IGF-1 in the wound site. Further studies are suggested to determine if these findings can be replicated in human patients.

126

**The use of a tailored knowledge-translation strategy to change bowel preparation practices. C. Eskicioglu, A. Gagliardi, D.S. Fenech, C. Victor, R.S. McLeod. From the Division of General Surgery, University of Toronto, Toronto, Ont.**

Mechanical bowel preparation (MBP) before elective colorectal surgery has been the standard in surgical practice. There is strong level-I evidence that in most patients, MBP is not required.

Despite this, physician behaviour has been slow to change. Thus, the purpose of this study was to determine if a knowledge-translation strategy could change the preoperative management of patients undergoing elective colorectal surgery with regard to MBP. The knowledge-translation strategy included guideline development, consensus, education by opinion leaders, audit and feedback and reminder cards. This before–after study was conducted at 6 adult teaching hospitals, and the primary outcome was compliance to the recommendations presented in the guideline

regarding MBP, normal diet on the day prior to surgery and enemas. Two hundred eighty-two patients were enrolled in the study, with 111 enrolled before the intervention and 171 enrolled after the intervention. Demographic and clinical characteristics between the 2 groups were similar. Overall, 81.1% of patients in the “before” arm and 88.4% in the “after” arm received MBP in compliance with the guideline ( $p = 0.038$ ). This included an increased use of MBP in patients having LAR (23.1% “before” v. 56.0% “after”) and a decreased use of MBP in patients having all other open procedures (35.3% “before” v. 25.3% “after”). Furthermore, normal diet was encouraged in concordance with the guideline in 45.6% of the patients in the “before” arm and 55.8% in the “after” arm ( $p = 0.080$ ). The use of enemas was compliant with the guideline in 88.5% of “before” patients and 94.2% of “after” patients ( $p < 0.001$ ). The results of this study reveal that a tailored, multi-faceted knowledge-translation strategy can be used to change surgeon behaviour in this clinical scenario. Future research to identify barriers for compliance may be beneficial to further increase long-term adherence to this evidence-based guideline.

**2009 PARTNERS**

---

The Canadian Surgery Forum Steering Committee acknowledges and thanks the following organizations (confirmed to date) for their support of the 2009 Forum:

**PLATINUM PARTNER**

ETHICON and ETHICON ENDO-SURGERY, units of Johnson & Johnson Medical Products, a division of Johnson and Johnson Inc.

**GOLD PARTNERS**

Covidien  
Olympus Canada Inc.  
Sanofi-Aventis  
Stryker Canada

**PARTENAIRES EN 2009**

---

Le Comité de direction du Forum canadien de chirurgie remercie les organisations ci-dessous (confirmé jusqu'ici) de leur appui au Forum 2009:

**PARTENAIRE DE GROUPE PLATINE**

ETHICON et ETHICON ENDO-SURGERY, unités de Johnson & Johnson Medical Products, division de Johnson and Johnson Inc.

**PARTENAIRES DU GROUPE OR**

Covidien  
Olympus Canada Inc.  
Sanofi-Aventis  
Stryker Canada