

## **Canadian Surgery Forum**

**Abstracts of presentations to the  
Annual Meetings of the**

**Canadian Association  
of Bariatric Physicians  
and Surgeons**

**Canadian Association  
of General Surgeons**

**Canadian Association  
of Thoracic Surgeons**

**Canadian Hepato-Pancreato-  
Biliary Association**

**Canadian Society of  
Surgical Oncology**

**Canadian Society  
of Colon and  
Rectal Surgeons**

**Vancouver, BC  
Sept. 17–21, 2013**

## **Forum canadien de chirurgie**

**Résumés des communications  
présentées aux congrès annuels de**

**l'Association canadienne  
des médecins et chirurgiens  
bariatriques**

**Association canadienne  
des chirurgiens généraux**

**l'Association canadienne  
des chirurgiens thoraciques**

**Canadian Hepato-Pancreato-  
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**la Société canadienne  
d'oncologie chirurgicale**

**la Société canadienne des  
chirurgiens du côlon  
et du rectum**

**Vancouver (C-B)  
du 17 au 21 sept., 2013**

# Canadian Association of Bariatric Physicians and Surgeons

## Association canadienne des médecins et chirurgiens bariatriques

**1**  
**(CJS Editors' Choice Award) Weight loss and obesity-related outcomes of gastric bypass, sleeve gastrectomy and gastric banding in patients enrolled in a population-based bariatric program: prospective cohort study.** *R.S. Gill, S. Apte, S. Majumdar, C. Agborsangaya, C. Rueda-Clausen, D. Birch, S. Karmali, S. Klarenbach, A. Sharma, R.S. Padwal.* From the University of Alberta, Edmonton, Alta.

Bariatric care is increasingly being delivered in Canada within publicly funded regional programs. The optimal bariatric surgical procedure for severely obese individuals receiving bariatric care is currently unknown. The objective of this population-based prospective cohort study was to compare the effectiveness of laparoscopic Roux-en-Y gastric bypass (LRYGB), laparoscopic sleeve gastrectomy (LSG), and laparoscopic adjustable gastric banding (LAGB) in severely obese patients.

A total of 150 consecutive patients (51 LRYGB; 51 LSG; 48 LAGB) from the population-representative, publicly funded Weight Wise bariatric program were examined. The primary outcome was weight change (kg). Between-group changes were analyzed using multivariable regression adjusted for age, sex, and baseline weight. Last-observation-carried-forward imputation was used for missing data.

At baseline, mean age was  $43.5 \pm 9.5$  years, 87.3% were females and overall preoperative BMI was  $46.2 \pm 7.4$  kg/m<sup>2</sup>. Absolute (kg) and relative (% of baseline) mean weight losses were  $36.6 \pm 19.5$  kg (26.1%  $\pm$  12.2%) for LRYGB,  $21.4 \pm 16.0$  kg (16.4%  $\pm$  11.6%) in for LSG, and  $7.0 \pm 9.7$  kg (5.8%  $\pm$  7.9%) for LAGB ( $p < 0.0001$  for between-group comparisons) at 2 years. Change in BMI was significantly greater in the LRYGB ( $-13.0 \pm 6.6$  kg/m<sup>2</sup>) group compared with both the LSG ( $-7.6 \pm 5.7$  kg/m<sup>2</sup>) and the LAGB ( $-2.6 \pm 3.5$  kg/m<sup>2</sup>) groups ( $p < 0.0001$  for between-group comparisons). In addition, change in BMI was significantly greater in the LSG group compared with the LAGB group ( $p < 0.05$ ). Hypertension, diabetes, and dyslipidemia prevalence's decreased to a significantly greater degree with LRYGB compared with LAGB ( $p < 0.05$ ).

In a publicly funded bariatric surgery program providing population-based bariatric care to severely obese individuals, LRYGB and LSG demonstrated greater weight loss than LAGB. LRYGB was more effective than LAGB in improving obesity-related comorbidities.

**2**  
**Early outcomes of a small, rural bariatric surgery program.** *D. Pace, L. Twells, C. Smith, D. Boone, K. Manning, K. Lester, C. Dillon, W. Midozi, R. Murphy, L. Bartlett, D. Gregory.* From Memorial University, St. John's, Nfld.

This retrospective study evaluated the short-term outcomes of our first 162 laparoscopic sleeve gastrectomies.

Between August 2010 and February 2013, 212 patients underwent LSG as a sole bariatric operation. A retrospective review of a prospectively collected database was performed. Postoperative complications and weight loss at 12 months were examined. Quality of life (using IWQOL-lite and EQ-5D) and diabetes resolution were also examined. Data were analyzed using a Student  $t$  test or  $\chi^2$  test where appropriate.

Thus far, data have been collected on 162 patients with average follow-up of 138 days (SD 113). The mean age was 43.9 (SD 9.6) and there were 131 females. Mean initial body weight (kg) and BMI were 134.6 (SD 52.6) and 48.5 (SD 6.8). The majority of these patients 106 (73.2%) had 4 or more comorbidities.

Median length of hospital stay was 2 days. There were no conversions to open surgery.

In terms of complications, there were 3 staple line leaks (1.85%; 1 required early reoperation and the other 2 presented 10 days later with small intra-abdominal collections that resolved with conservative measures), 1 gastric volvulus that required early reoperation, and 2 patients experienced a pulmonary embolus (1.23%). One patient required a blood transfusion in the early postoperative period. There were 2 superficial wound infections (1.23%). Two patients developed postoperative dysphagia (1.85%) requiring endoscopic dilation.

At 12 months, there were 67 patients with a mean body weight (kg) BMI of 93.4 (SD 15.9;  $p < 0.0001$ ) and 34.4 (SD 4.8;  $p < 0.0001$ ). Of the 56 patients with type 2 diabetes, 35 (62.5%) achieved remission within 12 months and this occurred most frequently within 3 months 23 (41.1%). At 12-month follow-up, only 23.5% of this group was taking antidiabetic medication. All 34 pre-diabetics achieved remission within 6 months. In terms of quality of life, the mean EQ-5D VAS score improved from 59.62 to 82.92 ( $p < 0.05$ ) and the mean IWQOL-lite score improved from 44 to 86 ( $p < 0.05$ ).

Laparoscopic sleeve gastrectomy is a safe and effective bariatric procedure. Resolution of comorbidity and improvement in quality of life in our small, rural program is comparable with that reported in the literature.

**3**  
**Is early discharge of patients post-laparoscopic Roux-en-Y gastric bypass safe?** *A. Bazzarelli, R. Wu, F. Haggart, A. Neville, J. Yelle, I. Raiche, J. Mamazza.* From the Ottawa Hospital, Ottawa, Ont.

Bariatric surgery cases have risen significantly in order to combat the obesity epidemic. The timing and related safety of early discharge after laparoscopic Roux-en-Y gastric bypass (LRYGB) is

still debated, and the safety of early discharge (< 24 h) after surgery remains unclear. The objective of this study was to examine the impact of early discharge on surgery related readmission following LRYGB.

A retrospective review of patients undergoing LRYGB from September 2009 to March 2011 at the Ottawa Hospital was performed. Discharge readiness was determined by adequate PO analgesia, tolerating fluids, voiding well, ambulating without assistance and absence of tachycardia. Fisher exact tests or  $\chi^2$  tests were used for categorical variables and student *t* tests for continuous variables to compare differences between patients discharged on postoperative day (POD) 1 (< 24 h) and those discharged on POD 2 or 3.

A total of 638 patients were included. Thirty-four patients were discharged on POD 1 (early DC) and 604 patients were discharged on POD 2 or 3 (standard DC). The 30-day readmission rates were not different between early DC and standard DC ( $p = 1.0$ ). There were 2 readmissions in the early DC group (5.88%) as compared with 47 readmissions in the standard DC group (7.78%). The 2 groups (early DC v. standard DC) were comparable in terms of mean age (44.38 v. 45.72 yr,  $p = 0.49$ ), sex (77% female v. 82%,  $p = 0.36$ ), mean BMI (48.21 v. 59.44,  $p = 0.28$ ), perioperative risks as indicated by the American Society of Anesthesiologists (ASA) score (71% v. 79% ASA 3,  $p = 0.05$ ), and total number of concurrent intraoperative procedures (11.8% v. 10.6%,  $p = 0.83$ ).

Early discharge from hospital within 24 hours after LRYGB appears to be safe and does not adversely affect readmission. Fast tracking patients following surgery may result in significant hospital cost savings and a reduction waiting lists.

#### 4

**Defining the learning curve: early experience of laparoscopic Roux-en-Y gastric bypass from a bariatric centre of excellence. A. Smith, F. Saleh, A. Elnahas, T. Jackson, F. Quereshy, T. Penner, D. Urbach, A. Okrainec. From the Department of Surgery, University Health Network, University of Toronto, Toronto, Ont.**

Obesity is a leading public health challenge. The laparoscopic Roux-en-Y gastric bypass (LRYGB) has emerged as an effective and durable treatment option. Previous studies indicate that the learning curve associated with this advanced laparoscopic procedure is within the range of 100 cases per surgeon. The aim of the current study is to describe the learning curve of LRYGB at a Bariatric Centre of Excellence by examining operative time and outcomes of 3 non-bariatric fellowship-trained advanced laparoscopic surgeons.

This retrospective cohort study employed a hospital-generated database that captured elective bariatric procedures. Outcomes of interest included operative time and unexpected return to the operating room.

From Nov. 16, 2009 to Aug. 30, 2013, 734 elective LRYGB were performed. Mean operative time for the 3 surgeons decreased by over 15 minutes as experience with LRYGB increased beyond 100 cases (146 v. 130.9 min;  $p < 0.001$ ). Unexpected return to the operating room decreased following the initial 100 cases; however, this did not reach significance (4% unexpected return v. 2.08%;  $p = 0.13$ ). To further describe the institutional learning curve, the first 150 cases performed at our centre were analyzed and compared with the subsequent 584 cases performed. As an institution, the mean operative time

decreased by over 20 minutes as experience with LRYGB increased (153.9 v. 133.3 min;  $p < 0.001$ ). Similarly, unexpected return to the operating room decreased following the first 150 cases (5.3% unexpected return v. 2.6%;  $p = 0.08$ ).

Laparoscopic Roux-en-Y gastric bypass is a technically demanding procedure with an appreciable learning curve. Results from this single-centre retrospective cohort study demonstrate that as experience with this advanced laparoscopic procedure increases, operative time among surgeons decreases. Unexpected return to the operating room, on the other hand, does not appear to be affected by experience. Additional studies encompassing more specific short-term outcomes are required to fully elucidate this learning curve.

#### 5

**Bariatric surgery in patients with renal disease: Is it safe and is there an optimal approach? F. Saleh. From the University of Toronto, Toronto, Ont.**

Obesity rates among patients with chronic kidney disease (CKD) and end-stage renal disease (ESRD) mirror that of the general population. With growing interest to offer bariatric surgery to these patients, concerns remain regarding safety.

The American College of Surgeons National Surgery Quality Improvement Program was used to collect on selected laparoscopic bariatric procedures between 2005 and 2011. Estimated glomerular filtration rate (GFR) was calculated for each patient and grouped according to their respective stages of CKD. Univariate and multivariate analyses were used to compare complication rates across stages of GFR for the Roux-en-Y gastric bypass (RYGB), laparoscopic adjustable gastric band (LAGB), and longitudinal sleeve gastrectomy (LSG) separately. In addition, the different procedures were compared with each other for ESRD.

A total of 64 589 patients received bariatric surgery: RYGB was the most common (64.5%), followed by the LAGB (29.8%) and LSG (5.7%). Normal GFRs (stage 1) were the majority comprising 61.7% of patients, followed by stage 2 with 32.0%, stage 3 with 5.3%, and stage 4 and 5 with 1.0%. After adjusting for important patient characteristics, overall complications increased from stage 1 to stage 4/5 CKD for each of RYGB, LAGB, and LSG but none of the relationships were statistically significant ( $p > 0.05$ ). Similarly, major complications generally increased across stages of CKD for each procedure but was only significant for RYGB comparing stage 3 to stage 1, with an odds ratio 1.22 (95% CI 1.01–1.47;  $p = 0.042$ ) and risk difference 0.96% (95% CI 0.03–1.96). Considering just stage 4/5 CKD, both overall ( $p = 0.114$ ) and major complications ( $p = 0.032$ ) were highest in the RYGB group, followed by LSG and LAGB.

Increasing stages of CKD in this study was not statistically associated with increased 30-day postoperative complications. Further research is needed to identify which patients with CKD will benefit from bariatric surgery.

#### 6

**A comparison of weight loss and follow-up interventions required for sleeve gastrectomy and gastric bypass at a single centre: Is there an optimal procedure for Canada? A. Munshi, T. Alford, C. Sheppard, S. Karmali, C. de Gara, D. Birch. From the University of Alberta, Edmonton, Alta.**

Laparoscopic gastric bypass (LRYGB) is accepted by many as the gold standard surgical treatment for severe obesity. Experience with the laparoscopic sleeve gastrectomy (LSG), initially used as a bridge to a LRYGB in the super obese, suggests it may be used as a definitive procedure with comparable weight loss to LRYGB. In this study, we will compare outcomes of LRYGB and LSG in Alberta with specific attention to the burden of follow-up and costs of investigations required in the medium term.

A retrospective chart review was completed for patients undergoing LRYGB or LSG at a single centre from January 2008 to December 2012, by 3 surgeons with similar operative techniques. We excluded patients who had revisional bariatric surgery, patients from out of province, and those who underwent a planned staged LSG. Data collected included patient demographics, weight loss, pre- and postoperative obesity related comorbidities, early and late complications and investigations required.

We collected data on 255 patients who underwent LSG and 235 patients who underwent LRYGB. Patient age, preoperative BMI, and comorbidities of diabetes, hypertension, hyperlipidemia, and gastroesophageal reflux disease were not significantly different between the 2 groups. Mean follow up time was 12 months for LSG and 13 months for LRYGB. Weight loss was significantly different between the 2 groups ( $p < 0.001$ ); mean BMI after LSG fell from 49.1 kg/m<sup>2</sup> to 35.7 kg/m<sup>2</sup>, and after LRYGB from 49.9 kg/m<sup>2</sup> to 32.2 kg/m<sup>2</sup>. Resolution of comorbidities seen after LSG and LRYGB, respectively, showed 39.4% and 64.1% for diabetes, 30.1% and 45.2% for hypertension, 29.9% and 42.6% for hyperlipidemia, 21.6% and 23.6% for reflux disease. Differences between these 2 groups were significant for LRYGB-induced diabetes ( $p < 0.01$ ) and hypertension ( $p < 0.05$ ) remission. Complications rates for LSG include: 1.2% postoperative bleeding, no leaks, strictures, or thromboembolic events; for LRYGB there were 5.1% postoperative bleeds, leak 0.9%, early bowel obstruction 2.1%, thromboembolic events 1.3% and wound infection 14.9%. Late complications from LRYGB include marginal ulcers 8.8%, strictures 6.9% and internal hernias 1.4%. Patient complaints leading to follow up by the surgical team were significantly more frequent for LRYGB (upper endoscopy, contrast studies, CT scans, operative intervention). The cost of these complications and their diagnostic procedures/imaging resulted in a mean cost per patient for LSG of \$190, versus \$1077 for LRYGB.

Laparoscopic gastric bypass leads to greater weight loss in the medium term in comparison to LSG and increased likelihood of remission of type 2 diabetes. However, there is a greater burden of care for LRYGB in follow-up leading to more frequent interventions and greater costs. In a province with limited resources and a significant burden of disease, LSG may be the most appropriate treatment option for severe obesity, balancing clinical effectiveness and cost efficiency. Further study is necessary to examine the long-term implications and costs of these procedures in order to optimize the surgical management of severe obesity.

## 7

**Laparoscopic adjustable gastric band complication and revision rates in a publicly funded obesity program. C. Sheppard, K. Whitlock, C. de Gara, S. Karmali, D. Birch. From the University of Alberta, Edmonton, Alta.**

The rates of obesity and associated comorbidities are increasing globally. Surgical techniques have been used to address the diffi-

culties of conventional weight loss strategies. One of 3 generally used techniques is the laparoscopic adjustable gastric band (LAGB), which is a restrictive-type procedure. Unfortunately there is a high rate of failure (approximately 40%) and postoperative complications associated with this procedure. The objective of this study was to determine the complication and revision rate for LAGB patients at a publicly funded Canadian urban centre.

A retrospective chart review of LAGB patients in a publicly funded obesity program was performed from 2009 to 2013. A total of 122 LAGB patients were reviewed. Patients were an average age of 46.2 ± 12.1 years, had a preop BMI of 40.9 ± 5.2 kg/m<sup>2</sup>, and their comorbidities were 26% diabetes, 47% hypertension, 26% hyperlipidemia, and 19% reflux. Wound infection (1.7%) was the only immediate complication observed. Late complications consisted of band slip (5.7%), band erosion (0.8%), incisional hernia (2.5%), port site complication (4.1%), dysphagia (10.7%), and weight regain (9.9%). The band removal rate was 15.6% after an average of 32.4 ± 22.8 months, with a subsequent 7.4% undergoing another bariatric surgery after 39.6 ± 25.2 months. Of 51 band removals performed, 63% were medical tourists. The average lowest achievable postop BMI was 37.0 ± 4.8 kg/m<sup>2</sup> with a follow-up time of 12.0 ± 9.6 months. Comorbidity resolution was 11% for diabetics, 16% for hypertension, 19% for hyperlipidemia, and 20% for reflux. The average total cost of postop LAGB complications and care was \$2748 ± \$370.

The complications from LAGB resulted in a significant number of band removals and revision surgeries. Compared with other bariatric procedures, LAGB has significantly higher interventional costs with less weight loss and comorbidity resolution.

## 8

**The Covidien TriStaple system versus the duet tissue buttress in laparoscopic sleeve gastrectomy: a comparative study. M. Dykstra, N. Switzer, C. Sheppard, K. Whitlock R. Gill, X. Shi, S. Karmali. From the University of Alberta, Edmonton, Alta.**

The laparoscopic sleeve gastrectomy (LSG) is growing increasingly popular as a first line bariatric procedure due to its ability to both restrict oral intake and modulate gut hormone regulation. The most significant challenge for surgeons associated with LSG is postoperative hemorrhage and gastric staple line leakage. To mitigate the risk of these complications, bariatric surgeons have promoted numerous preventative techniques. These techniques include over-sewing the staple line, adding buttress material and, most recently, adding additional staple lines.

Our objective was to assess and compare 2 of these techniques: staple line reinforcement via the Duet tissue buttress reinforcement stapler system and the Covidien TriStaple design. We performed a qualitative institutional review of complications in postoperative LSG patients.

We performed a retrospective review of 213 consecutive patients that underwent LSG at a single institution between January 2008 and October 2012. There were 97 operations completed with Duet staple line buttress reinforcement, and 116 operations that used the Covidien TriStaple system. Our primary outcomes were staple line bleed or leakage. Secondary outcomes included wound infection, hematoma, cardiopulmonary complications, and operative time.

Both patient cohorts had similar baseline demographics. The mean patient age was 44.4 ± 9.2 years and 44.3 ± 9.5 years ( $p = 0.938$ ), and

preoperative BMI was  $44.9 \pm 9.3$  and  $44.3 \pm 6.9$  kg/m<sup>2</sup> ( $p = 0.78$ ) for the TriStaple and buttress group respectively. Our primary outcome of gastric leak was not met in either group, and the rate of gastric bleeding was not significantly different between the TriStaple and buttress group (0 v. 1;  $p = 1.00$ ). We found no significant difference between the TriStaple and buttress groups in regards to wound infection (1 v. 4;  $p = 0.379$ ), hematoma (1 v. 0;  $p = 0.455$ ), or cardiopulmonary complications (0 v. 1;  $p = 1.00$ ). Interestingly, we found that the OR time was significantly shorter in the TriStaple group ( $80 \pm 22$  min) than in the buttress group ( $96 \pm 25$  min) ( $p < 0.001$ ).

Both the TriStaple and the Duet Tissue Buttress system are safe and efficacious options for managing the staple line in a laparoscopic sleeve gastrectomy, as both show low rates of postoperative complication. We found no significant differences in gastric bleeds or leaks between the 2 systems. Due to the low incidence of these complications, further studies with larger patient populations and randomization are needed to detect differences between the 2 systems.

### 9 Three-year outcomes for bariatric surgery in a regionalized surgical care system: the Ontario experience. A. Doumouras, F. Saleh, D. Hong. From McMaster University, Hamilton, Ont.

In 2008 and 2009, as part of the diabetes prevention strategy in Ontario, Canada, the Ministry of Health formed the Ontario Bariatric Network (OBN). The OBN introduced the first centre of excellence model for bariatric surgery in Canada, consisting of 7 hospitals within 4 Bariatric Centres of Excellence, and since its inception, there have been no systematic, population-based outcomes reported. Our objective was to evaluate the mortality and major morbidity of bariatric surgery in Ontario during the initial years of the implementation of Canada's first regionalized bariatric care system.

This was a population-based cohort study that included all patients, (age > 18 yr) who received a Roux-en-Y gastric bypass (RYGB) or sleeve gastrectomy (SG) procedure in the province of Ontario from March 2009 until April 2012 for the purposes of weight loss. Data were derived from the Canadian Institute for Health Information Discharge Abstract Database and Hospital Morbidity Database. Current data reflect only initial admission.

Over 3 years, 5009 procedures (90.8% RYGB, 8.1% SG) were performed with an overall complication rate of 5.4% (95% CI 4.7–6.0). Major complications were most common after RYGB

(5.4%; 95% CI 3.3–5.8) followed by SG (4.3%; 95% CI 2.6–6.8) ( $p < 0.05$ ). Mortality rate for all procedures was 0.10% (95% CI 0.03–0.2). Patients' average age (44.6 yr), sex preponderance (female 81.9%) and major comorbidity frequency (diabetes 29.1%, sleep apnea 30.7%, hypertension 27.3%) differed significantly by procedure type in univariate analyses.

The outcomes from the centre of excellence model for bariatric surgery in Ontario are equivalent to other major population-based outcomes in bariatric surgery.

### 10 The epidemiology of readmission after bariatric surgery in Ontario. F. Saleh, A. Doumouras, D. Hong. From McMaster University, Hamilton, Ont.

In 2009, the Ministry of Health formed the Ontario Bariatric Network (OBN). The OBN introduced the first centre of excellence model for bariatric surgery in Canada, consisting of 7 hospitals within 4 Bariatric Centres of Excellence. To date there have been no systematic, population-based outcomes reported. Our objective was to evaluate the readmission rate, characteristics of readmitted patients, and factors associated with readmission.

We performed a population-based cohort study that included all patients who received a Roux-en-Y gastric bypass (RYGB) or sleeve gastrectomy (SG) procedure in Ontario from March 2009 until April 2012 for the purposes of weight loss. Data were derived from the Canadian Institute for Health Information Discharge Abstract Database and Hospital Morbidity Database. Current data reflect only initial admission.

Over 3 years, 5009 procedures (90.8% RYGB, 8.1% SG) were performed with an overall 30-day readmission rate of 7.7% (7.0%–8.5%), which amounted to 385 readmissions in 336 patients. The most common reasons for readmission were: pain and vomiting (23.4%), infectious complications (18.2%), bleeding complications (10.4%), followed by small bowel obstructions (6.0%). The median length of stay was 3 days (IQR 2–6) with 43.1% staying for 2 or fewer days. Eighty-two patients (35.3% of the readmissions, 1.6% of the total cohort) required reoperation and there were 5 deaths in all.

The readmission rate after bariatric surgery in Ontario is similar to other major population-based bariatric surgery programs. Further research is necessary to identify areas where readmissions can be safely reduced.

# Canadian Society of Colon and Rectal Surgeons

## Société canadienne des chirurgiens du côlon et du rectum

11

**Can recent health service use predict postoperative complications in seniors undergoing colon cancer surgery? H. Alabbas, S. Krotneva, A. Ramjaun, T. Eguale, A. Meguerditchian. From McGill University, Montréal, Que.**

Colon cancer (CC) surgery is associated with high morbidity, particularly in seniors. There is a lack of risk-profiling tool for identifying the most vulnerable patients. The aim of this study was to identify predictors of severe postoperative complications in seniors undergoing CC surgery.

A retrospective cohort of CC patients aged  $\geq 65$  years was provided by the Québec provincial healthcare insurance provider (2000–2006). Thirty-day postoperative severe complications were assessed using Clavien–Dindo classification. A multivariate Cox model was used to evaluate associations between complications and patient characteristics.

A total of 3789 patients were included (median age 76; female 54.3%). Emergency procedures were encountered in 24.2% of cases. Twenty-nine percent of the cohort experienced a grade III, IV, or V complication, 17.3%, 12.6%, and 5%, respectively. The incidence of emergency department postoperative visits and readmissions were 17.8% and 11.3%, respectively. In multivariate analysis, significantly associated variables with complications were male sex (HR 1.28, 95% CI 1.13–1.45), age  $\geq 85$  years (HR 1.25, 95% CI 1.03–1.52),  $\geq 10$  active medications prescribed 6 months preceding surgery (HR 1.24, 95% CI 1.03–1.49), recent care for renal insufficiency or cardiovascular disease (HR 1.43, 95% CI 1.02–1.99; HR 1.25, 95% CI 1.10–1.43), and emergency procedures (HR 1.39, 95% CI 1.22–1.59).

A large number of newly prescribed medications, recent care for renal insufficiency or cardiovascular disease, and emergency procedures were associated with severe postoperative complications. This study demonstrates the potential of developing assessment tools using recent health service use to identify vulnerable seniors at risk of postoperative complications.

12

**Appropriateness of transfusions for colorectal surgery (ATRACS): a multi-institutional assessment of current red blood cell transfusion practices. J. Hallet, I. Pronina, A. Hanif, L. Yohanathan, D. Wallace, J. Callum, Y. Lin, R. McLeod, N. Coburn. From Sunnybrook Health Sciences Centre; The Odette Cancer Centre; Mount Sinai Hospital; and the Division of General Surgery, University of Toronto, Toronto, Ont.**

Perioperative anemia is common, yet detrimental, in colorectal surgery. Anemia treatment with red blood cell transfusions

(RBCT) carries risks of increased morbidity, delayed recovery, and worse oncologic outcomes. We sought to examine the appropriateness and variation in RBCT practice for colorectal surgery.

We conducted a multi-institutional retrospective cohort study at 3 teaching institutions. Fifty patients receiving RBCT (RBCT) and 50 non-transfused (NT) patients undergoing elective colorectal resection were included at each site. RBCT and NT patient characteristics were compared. Primary outcome was proportion of appropriate RBCT (hemoglobin  $\leq 70$  g/L or symptoms/bleeding). Secondary outcomes included transfusion trigger (nadir hemoglobin before transfusion), percentage of single-unit RBCT, completion of preoperative anemia work-up, and use of iron supplementation.

We included 300 patients. RBCT patients were older ( $p = 0.01$ ) than NT ones. They had similar comorbidity profiles, except for preoperative anemia (RBCT 57% v. NT 25%;  $p < 0.01$ ). RBCT patients underwent more extensive and longer surgeries ( $p < 0.01$ ) with higher blood loss ( $p < 0.01$ ), experienced postoperative bleeding more often ( $p < 0.01$ ), and had longer length of stay ( $p < 0.01$ ). A total of 69% of RBCT patients received appropriate transfusions, with significant differences between institutions (82% v. 68% v. 59%;  $p = 0.01$ ) for patients with similar characteristics. Mean transfusion triggers differed between sites (78.3 v. 71.2 v. 64.5 g/L;  $p = 0.01$ ). Single-unit transfusion occurred in 49% of RBCTs. Complete anemia workup occurred in 15.9% of anemic patients, and 23.2% received preoperative iron supplementation, with no difference based on institution or transfusion groups.

We observed a significant gap between recommendations and observed RBCT practice, with institutional variations. Preoperative anemia is rarely assessed or treated. Better identification of patients at risk for transfusion, preoperative anemia management, and restrictive RBCTs use are warranted to minimize RBCT risks for colorectal surgery. We identified areas in need of improvement to target in a tailored blood conservation program.

13

**Catheter fecal management systems can cause life-threatening rectal bleeding: a systematic review. M. Livingston, D. Mainprize, N. Parry, M. Ott. From Western University, London, Ont.**

Catheter fecal management systems are often used to manage inpatients with fecal incontinence, but the safety profile remains unclear. The purpose of this study was to perform a systematic review to identify all reported cases of rectal bleeding associated with the use of these devices.

We performed a structured search of Medline, Embase, and the Cochrane Central Register of Controlled Trials for studies reporting rectal bleeding associated with catheter fecal management systems. There were no limits placed on date or language. Titles and

abstracts of 144 articles and conference proceedings were independently reviewed by 2 investigators. Nine studies met the inclusion criteria and were included in the review. We also hand-searched the reference lists of relevant articles in an attempt to identify additional cases.

We identified 13 reported cases of rectal bleeding associated with the use catheter fecal management systems. Eleven (85%) occurred in an intensive care unit and 2 (15%) in extended care facilities. The majority of patients were receiving anticoagulation or antiplatelet therapy at the time of these events. The duration of catheter use before bleeding ranged from 4 days to approximately 3 weeks. The mean number of bleeding episodes was 1.5 (range 1–4). All patients were investigated initially by endoscopy. Definitive management included endoscopic interventions ( $n = 3$ ), transanal surgical ligation ( $n = 6$ ), angiographic embolization ( $n = 1$ ), and spontaneous resolution following reversal of coagulopathy ( $n = 1$ ). Five patients required transfusions, which ranged from 9 to 23 units of packed red blood cells. There was 1 death due to exsanguination following failed endoscopic management. Catheter fecal management systems can cause life-threatening rectal bleeding. We recommend that these devices be used in hospital settings only, that the duration of treatment be minimized whenever possible, and that coagulopathy, anticoagulation, and antiplatelet therapy be considered absolute contraindications.

#### 14

**Tumour budding predicts recurrence after curative resection for T2N0 colorectal cancer.** *R. Garfinkle, L. Lee, M.-J. Cardin, A. Spatz, N. Morin.* From the Jewish General Hospital, Montréal, Que.

Tumor budding (TB) is defined as the presence of a cluster of up to 4 poorly differentiated cells along the invasive margin. TB may increase the risk of recurrence in colorectal cancer, but its effect in T2N0 colorectal cancer is unknown. Therefore, the objective of this study was to determine the impact of TB on recurrence and disease-free survival (DFS) after curative resection for T2N0 colorectal cancer.

All patients who underwent surgery for stage I (pT2N0) colorectal cancer at a single institution from 2000 to 2010 were reviewed. Patients with hereditary colorectal cancer syndromes, inflammatory bowel disease, positive resection margins, who received neoadjuvant or adjuvant therapy, or who died within 90 days of operation were excluded. TB was independently assessed by 2 blinded pathologists, according to Ueno's criteria. Patients were divided into 2 groups: TB- ( $\leq 9$  budding foci within 1 hpf) and TB+ ( $\geq 10$ ). Cox proportional hazards regression determined the independent effect of TB on DFS.

A total of 85 patients (49 TB- and 36 TB+) were included. Overall recurrence rate was 11% (9 of 85) with a mean follow-up of 46.2 (SD 31.5) months. Interrater reliability for TB assessment was excellent ( $\kappa = 0.85$ ). TB+ patients were more likely to be younger (65.7 [SD 11.4] v. 70.5 [SD 10.6],  $p = 0.047$ ) and have rectal tumours (68% v. 38%,  $p = 0.007$ ), but were otherwise similar to TB- patients. There were more recurrences in TB+ patients than in TB- patients (19% v. 4%,  $p = 0.033$ ). On univariate analysis, there was a trend toward lower DFS in the TB+ group. Multivariate analysis demonstrated that TB+ was independently associated with poor DFS (HR 5.37, 95% CI 1.05–27.54) after adjusting for age, tumour location, and anastomotic leak (a priori confounders).

High TB was independently associated with increased recurrence and lower DFS after T2N0 colorectal cancer resection. TB offers additional prognostic information that may impact treatment strategy.

#### 15

**Different scopes for different folks? A comparison of patient populations and adenoma detection rates for out-patient centre and hospital-based colonoscopies.** *J. Motter, S. Jessula, A. Grunbaum, A. Kezouh, P. Gordon, C. Vasilevsky, N. Morin, J. Faria, G. Ghitulescu, M. Boutros.* From the Jewish General Hospital, Montréal, Que.

In Canada, patients may opt for a private out-patient centre (OP) rather than a hospital-based (HB) colonoscopy. The aim of our study was to compare patient populations and adenoma detection (AD) rates for OP versus HB colonoscopies. To our knowledge, no study has yet compared AD in HB and OP colonoscopies.

From 2009 to 2012, an equal random sample of 4 endoscopists' HB colonoscopies and all of the same 4 endoscopists' OP colonoscopies were reviewed. Demographic variables, symptoms, personal and family history, indications for colonoscopy, quality of preparation, cecal intubation, and AD rates were collected. Due to the imbalance between HB and OP variables, the propensity score of an HB versus OP colonoscopy was estimated using logistic regression with all covariates. Matching between cases of AD to 4 controls by quintile propensity scores was performed and a conditional logistic model was constructed.

A total of 4347 colonoscopies (1162 OP and 3185 HB) were reviewed. Patients who underwent HB compared with OP colonoscopies were older (61.1 v. 59.9,  $p = 0.003$ ) and more likely to be female (58.3% v. 51.9%,  $p = 0.0002$ ). Indications for HB and OP colonoscopies were significantly different: low-risk screening (26.8% v. 96.6%,  $p < 0.001$ ), high-risk screening (43.2% v. 1.6%,  $p < 0.0001$ ) and diagnostic (33.6% v. 1.7%,  $p < 0.0001$ ). Hospital-based compared with OP colonoscopies had significantly less adequate preparation (94.7% v. 98.3%,  $p < 0.0001$ ) and cecal intubation rates (95.3% v. 98.5%,  $p < 0.0001$ ). For 3258 screening colonoscopies, crude HB and OP AD rates were 22.2% and 12.3% ( $p < 0.001$ ), respectively. The propensity matched odds of AD in HB compared with OP screening colonoscopy was 1.47 (95% CI 1.12–1.95).

Out-patient centre colonoscopies were namely for low-risk screening. Patients who underwent OP colonoscopies were more likely to be young, male and have an adequate preparation. Despite identical endoscopists and colonoscopy equipment, in a propensity matched cohort, AD was higher for HB compared with OP colonoscopies.

#### 16

**Normalization of carcinoembryonic antigen levels post-neoadjuvant therapy is a strong predictor of pathologic complete response in rectal carcinoma.** *A. Kleiman, A. Farsi, A. Petrucci, A. Kezouh, T. Vuong, P. Gordon, C. Vasilevsky, N. Morin, J. Faria, G. Ghitulescu, M. Boutros.* From the Jewish General Hospital, Montréal, Que.

Several authors have investigated the relationship between carcinoembryonic antigen (CEA) and pathologic complete response (PCR) without consensus regarding its predictive value. This

study aims to examine the association of pretreatment and post-treatment CEA with PCR.

We conducted a retrospective chart review of a prospectively maintained database of all patients who underwent primary rectal cancer resections after neoadjuvant treatment. Patients were divided into 3 groups based on final pathology: PCR ( $t = 0$ ), partial response (PR), and no response (NR). Pretreatment CEA was measured at the initial oncologist/surgeon visit. Posttreatment CEA was measured after neoadjuvant treatment, before surgery. Normal CEA ranges from 0–3.0 ug/L. The  $\chi^2$ , Student  $t$  and Wilcoxon rank sum tests were used for univariate analyses for categorical, normally distributed continuous and non-normally distributed continuous variables. All variables with  $p < 0.15$  were included in a multivariate logistic regression model.

A total of 141 (63 yr, 60.4% male) patients underwent primary rectal cancer resections after neoadjuvant treatment (56% external beam, 44% brachytherapy). Twenty-eight (19.96%) achieved PCR, 43 (30.5%) PR, and 69 (48.9%) NR. On univariate analysis, patients with PCR had similar demographics, pretreatment tumour characteristics, staging, and CEA levels. For patients with initially elevated CEA ( $n = 85$ ), those achieving PCR had significantly lower posttreatment CEA than those with other outcomes (median 2.2 [IQR 1.00–2.90] v. 3.3 [IQR 1.9–6.3];  $p < 0.03$ ). On multivariate logistic regression, taking into account age, sex, poorly differentiated tumours, and smoking status, a normalization of initially elevated CEA is a highly significant predictor of PCR (OR 59.2 [95% CI 1.66– $\infty$ ]).

In patients with initially elevated CEA, normal postneoadjuvant treatment CEA is a highly significant predictor of PCR.

## 17

**Is laparoscopic resection in select T4 colorectal lesions comparable to open resection for achieving adequate margins? A. Elnahas, A. Okrainec, T.D. Jackson, F.A. Quereshy. From the Department of Surgery, University Health Network, University of Toronto, Toronto, Ont.**

Laparoscopic resection has been considered a relative contraindication for T4 colonic and rectal lesions due to concern over inadequate margins. The objective of this study is to compare planned laparoscopic and open resections of T4 lesions with respect to positive margin rates.

A propensity score-based analysis was performed using data from the American College of Surgeons' National Surgical Quality Improvement Program from 2011 and 2012. The study population consisted of patients that underwent a colorectal resection for a primary T4 lesion during 2011 and 2012. Patients were excluded if they had evidence of metastatic disease. Multiple imputation was employed for missing data and propensity scores were derived from relevant clinical characteristics to determine the likelihood of a planned laparoscopic approach. The final multivariable regression model included important confounders along with the propensity score to determine the adjusted odds ratio (OR) for positive margins based on surgical approach.

The subselected population consisted of 304 and 478 patients in the laparoscopic and open group, respectively. Although the 2 groups were statistically similar with respect to most demographic and clinical variables, the proportion of patients that received neoadjuvant therapy was higher in the open group ( $p < 0.01$ ). The laparoscopic group had 66 (22.7%) cases with positive

margins and the open group had 126 (27.9%). Among patients with a planned laparoscopic approach, 77 (25%) required conversion to an open procedure with 19 (25%) cases resulting in positive margins. After covariate adjustment, no statistical difference was found between planned laparoscopic and open resections with respect to positive margin status (OR 0.77,  $p = 0.16$ , 95% CI 0.54–1.10).

Select patients with T4 lesions that underwent planned laparoscopic colorectal resections did not have a significantly higher positive margin rate compared with patients with open operations. Experienced laparoscopic surgeons are able to selectively perform adequate resections for T4 colorectal lesions.

## 18

**Is early discharge following elective oncologic colon resections in select patients safe? Analysis of short-term outcomes. A. Elnahas, A. Okrainec, T.D. Jackson, F.A. Quereshy. From the Department of Surgery, University Health Network, University of Toronto, Toronto, Ont.**

In the era of enhanced recovery programs, understanding the safety and feasibility of early discharge following colon resections is necessary. The objective of this study is to determine if “early discharge” by postoperative day (POD) 2 following oncologic colon resections is comparable to “standard discharge” (i.e., POD 3 or 4) with respect to 30-day patient outcomes.

Data from the National Surgical Quality Improvement Program participant use file was used to perform a retrospective cohort analysis. Patients included were discharged on POD 1, 2, 3 or 4 after elective oncologic colon resections during 2011 and 2012. Patients with metastasis, concurrent procedures or recorded complications/death during their principal admission were excluded. The outcomes included the 30-day adverse event (serious complications, mortality or reoperations) and readmission rates. A multivariable regression determined the adjusted odds ratios (OR) for each outcome.

There were 305 and 2277 patients in the early and standard group, respectively. The early group had 6 (1.97%) 30-day adverse events and the standard group had 59 (2.59%). There were 16 (5.56%) readmissions in the early group and 135 (6.24%) in the standard group. No statistical difference was found between early and standard discharge with respect to the 30-day adverse event rate (OR 0.93,  $p = 0.87$ , 95% CI 0.41–2.12) and readmission rate (OR 1.03,  $p = 0.90$ , 95% CI 0.61–1.76).

Patients discharged by POD 2 after elective oncologic colon resections did not have significantly higher adverse event or readmission rates compared with patients discharged on POD 3 or 4. Select patients may be safely discharged early after uncomplicated surgery.

## 19

**Rate of positive circumferential radial margins in rectal cancer is dependent on pathologist and surgeon performance and on the definition of a positive CRM: data from Local Health Integration Network 4. C. Keng, S. Kelly, S. Forbes, M. Cadeddu, V. Grubac, M. Simunovic, C. Eskicioglu, N. Amin, I. Yang, L. Thabane, F. DeNardi, S. Tsai, A. Coates, P. Lovrics. From McMaster University, Hamilton, Ont.**

A positive circumferential radial margin (CRM) following rectal

cancer surgery is an important predictor of local tumour recurrence and likely a reflection of overall surgical quality. The definition of a positive CRM varies internationally, and reported rates of positive CRM vary greatly in the literature. We used times-series population-based data to assess pathologist and surgeon performance in this area.

Chart reviews provided relevant data from consecutive patients undergoing major rectal cancer surgery from years 2006 to 2012 in all 11 Local Health Integration Network 4 (LHIN-4) hospitals in Ontario. Key outcomes included rates of pathologic examination of the CRM, rates of reporting actual CRM distance in millimetres and rates of positive CRM. We calculated the rate of positive CRM using various definitions. Changes included positive margin cut-offs of  $\leq 1$  mm versus  $\leq 2$  mm; inclusion and exclusion of cases deemed positive despite no actual distance provided on pathology reporting; and third, inclusion and exclusion of cases where no CRM assessment was done. We selected the final positive CRM as under 1 mm or comment of a positive CRM.

A total of 1221 consecutive rectal cancer cases were analyzed. The rate of comment on the CRM on pathology reports increased over time from 92% to 100%, while the rate of reporting actual CRM distance increased from 54.7% to 93.2% ( $p < 0.01$ ). Depending on how the rate of positive CRM was defined, its value varied widely, for example: anywhere from 8.5% to 19.4% in 2006, and from 6.0% to 12.5% in 2012. When defining a positive CRM as tumour cells  $\leq 1$  mm from the specimen edge, and the inclusion of cases with no distance but a reported positive CRM, the positive CRM rate for years 2006–12 decreased from 14.0% to 6.3%, respectively ( $p < 0.01$ ).

We observed marked increases in CRM distance reporting, while rates of positive CRM dropped dramatically, suggesting both improved pathologist and surgeon performance over time. Changing definitions greatly influenced rates of positive CRM, indicating the need for more transparency when such rates are reported in the literature.

## 20

**Laparoscopic colorectal cancer resection in the obese: a meta-analysis. A. Fung, M. Morris, A. Saleem, S. Wexner, C. Vasilevsky, M. Boutros. From the Jewish General Hospital, Montréal, Que.**

Laparoscopic colorectal cancer resections in obese patients pose technical challenges that may negatively impact oncologic adequacy. A meta-analysis was performed to assess the outcomes of laparoscopic colorectal cancer surgery in obese and nonobese patients.

Studies were identified by searching Medline, Embase, CINAHL, Global Health, BIOSIS Previews, Web of Science, Scopus, Cochrane and Database of Abstracts of Reviews of Effects from inception to August 2013. Studies that compared outcomes of laparoscopic colorectal malignant neoplasms in obese and nonobese patients were selected for meta-analysis. Only studies that defined obesity by criteria of the National Institutes of Health ( $\text{BMI} \geq 30 \text{ kg/m}^2$ ) were included. Operative, postoperative and oncologic outcomes were evaluated. Pooled odds ratios (OR) and weighted mean differences (WMD) with 95% confidence intervals (CI) were calculated using fixed or random effects models.

Eleven observational studies with a total of 3871 patients were included in the meta-analysis (Fig. 1). Operative time (WMD

35.57, 95% CI 0.82–70.33), conversion rate (OR 2.20, 95% CI 1.62–2.97), postoperative morbidity (OR 1.57, 95% CI 1.21–2.05), wound infection (OR 4.17, 95% CI 2.38–7.32) and anastomotic leak (OR 1.72, 95% CI 1.02–2.91) were all significantly increased in the obese group. Lymph node retrieval, distal and circumferential margins, and 5-year disease-free and overall survival were similar in both groups.

Obese patients undergoing laparoscopic colorectal cancer resections are at higher risk of postoperative complications compared with nonobese patients. Laparoscopic colorectal cancer surgery in the obese poses an increased technical challenge compared with nonobese patients. Despite these challenges, oncologic adequacy of laparoscopic colorectal cancer resections is comparable in both groups.

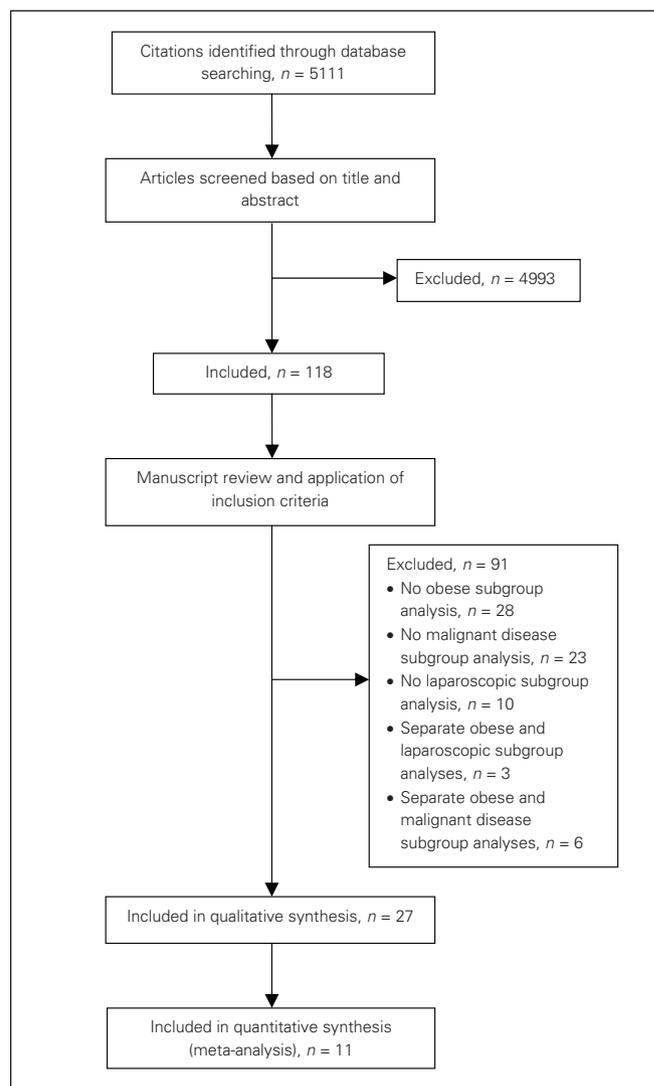


Fig., abstract 20. Study selection.

## 21

**Toward standardizing the rectal cancer surgery consent process: the evaluation of the rectal cancer decision aid. R. Wu, D. Stacey, A.S. Scheer, H. Moloo, R. Auer, S. Tadros, M. Friedlich, B. Potter, R. Boushey. From the Ottawa Hospital, Ottawa, Ont.**

In rectal cancer surgery, the view that avoiding a stoma can improve quality of life (QoL) is challenged as low anterior resection and abdominoperineal resection have been shown to be equivocal in overall QoL. Patient decision aids (PtDA) are tools to facilitate shared decision making between patients and clinicians. We developed the rectal cancer PtDA and the aim of this study is to evaluate its effect on patients' choice and decision-making process.

A before and after study design is used to evaluate 38 adults with a rectal cancer at 10 cm or below from a tertiary cancer centre. Questionnaires were administered before and after using the take home PtDA. Outcomes are knowledge, decisional conflict, choice preference, value, readiness for decision-making, acceptability of the tool, and the feasibility of implementation.

Of the 13 patients recruited thus far, the mean age of patients was  $62.85 \pm 11.10$  years. The average location of tumour was  $6.4 \pm 1.7$  cm above the anal verge. Prior to PtDA use, only 1 patient (7.7%) preferred a permanent stoma, whereas viewing the PtDA resulted in 4 patients (30.8%) preferring APR. Post PtDA use, there was an knowledge improvement score of 37.5% and a decisional conflict reduction of 6.9%. The majority (92.3%) would recommend the tool to others. The study will be complete in August 2014.

The rectal cancer PtDA may reduce variability in rectal cancer surgery consent process. Our results suggested it would improve patient knowledge, reduce decisional conflict, and help patients identify their values and choice preferences.

## 22

**Transanal endoscopic microsurgery for rectal villous tumours: Can we rely solely on preoperative biopsies and the surgeon's experience?** *F. Letarte, A. Bouchard, S. Drolet, P. Bouchard. From the Centre hospitalier universitaire de Québec, Charlesbourg, Que.*

Transanal endoscopic microsurgery (TEM) has been proven safe and even superior to transanal excision for resection of rectal villous adenomas. Appropriate patient selection is essential to assure adequate surgical treatment. However, the role of preoperative imaging and its advantages are not well established. The purpose of this study is to compare the value of pre-TEM imaging and the value of no imaging in patients with rectal villous tumours.

Medical files of 178 consecutive patients who had the TEM procedure from April 2011 to September 2013 in a single academic centre in Quebec were reviewed retrospectively. Patients with preoperative histologic diagnosis of rectal villous tumour were included and placed in groups according to their preoperative imaging modality. Preoperative diagnosis was then compared with final histopathological results.

A total of 146 patients were included. Of these, 112 patients did not have any form of preoperative imaging, 22 patients had endorectal ultrasound (ERUS) and 12 patients had magnetic resonance imaging (MRI). In the no imaging group, preoperative diagnosis was concomitant with final histopathological result in 89% of cases. No patient had an insufficient surgery. In the ERUS group, preoperative diagnosis was right in 41% of cases but overstaged 50% of cases. This would have led to unnecessary radical surgery in 14% of patients. In the MRI group, all 12 preoperative diagnoses overstaged the lesions. Overall, no patient in the group without imaging had an inappropriate surgery while

44% of the imaging groups had a preoperative diagnosis that would have led to an inappropriate, more radical resection.

In cases of rectal villous tumours, preoperative biopsies free of invasive carcinoma in addition to benign appearance on evaluation by the operating surgeon are sufficient to appropriately select patients for TEM resection. It seems that preoperative imaging does not offer any advantage and could lead to inappropriate radical surgery.

## 23

**The 2-question questionnaire: an initial step in reducing surgical site infections in colorectal surgery using a comprehensive unit-based safety program.** *A. Berg, D. Kubelik, H. Moloo, D. Schramm, B. Skinner, S. Sundaresan. From the Division of General Surgery, University of Ottawa, Ottawa, Ont.*

The Department of Surgery at the Ottawa Hospital introduced a comprehensive unit-based safety program (CUSP) in order to reduce surgical site infections (SSIs). A preliminary step in implementation of CUSP was administration of a questionnaire concerning SSIs. Our objective was to solicit feedback from frontline workers at the Ottawa Hospital regarding their perceptions of root causes of SSIs in order to identify practical solutions for SSI reduction in colorectal surgery.

A multidisciplinary general surgery CUSP team was created from nurses, physicians, housekeeping and logistical services, and administrators from the Ottawa Hospital, Civic Campus. All members watched an educational video about the science of safety and attended departmental Grand Rounds, followed by a meeting with mentors from Johns Hopkins Hospital to understand the vision of CUSP. An anonymous, online, standardized 2-question questionnaire was administered to CUSP members in April 2013. Questions included: "Please explain how you think the next patient will get an SSI?" and "Please explain what can be done to prevent patients from getting an SSI?"

A total of 45 perceived root causes of SSIs were identified and 64 potential solutions were provided. Perceived causes of SSIs were broadly grouped into categories based upon common themes, including hand-washing, prep, intraop practices, wound care, cleaning practices, equipment, surgical attire, medications, environment, staff, communication, education and culture.

We identified numerous potential ways to reduce SSIs within colorectal surgery at the Ottawa Hospital. We believe that soliciting feedback from frontline workers through the CUSP framework empowers them to think critically about their daily practices and to work toward a common goal of patient safety. The CUSP team for General Surgery has now analyzed potential root causes of SSIs identified from this questionnaire and is currently implementing solutions while monitoring their impact on SSI reduction.

## 24

**Measuring patient satisfaction within an enhanced recovery after colorectal surgery program.** *L. Lindsay, E. Pearsall, M. McKenzie, R. McLeod. From the University of Toronto, Toronto, Ont.*

An enhanced recovery after surgery (ERAS) program is a multimodal perioperative program that aims to accelerate recovery and reduce complications postoperatively. A number of studies have

shown ERAS protocols and early discharge to be safe; however, there is a paucity of information available on how these protocols affect patient satisfaction. The aim of this study was to assess patient satisfaction within an ERAS program for colorectal surgery.

A 28-item patient satisfaction survey was developed through consultation with Ontario ERAS surgical, anesthetist and nurse leads from participating hospitals. As well, the survey was pilot tested on ERAS patients. Items assess satisfaction with preoperative counselling, pain management, postoperative activities and overall satisfaction. The survey was distributed to patients undergoing colorectal surgery through the ERAS program across 14 hospitals in Ontario between November 2013 and January 2014. Patients were asked to complete and return the survey upon discharge from hospital.

One-hundred and ninety-one patients (111 male, 80 female, mean age  $56.29 \pm 17.24$  yr) completed the patient satisfaction survey. Sixty-seven (35.1%) patients had open surgical procedures and 117 (61.3%) laparoscopic. A total of 65 patients experienced adverse events. Mean hospital stay was  $6.26 \pm 4.39$  days. Overall, patients participating in the ERAS program were highly satisfied. Fifty-six percent of patients agreed that they were satisfied with the ERAS program, and 34.6% strongly agreed. Comments made frequently by patients described the excellent care given by physicians and nurses contributing to their recovery.

Overall, patients participating in the ERAS program are highly satisfied with all aspects measured. Future research includes administering a second survey to determine if increased compliance with the ERAS protocol leads to increased patient satisfaction.

## 25

**Rectal exam: knowledge and perception of family medicine residents in the province of Québec. A. Bussi eres, A. Bouchard, S. Drolet. From Laval University, Qu ebec, Que.**

Digital rectal exam (DRE) is often used by first line practitioners. According to the literature, in this setting it has a positive predictive value of 0.29, and is omitted in at least 10% of the patients referred to a specialist. We choose to survey family medicine residents of the province of Qu ebec to explore the current medical practice.

A survey of 17 questions was built after a literature review and consultation of a group of colorectal surgeons and family doctors. The goals of the survey were to evaluate knowledge, training and perception of the residents on DRE. An e-mail was sent to all residents enrolled in a family medicine program with a link to an online survey, available in French and English. To achieve a power of 80% ( $\alpha$  error of 0.05) a minimum of 137 participants were needed.

Two hundred and seventeen residents out of a possible 879 answered the survey (24.7%). Throughout their training, one-third did not receive any supervision or feedback according to DRE technique. Seventy percent failed at least once to determine the nature of an abnormality. Most frequently reported reasons to omit DRE were patient refusal, inadequate setting and lack of time.

Future first-line practitioners recognize the importance of DRE in the evaluation of anorectal complaints. A majority of the residents have experienced difficulty with the interpretation of the exam in their practice. More than 80% would be interested in additional training.

## 26

**Transanal endoscopic microsurgery for malignant polyps found at endoscopy. C. Chernos, E. Crocker, D. Hochman. From the University of Manitoba Faculty of Medicine Department of Surgery, Winnipeg, Man.**

The management of malignant polyps found on endoscopy remains a topic of contention. Historically, the options available included careful endoscopic surveillance, local resection for smaller lesions, or formal resection with a total mesorectal excision. With the advent of transanal endoscopic microsurgery (TEM), there is now another surgical option to manage these malignant lesions. The adequacy of treatment following TEM surgery for such lesions will be examined.

A database of 164 patients, who underwent TEM resections for rectal lesions in Manitoba between May 2009 and February 2014, was used. From this database, 27 patients underwent TEM for malignant lesions found on endoscopy. Lesion characteristics including pathology type, tumour height, completeness of resection and recurrence were examined. Surgical complication rates were also recorded.

Twenty-seven patients underwent TEM resection for a malignant rectal lesion. One procedure was aborted due to the anatomic location of the lesion and the patient underwent a low anterior resection. They were therefore excluded from analysis. The most common indication for surgery was adenocarcinoma (18). Final pathology following TEM resections demonstrated no residual disease in 15 cases, residual adenoma in 5, adenocarcinoma in 4, carcinoid in 1, and leiomyoma in 1 case. Full thickness excision was achieved in all 26 patients (100%) and margins were negative in 25 (96%). Of the adenocarcinomas, final staging showed T0 disease in 20 patients (77.0%), T1 in 2 (7.7%), and T3 in 2 (7.7%). Of the 3 patients with residual carcinoma found on TEM, all were offered further therapy but 3 declined surgery given their ages greater than 90 years. A total of 2 recurrences were noted (7.7%), with a mean time to recurrence of 20 months (18–22 mo). The mean follow-up interval was 10 months (0–37 mo). There were no procedural complications noted such as bleeding, infection or mortality.

Transanal endoscopic microsurgery is an important and beneficial surgical technique that can be used to stage patients with malignant polyps and in appropriate cases, may offer a safe and effective alternative to formal resection.

## 27

**Transanal endoscopic microsurgery for unanticipated malignancies – this unexpected finding does not affect final outcomes. C. Chernos, E. Crocker, D. Hochman. From the University of Manitoba Faculty of Medicine Department of Surgery, Winnipeg, Man.**

Transanal endoscopic microsurgery (TEM) is increasingly popular for the treatment of complex rectal lesions. There are occasions where in spite of initial benign biopsies, final TEM specimen pathology reveals unanticipated malignancies. The outcome of such patients is not fully known and will be examined in this study.

Between May 2009 and February 2014, 164 patients underwent TEM surgery for rectal lesions in Manitoba. Twenty-six patients who underwent TEM resections for benign adenomas were found to have malignancies on their final pathology. Outcomes, recurrences, and rates of subsequent surgery for patients

having undergone TEM as their primary surgical therapy are examined in this study.

Of the 26 patients identified, 1 was found to have an overt malignancy on frozen section during TEM and the procedure was aborted in place of formal resection, this patient was included in the analysis. Average length of follow up was 15 months (0–44). Complete resection was achieved with negative margins in 24 cases (92%) and full thickness excision in 25 (96%). The peritoneal cavity was not entered and there were no surgical complications. The most common final pathological staging was T1 (17), followed by T2 (5) and T3 (3). All patients upon the discovery of cancer were offered additional surgery. Of these, 6 (23%) had additional surgery: LAR (4), Hartmann's (1) and APR (1); the remainder preferred close surveillance. Three patients were found to have metastatic disease during staging following TEM; 2 had T3 lesions and 1 had a T1 lesion at presentation. Three patients (11.5%) undergoing close surveillance developed recurrences; 2 underwent salvage surgery while the third is undergoing neoadjuvant therapy. The average time to recurrence was 23 months (21–25 mo). The mean follow-up interval was 15 months (0–44 mo).

This series shows that when cancer is identified by TEM, the TEM itself is usually curative for early-stage disease, and recurrences are rare. In cases of advanced disease or recurrence, TEM resection does not prevent a subsequent total mesorectal excision, with a good result, when indicated.

## 28

### **Transabdominal versus transanal excision of T1 rectal cancer. M. Recsky, C. Brown. From St. Paul's Hospital, Vancouver, BC**

The surgical standard of care for rectal cancer is total mesorectal excision (TME). Local excision with techniques such as transanal endoscopic microsurgery (TEM) have emerged as a reasonable alternative in patients with early rectal cancers. Our objective was to compare the short and long-term outcomes in patients with T1 rectal cancer treated with TEM versus TME.

All patients with rectal cancer treated at our centre have clinical and surgical data collected and maintained in the St. Paul's Hospital Rectal Cancer Database. For this study, all patients with T1 rectal cancer treated by either TEM or TME were identified in the database and analyzed for differences in short- and long-term outcomes. Short-term outcomes included length of stay (LOS), operative time and perioperative complications. Longer-term outcomes included overall and cancer-free survival.

From March 2007 to October 2013, there were 32 patients with a T1 cancer managed with TEM, compared to 19 treated with TME. Mean LOS was significantly shorter for TEM (0.5 v. 7.2 d,  $p < 0.001$ ). Operative time was significantly shorter for the transanal approach (56 mins) compared to TME (180 min;  $p < 0.001$ ). At median 20.5 months follow up, there was no significant difference in overall survival (97% v. 100%). Overall, there was a trend toward higher recurrence rate in those treated with TEM versus TME (4 of 32 v. 0 of 19,  $p = 0.28$ ).

## 29

### **Transanal endoscopic microsurgery for giant polyps – the Manitoba experience. C. Chernos, E. Crocker, D. Hochman. From the University of Manitoba, Faculty of Medicine Department of Surgery, Winnipeg, Man.**

Historically, patients with complex rectal lesions not amenable to complete endoscopic resections required radical surgical excision. Giant polyps, defined in the literature as lesions greater than 4 × 4 cm in dimension, are a particularly difficult subset of polyps. With the advent of transanal endoscopic microsurgery (TEM) we are now able to achieve full curative resection of even these complex lesions with a minimally invasive surgical technique. This case series examines the outcomes of patients with giant rectal polyps following TEM resection.

Between May 2009 and February 2014, 164 patients underwent TEM for rectal lesions in Manitoba. All patients who met criteria of a giant rectal lesion, defined as lesions > 16 cm<sup>2</sup> in area were included in the study analysis, focusing on completeness of resection, quality of specimen, and recurrence rate.

Eighty patients (48.8%) underwent TEM for a giant rectal lesion. The average size of the lesion was 31.1 cm<sup>2</sup> in area (16.2–73.5 cm<sup>2</sup>). The most common pathology following resection was an adenomatous polyp in 61 (76.2%) cases. The average height of the lesion from the anal verge was 9.6 cm. Lesions were removed with full thickness excision in 77 (96%) cases and had negative resection margins in 67 (84%). Pathology identified unanticipated malignancy malignancies in 16 patients (20%). Recurrences were noted in 7 (8.8%) cases, with a mean time to recurrence of 17 months (8–25 mo). The mean follow-up interval was 8 months (0–34 mo). Procedural complications occurred in a total of 3 patients (3.8%), and consisted of postoperative bleeding.

Compared with current literature, we demonstrate a higher rate of TEM resections of giant rectal polyps. In spite of their size, these lesions were successfully removed with clear margins in majority of cases. These large polyps also contained a high percentage of unrecognized malignancies. Overall, TEM has been found to be a safe alternative to radical surgical excision of giant rectal polyps, with a low complication rate.

## 30

### **Time to recurrence as a marker for tumour aggressiveness in colorectal cancer. A. Schellenberg, F. Christian. From the University of Saskatchewan, Saskatoon, Sask.**

The pathological characteristics of colorectal cancer, such as tumour-node-metastasis (TNM) stage, which influence prognosis are currently well established. However, tumour pathology has not been well correlated with the specific time to disease recurrence. Our aim is to correlate specific pathological tumour characteristics of colorectal cancer with subsequent time to recurrence following surgical resection with intention to cure.

A retrospective study of patients diagnosed with colorectal cancer who subsequently underwent curative resection from 2000 to 2005 was completed. A total of 226 medical charts from Royal University Hospital in Saskatoon, Canada, were reviewed. Demographic data, adjuvant treatments, tumour characteristics and follow-up data, including the time of local recurrence or metastasis, were recorded. Patients who received preoperative chemotherapy or radiation or demonstrated preoperative evidence of metastatic disease were excluded.

The mean age of the patients in the study was 68.5 years, with 52% male and 48% female patients. In univariate analysis, advanced T stage, N stage, and the presence of vascular invasion and lymphatic invasion had significantly higher odds of disease recurrence. In the multivariate Cox model, T3 stage had a significantly lower hazard

ratio (HR) relative to T4 stage (HR 0.36,  $p < 0.05$ ). N0 stage (HR 0.15,  $p < 0.001$ ) and N1 stage (HR 0.10,  $p = 0.05$ ) had significantly lower hazard ratios relative to N2. Mean number of years to first recurrence for T3 and T4 stage were 3.3 and 1.1 years, respectively, and N0, N1 and N2 stage were 6.3, 3.3 and 1.9 years, respectively. Mean number of years to first recurrence for the presence of vascular and lymphatic invasion were 2.3 and 2.5 years, respectively.

Time to recurrence is a good surrogate marker of tumour aggressiveness and can advantageously be correlated with specific pathological markers and TNM stage.

### 31

**Surgical site infections following colorectal surgery for inflammatory bowel disease and diverticulitis. F. Hagggar, S Rashid, R. Wu, J. Mamazza, H. Moloo, I. Raiche. From the Ottawa Hospital, Ottawa, Ont.**

Surgical site infections (SSIs) can significantly impact length of hospital stay, postoperative morbidity and mortality, quality of life and the cost of health care. The objective of this study is to determine risk factors for SSIs after colorectal resections for inflammatory bowel disease (ulcerative colitis and Crohn's disease) and diverticulitis.

All hospital admissions data of patients undergoing elective colorectal for diverticular disease and inflammatory bowel disease performed in Australia between January 2001 and December 2010 were obtained from a national hospital morbidity database. A logistic regression model was fitted to identify independent risk factors associated with SSIs after index colorectal resections for benign conditions. Surgeries for colorectal malignancies were excluded.

A total of 19013 colorectal resections for diverticular disease ( $n = 9986$ ) and IBD, ulcerative colitis and Crohn's ( $n = 9027$ ) were included in the analysis. The majority of procedures were performed using the laparoscopic approach (73.8%). Patients who developed SSIs had a significantly higher overall comorbidity burden ( $p < 0.001$ ), higher perioperative complication rates ( $p < 0.001$ ) and longer length of stay ( $p < 0.01$ ) compared with those who did not develop SSIs. Type of surgical technique used was found to be an independent risk factor for developing SSIs. Patients undergoing laparoscopic procedures had a significantly reduced risk of SSI compared with the open surgery patients ( $p < 0.001$ ). Other significant independent risk factors for SSI included advanced age, male sex, hemorrhage and hematoma, wound dehiscence, intestinal obstruction and comorbidities such as anemia, liver disease, coagulopathy, fluid and electrolyte disorders, pulmonary circulatory disease and renal failure (all  $p < 0.05$ ).

Patients with inflammatory bowel disease and diverticulitis confer a high risk cohort for developing SSIs following colorectal surgery. Not surprisingly, patients undergoing the laparoscopic procedure had a significantly reduced risk of SSIs compared with patients in the open surgery cohort.

### 32

**Sarcopenia is not predictive of anastomotic leak or length of stay following surgery for colorectal cancer. K. Klingbeil, M. Brar, R. Daigle, I. Datta, J. Heine, W.D. Buie, A. MacLean. From the University of Calgary, Calgary, Alta.**

Sarcopenia is the loss of skeletal muscle mass, and has been associated with worse outcomes in many conditions. The effect of

sarcopenia on short-term outcomes following resection for colorectal cancer (CRC) remains unknown. Normalized psoas cross-sectional area (NPCSA) on CT is a correlate of total body muscle volume, a measure of sarcopenia, and may be predictive of nutritional reserves. The purpose of this study was to assess for an association between NPCSA and anastomotic leak (AL) and length of stay (LOS) after CRC surgery.

All patients aged 18–75 years with CRC undergoing surgery from 2008 to 2010 in our health region were identified. Patients without a perioperative abdominal CT, no recorded height, stage 4 disease, or who did not have an anastomosis were excluded. Risk factors of AL and LOS were abstracted from patients' charts. Patients were classified as having an AL based on radiologic or operative findings. Total psoas area was measured at the superior limit of the L4 transverse process and was normalized by height. Average psoas density (APD) was also recorded. NPCSA and other risk factors for AL were then analyzed in predicting AL and LOS.

A total of 439 patients were included, of which 40 patients had an AL. Colorectal anastomosis below the peritoneal reflection (OR 3.3, 95% CI 1.4–8.0) and smoking (OR 2.4, 95% CI 1.1–5.7) are associated with AL on multivariate analysis, while NPCSA, APD, BMI, patient age, sex, other comorbidities and laparoscopy are not. Patient age ( $B = 0.26$ , 95% CI 0.09–0.44) and laparoscopy ( $B = -4.9$ , 95% CI -9.5 to -0.27) are associated with LOS on multivariate analysis, while NPCSA, APD, BMI, gender, patient comorbidities and type of anastomosis are not.

Sarcopenia, as defined by NPCSA, is not predictive of AL or prolonged LOS following resections for CRC. Colorectal anastomosis below the peritoneal reflection and smoking increase the risk of AL. Advancing patient age predicts an increase in LOS, while laparoscopy predicts a decreased LOS.

### 33

**Oncologic outcomes and undertreatment issues associated with a selective approach to neoadjuvant radiation therapy in patients with cT3N0 rectal cancer: early results from a retrospective cohort. C. Boulanger-Gobeil, G. Dion, F. Letarte, R. C. Grégoire, A. Bouchard, S. Drolet. From Laval University, Québec, Que.**

Utilization of neoadjuvant radiation therapy in cT3N0 rectal cancers remains a subject of controversy in the literature. Its use offers potential reduction in local recurrence without significant improvement in survival and is associated with decreased bowel and sexual function. We aim to investigate the outcome of patients with cT3N0 according to the use of neoadjuvant radiation. All patients presenting with new rectal cancer having a clinical stage cT3N0 on preoperative MRI were identified. Patients were then stratified according to the use of neoadjuvant radiation or its omission. Outcomes included overall and disease-free survival. Specimen quality and perioperative data were also recorded. Statistical analysis was realized with SAS. A total of 119 patients presenting with cT3N0 rectal cancer between 2006 and 2013 were identified. Ninety-six patients received neoadjuvant chemotherapy while 23 underwent upfront surgery. Patients in whom radiation was omitted were significantly older (71 v. 62 yr;  $p < 0.001$ ) compared with patient having radiation. Median follow up was similar between groups (23 v. 21 mo;  $p = 0.6$ ) Thirty-five percent of patients received adjuvant chemotherapy. No patient

received postoperative radiation. Overall survival favoured patients having neoadjuvant radiation (53 v. 41 mo;  $p = 0.02$ ) although disease-free survival was not different between group (22 v. 19 mo;  $p = 0.8$ ). Neoadjuvant radiation is currently omitted in 20% of patient presenting with CT3N0 rectal cancer in our centre. Although overall survival appears to be reduced in the cohort of patients having upfront surgery there is no difference in disease-free survival. Further studies are needed to optimize patient selection for the utilization of radiation in cT3N0 rectal cancer.

### 34

**Surgical outcomes and cost advantages of transanal minimally invasive surgery.** *B. Howe, P. Colquhoun, M. Ott, K. Leslie.* From the Western University, London, Ont.

Transanal minimally invasive surgery (TAMIS) is a relatively new technique for local resection of early malignancies and benign lesions of the rectum. We have been performing TAMIS at our institution since December 2012. A review of our cases has been performed to assess results and investigate the advantages TAMIS may provide to the health care system

TAMIS has been performed on 24 patients in our centre over a 16-month period. Our patients were between 39 and 83 years of age. The mean distance of the lesion to the anal verge was 7.6 cm (range 3–10). The mean size of our resection specimen was 5.23 cm (range 2–9) and mean size of the tumour was 3.04 cm (range 0.3–7.5). Pathology revealed 14 adenomas, 7 invasive cancers, 1 carcinoid, 1 no residual neoplasm postendoscopic excision of carcinoid with questionable margins, 1 pathology pending. Complete excisions with negative margins were accomplished in 100% of cases. Mean operative time was 94.4 min (range 38–196). The median length of stay postoperatively was 2 days. We estimate that TAMIS saved an average of 10.3 days of hospitalization and \$542 in surgical supplies per case performed, had patients undergone conventional treatment for their pathology. For our 24 patients the total saving was approximately \$13 027 in surgical supplies and 247 hospital days. Two patients required return to the operating room: one patient who was anticoagulated (INR 3.8) experienced significant rectal bleeding 13 days postoperatively from the incision line; a second patient experienced rectal bleeding and significant pain on postoperative day 1 that was attributed to a partial dehiscence of the proctotomy site. Our initial experience with TAMIS demonstrates it as an effective tool for resection of lesions in the rectum. Its cost savings to the health care system are enormous as demonstrated by a reduction in operating room time, surgical supplies, and reduced stay in hospital postoperatively.

### 35

**(CJS Editors' Choice Award) To suture or not: a multi-centre, randomized, controlled trial of open versus closed management of full thickness transanal endoscopic microsurgery (TEM) rectal lesion resections.** *C. Brown, D. Hochman, M. Raval, H. Moloo, T. Phang, A. Bouchard, L. Williams, S. Drolet, R. Boushey.* From the University of British Columbia, Vancouver, BC; University of Manitoba, Winnipeg, Man.; University of Ottawa, Ottawa, Ont.; Laval University, Québec, Que.; and Dalhousie University, Halifax, NS

After full-thickness excision of rectal lesions with transanal endoscopic microsurgery (TEM), there is evidence that the resulting defect, if fully within the mesorectum, can be safely left unsutured to heal by secondary intention. Our objective was to determine whether patients experienced more or less pain with this “open” management as compared with “closed” management (suture closure of the defect) after TEM resection.

Patients undergoing TEM resection at 5 Canadian centres were randomized to open or closed management of the rectal defect. Adult patients were eligible if the lesion was < 15cm from the anal verge, mesorectum was intact and surgeon decision that both open and closed approaches were technically possible and appropriate. Primary outcome was pain, as measured by visual analogue scale (VAS) at postoperative day 1, 3 and 7. Secondary outcomes included postoperative complications (bleeding, infection).

Between March 2012 and October 2013, 50 patients were enrolled, randomized to open ( $n = 22$ ) and closed ( $n = 28$ ) groups. Both groups were similar in age, gender, tumour height, tumour size, and OR time. Comparing open and closed groups, pain was similar at postoperative day 1 (VAS score 2.8 v. 2.6,  $p = 0.76$ ), 3 (2.8 v. 2.1,  $p = 0.23$ ) and 7 (2.8 v. 1.7,  $p = 0.10$ ). There was a trend toward more postoperative bleeds in the open group (27% v. 7%,  $p = 0.07$ ).

In this multicentre RCT, there was no difference in postoperative pain between the open and closed groups. We did observe a trend toward increased postoperative bleeding in the open group.

### 36

**Transanal endoscopic microsurgery: experience of the first 388 procedures at a Canadian colorectal surgery centre.** *C. Brown, T. Phang, A. Karimuddin, M. Raval.* From the University of British Columbia, Vancouver, BC

Transanal endoscopic microsurgery (TEM) was developed in the 1980s to facilitate a minimally invasive approach to rectal lesions. Recent RCTs suggest improved outcomes with TEM when compared with conventional transanal techniques. Since 2007, 3 surgeons at St. Paul's Hospital have performed TEM procedures. Our objective was to review this experience.

Between March 2007 and March 2014, data for patients with rectal lesions managed by TEM at St. Paul's Hospital were prospectively collected and maintained in the St. Paul's Hospital TEM database. Demographic, surgical, postoperative and long-term outcomes have been documented.

Over 7 years, 388 TEM procedures were performed at St. Paul's Hospital. In 26 patients, the procedure was a repeat TEM for persistent or recurrent disease. Of 362 primary procedures, patients were predominantly male (m:f 231:157) and elderly (mean age 67 yr [17–99]). The majority of procedures were for adenoma ( $n = 227$ ) or adenocarcinoma ( $n = 106$ ). Most patients were discharged on the day of surgery. The number of procedures increased from 19 in 2007 to 90 in both 2012 and 2013. Mean OR time decreased from 90 minutes in 2007 to 50 minutes in 2013. In 362 procedures, 36 (9.7%) patients experienced a significant complication: 21 (60%) had postoperative bleeding, 15 (40%) postoperative pain/low grade infection.

Transanal endoscopic microsurgery is a safe, effective treatment for most benign and some early malignant lesions. Our experience suggests that a regional TEM referral centre leads to concentrated technical experience with this relatively uncommon procedure and outcomes comparable to other large TEM series.

37

**Combined endoscopic and fluoroscopic approach to colonic stenting: Clinical results from a single centre.** *J. Armstrong, M. Lubanovic, D. Peck, P. Colquhoun, B. Taylor.* From the Western University, London, Ont.

Self-expandable metal stents (SEMS) have been used to treat large bowel obstructions (LBO) as a bridge to surgery or a form of palliation. The aim of this study is to examine the safety and efficacy of SEMS placement using a combined endoscopic and fluoroscopic approach over a 7-year period at a single institution. We reviewed a database of all SEMS attempts between 2005 and 2012. In total, 85 SEMS were attempted. Obstruction was malignant in 78 of 85 cases (91.8%). A total of 58.8% stents were attempted for palliation, and the remainder were a bridge to surgery (BTS).

The SEMS were successfully placed in 83.5% cases (80% in palliative group v. 88.6% BTS group, 80% in benign strictures v. 86.3% in malignant). Self-expandable metal stents were placed successfully in 100% of rectal and splenic flexure strictures, 78.3% sigmoid and rectosigmoid, 66.7% descending colon and 88.9% of transverse colon strictures. Two failed SEMS were successfully placed on a second attempt following adequate bowel preparation, leaving a total of 8 patients in the palliative group who were unable to be stented. Five went to the OR, 3 underwent resection of the obstruction and 2 received loop ostomies. All 4 BTS patients who failed SEMS underwent surgery, 2 received anastomoses, and 3 received ostomies (median time to surgery 1 d v. 27 d with successful SEMS). Following successful placement in the BTS group, 28/30 went on to have surgical management. A total of 73.3% received an anastomosis, and 46.7% received an ostomy.

The SEMS complication rate was 14%, including 3 stent migrations (2 d–5 mo), and 2 perforations (11 and 16 d). Seven patients reobstructed (mean time 7 mo; 5 were successfully restented).

These results are similar to that reported in previous literature, with technical success previously reported between 71%–97%. SEMS are valuable in the treatment for LBO in various scenarios, and can be safely placed with a combined endoscopic and fluoroscopic approach.

38

**Ten-year experience with self-expanding metal stents as a bridge-to-surgery with curative intent in the treatment of colorectal adenocarcinoma presenting with acute left-sided colonic obstruction.** *A. Saleem, G. Stern, J. Faria.* From McGill University, Montréal, Que.

The use of self-expanding metal stents (SEMS) as a bridge-to-surgery in malignant colonic obstruction has been questioned recently for possibly worsening oncologic outcomes.

This study assessed the oncologic outcome of SEMS as a bridge-to-surgery in the treatment of potentially curable colorectal adenocarcinoma (CRC) presenting with acute colonic obstruction. A retrospective chart review was performed at a university hospital with over 10 years use of SEMS as first line management in colonic obstruction. All patients treated with SEMS from May 2003 to July 2013 were reviewed. Primary outcomes included overall 5-year, median, and 5-year disease free survival rates. Secondary outcomes included complication rate, anastomosis and stoma rates were determined.

A total of 265 SEMS procedures were performed in 229 patients, of which 76 were bridge-to-surgery with curative intent for CRC without evidence of metastases at time of stenting. Median follow-up was 29 (3–113) months. Procedural and clinical success rates were 98.7% (75 of 76) and 98.7% (74 of 75), respectively. Two subclinical perforations, 3 stent migrations and 3 reocclusions occurred. A total of 93.4% (71 of 76) of patients underwent surgery with curative intent, 3.9% (3 of 76) were treated elsewhere, and 2.6% (2 of 76) never underwent surgery. At surgery, peritoneal carcinomatosis was found in 7% (5 of 71) and unresectable rectal cancer in 7% (5 of 71). Primary anastomosis was performed in 85.9% (61 of 71) with 3.3% (2 of 61) anastomotic leaks. Temporary and permanent stoma rates were 8.5% (6 of 71) and 14.1% (10 of 71), respectively. Five-year overall survival and median survival were 50.4% and 59.4 months, respectively. Excluding patients with incurable disease at surgery, 5-year overall survival, median and 5-year disease-free survival were 60.4%, 83.3 months and 68.2%, respectively.

Colonic stenting with curative intent in malignant colonic obstruction can be performed with good oncologic outcome.

# Canadian Association of General Surgeons

## Association canadienne des chirurgiens généraux

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**The effect of an acute care surgery service on the management of appendicitis.** R. Krouchev, G. Champagne-Parent, V. Trottier, E. Joos. From Laval University, Québec, Que.

In recent years, the acute care surgery (ACS) model has been proposed as a novel way of providing emergent general surgery treatment. Acute appendicitis is one of the most frequent causes of acute abdomen. It has been shown that timely operative intervention reduces complication and rupture rates in patients with appendicitis. We compared hospital length of stay and outcomes in patients treated by appendectomy before and after implementation of an ACS service.

We prospectively reviewed charts from 84 consecutive patients presenting with appendicitis and treated by appendectomy after the 1st of July 2011. Key time intervals and outcomes were reviewed for this period after implementation of the ACS service. This cohort was compared with a retrospectively reviewed cohort of 85 patients, treated with the traditional model before July 1, 2011.

Complication and rupture rates were similar between the 2 groups. Time to consult (1.87 v. 6.81 h,  $p < 0.0001$ ), overall time to OR (7.2 v. 11.3 h,  $p < 0.0001$ ) and hospital length of stay (1.7 v. 2.25 d,  $p = 0.0034$ ) were significantly decreased in the ACS model. Statistical significance was even stronger when uncomplicated appendicitis only was compared (1.0 v. 1.9 d,  $p = 0.0008$ ).

An acute care surgery service seems to be an efficient way of reducing hospital length of stay in patients being treated surgically for acute appendicitis.

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**Correlation of CT hypoperfusion complex and clinical hypotension in adult blunt trauma patients.** L. Smithson<sup>§</sup>, J. Morrell,<sup>†</sup> U. Kowalik,<sup>\*¶</sup> W. Flynn,<sup>\*\*</sup> and W.A. Guo.<sup>\*\*</sup> From the \*Department of Surgery, SUNY-Buffalo, Buffalo, NY, Departments of †Radiology and ‡Surgery, Erie County Medical Center, Buffalo, NY, §Current affiliation: Department of Surgery, Providence Hospital and Medical Centers, Southfield, Mich., and ¶Current affiliation: Department of Urology, University of Vermont, Burlington, VT

The CT hypoperfusion complex (CTHC) has been reported in radiology literature, but its correlation with tenuous hemodynamic status in adult blunt trauma patients has not been well studied. We hypothesized that these CT findings represent a clinically hypoperfused state and predict outcomes.

We retrospectively reviewed 52 adult blunt trauma patients who presented to our level I trauma centre with an ISS over 15, SBP under 90 mmHg, and underwent torso CT scans over a period of 5.5 years. Patient's demographics and clinical data were

recorded. All CT scans were assessed by our radiologist (J.M.) for 26 signs of the CTHC.

The most common signs of CTHC, in order of frequency, are free peritoneal fluid, small bowel enhancement, flattened IVC and flattened renal veins. All but the first sign are associated with an increase in serum base deficit levels. Patients with one of the first 4 signs had a significantly higher ICU admission rate than those without (all  $p < 0.05$ ). Flatten IVC and renal vein were associated with low hemoglobin on admission and increased need for blood production transfusion. The amount of crystalloid resuscitation in the first 24 hours, ICU or hospital LOS did not differ between patients with and without any findings of CTHC. Logistic regression model revealed that small bowel dilatation is an independent predictor of mortality (OR 5.50, 95% CI 1.27–23.78,  $p < 0.05$ ), and splenic injury an independent predictor of laparotomy (OR 7.50, 95% CI 1.67–33.71,  $p < 0.01$ ).

The CTHC correlates with clinical hypoperfusion in blunt trauma patients, and have important prognostic and therapeutic implications. The presence of CTHC in blunt trauma patients should draw immediate attention and prompt intervention. Trauma surgeons should be familiar with these signs and include them in the clinical decision making paradigms in order to improve the outcomes of trauma.

41

**Endoscopic versus open component separation: systematic review and meta-analysis.** N. Switzer, M. Dykstra, R. Gill S. Lim, E. Lester, C. de Gara, X. Shi, D. Birch, S. Karmali. From the University of Alberta, Edmonton, Alta.

The component separation technique (CST) was developed to improve the integrity of abdominal wall reconstruction for large, complex hernias. Open CST necessitates large subcutaneous skin flaps and therefore is associated with significant ischemic wound complications. The minimally invasive or endoscopic component separation technique (MICST) has been suggested in preliminary studies to reduce wound complication rates postoperatively.

In this study, we systematically reviewed the literature comparing open versus endoscopic component separation and performed a meta-analysis of controlled studies.

A comprehensive search of electronic databases was completed. All comparison studies included in the meta-analysis were assessed independently by 2 reviewers for methodological quality.

A total of 63 primary studies (3055 patients) were identified; 7 controlled studies and 56 case series. The total wound complication rate was lower for MICST (20.6%) compared with open CST (34.6%). The MICST compared with open CST was shown to have lower rates of superficial infections (3.5% v. 8.9%), skin dehiscence (5.3% v. 8.2%), necrosis (2.1% v. 6.8%), hematoma/seroma formation (4.6% v. 7.4%), fistula tract

formation (0.4% v. 1.0%), fascial dehiscence (0.0% v. 0.4%) and mortality (0.4% v. 0.6%). The open component CST did have lower rates of intra-abdominal abscess formation (3.8 v. 4.6%) and recurrence rates (11.1% v. 15.1%).

The meta-analysis included 7 nonrandomized controlled studies (387 patients). A similar overall trend was found favouring MICST, although most types of wound complications did not show to significance. The MICST was associated with a significantly decreased rate of fascial dehiscence and was shown to be a significantly shorter procedure.

This systematic review and meta-analysis comparing MICST to open CST suggests MICST is associated with decreased overall postoperative wound complication rates. Further prospective studies are needed to verify these findings.

#### 42

**Improving perioperative management of anemia and use of red blood cell transfusions for gastrointestinal surgery — results of a practice survey of general surgeons.** *J. Hallet, L. Yohanathan, D. Wallace, J. Callum, Y. Lin, S. McCluskey S. Rizoli, R. McLeod, N. Coburn, for the Best Practice in General Surgery group. From Sunnybrook Health Sciences Centre; The Odette Cancer Centre; The University Health Network, Saint-Michael's Hospital; Mount Sinai Hospital; and the Division of General Surgery, University of Toronto, Toronto, Ont.*

Despite guidelines recommending restrictive red blood cell transfusion (RBCT) strategies, transfusion practices vary significantly. Perioperative RBCTs carry risk of increased morbidity, delayed recovery and worse oncologic outcomes for surgical patients. We sought to evaluate attitudes of general surgery (GS) staff and residents regarding perioperative anemia management and RBCTs.

We developed, test-piloted, validated, and distributed a self-administered web-based survey to GS staff and residents in a network of 8 teaching institutions. Domains assessed were 1) preoperative assessment and management, 2) postoperative RBCTs and alternative strategies, 3) risks of RBCTs, and 4) barriers and facilitators to restrictive RBCT strategy.

Response rate was 46.6% (51 of 107). 51% of respondents said they were unlikely to conduct preoperative anemia work-up. Fewer than 50% used iron or erythropoietin supplementation. Referral to a blood conservation clinic or other consultant was low (23.5% and 27.4%, respectively). Cell-saver was not used by 82% for benign disease, and by 95% for malignant disease. Most respondents indicated following guidelines for single-unit transfusion (78%) and used a 70 g/L hemoglobin trigger (92%). Triggers were over 70 g/L with cardiac history (58%), active cardiac disease (94%), symptomatic anemia (68%), and suspected bleeding (58%). RBCTs were perceived to increase postoperative morbidity (62%), but not to impact postoperative mortality (48%), recovery (54%), or cancer recurrence (52%) and survival (48%). Institutional protocols (68%), blood conservation clinic (44%), scientific evidence (90%) and guidelines (84%) were perceived as encouraging restrictive use of RBCT.

Red blood cell transfusion practice varies in GS, especially for perioperative anemia risk management. Few respondents investigated and treated preoperative anemia or used alternative transfusion strategies. Stated use of RBCT appeared consistent with restrictive RBCT strategy for most patients, but not in case of cardiac disease or anemia symptoms. Guidelines tailored to GS

practice and institutional blood conservation programs are warranted to mitigate impact of preoperative anemia and promote responsible RBCTs use.

#### 43

**Impact of a hands-on component on learning in the Fundamental Use of Surgical Energy™ (FUSE) curriculum: a randomized-controlled trial in surgical trainees.** *A. Madani, Y. Watanabe, M.C. Vassiliou, P. Fuchshuber, D.B. Jones, S. D. Schwaitzberg, G. M. Fried, L.S. Feldman. From McGill University, Montréal, Que.*

While energy devices are ubiquitous in the operating room, they remain poorly understood and can result in significant complications. The purpose of this study was to estimate the extent to which adding a novel bench-top component improves learning of SAGES' Fundamental Use of Surgical Energy™ (FUSE) electro-surgery curriculum among surgical trainees.

Surgical residents participated in a 1-hour didactic electrosurgery (ES) course, based on the FUSE curriculum. They were then randomized to 1 of 2 groups: an unstructured hands-on session where trainees used ES devices (control group) or a goal-directed hands-on training session (Sim group). Pre- and post-curriculum (immediate and at 3 mo) assessments included knowledge of ES (multiple-choice examination), self-perceived competence for each of the 35 course objectives (questionnaire) and self-perceived comfort with performance of 7 tasks related to safe use of ES. Data expressed as median (interquartile range).

Fifty-six (29 control; 27 Sim) residents completed the curriculum. Baseline characteristics and scores were similar. Total score on the exam improved from 46% (40–54) to 84% (77–91) ( $p < 0.05$ ) for the entire cohort, with higher immediate post-curriculum scores in the Sim group compared with controls (89% [83–94] v. 83% [71–86],  $p < 0.05$ ). At 3 months, performance on the exam declined in both groups, but remained higher in the Sim group (77% [69–90] v. 60% [51–80],  $p < 0.05$ ). Both groups reported feeling greater comfort and competence postcurriculum (immediate and at 3 mo) compared with baseline. This improvement was greater in the Sim group with a higher proportion feeling “very comfortable” or “fully competent” (Sim: 3 of 7 tasks and 28 of 35 objectives; control: 0 of 7 tasks and 10 of 35 objectives).

A FUSE-based curriculum improved surgical trainees' knowledge and comfort in the safe use of ES devices. The addition of a structured interactive bench-top simulation component further improved learning and retention at 3 months.

#### 44

**Is polyp detection a good surrogate marker for adenoma detection if done by surgeons?** *D. Pace, M. Borgaonkar, D. Boone, J. McGrath, N. Hickey, M. Loughheed, B. Evans, G. Fallows. From Memorial University, St. John's, Nfld.*

While adenoma detection is a validated measure of quality in colonoscopy, it can be cumbersome to obtain due to a lack of automated interfaces between endoscopy and pathology databases. No report has looked at polyp detection as a surrogate for adenoma detection for surgeons. Our objective was to determine if polyp detection is a useful surrogate measure of colonoscopy quality for surgeons.

This retrospective cohort study was performed on all adults who underwent colonoscopy in the city of St. John's, Newfoundland, in the year 2012. Patients were identified through records from the health authority. Data were extracted from the electronic medical record (EMR), including the endoscopy procedure report, the nursing record of the endoscopy, and the pathology report. Data were recorded on a standardized data sheet and entered into SPSS version 20.0 for analysis. A correlation was obtained comparing adenoma detection and polyp detection for surgeons. For comparative purposes, a similar correlation was obtained for gastroenterologists.

Thus far, data were collected on 2541 patients. Mean age was 58.3 years ( $\pm 12.5$ ) with 1414 females. A surgeon performed 1065 procedures and a gastroenterologist 1476. A total of 13 surgeons and 8 gastroenterologists were studied. The adenoma and polyp detection rates for the entire group were 19.8% and 33.7%, respectively. There was a strong correlation between adenoma detection and polyp detection (Pearson correlation 0.688) for surgeons. This was similar to the correlation for gastroenterologists (Pearson correlation 0.697).

Polyp detection appears to be a good surrogate marker for adenoma detection as a measure of colonoscopy quality for surgeons.

#### 45

**Do general surgeons need to perform 200 colonoscopies annually to maintain competence? D. Pace, M. Borgaonkar, N. Hickey, J. McGrath, G. Fallows, M. Loughheed, B. Evans, D. Boone. From Memorial University, St John's, Nfld.**

Our objective was to determine if colonoscopy quality is related to the annual case volume of surgeons. This retrospective cohort study was performed on all adults who underwent colonoscopy by a surgeon in the city of St. John's in the year 2012. Patients were identified through records from the health authority. Data were extracted from the electronic medical record (EMR), including the endoscopy procedure report, the nursing record of the endoscopy, and the pathology report. Data were recorded on a standardized data sheet and entered into SPSS version 20.0 for analysis. A  $\chi^2$  test or Fisher exact test was done to determine if there was a difference in cecal cannulation, adenoma detection, polyp detection, or perforation rate for surgeons who performed  $> 200$  (group 1, median 271) or  $< 200$  (group 2, median 114) colonoscopies in 2012.

Thus far, data were collected on 1050 patients (group 1: 707; group 2: 343). Mean age was 59.5 ( $\pm 12.2$ ) years with 550 females. A total of 12 surgeons were studied with 6 surgeons in each group. There was a significant difference in cecal intubation rate (91.1% v. 86.0%,  $p = 0.020$ ) favouring the higher volume surgeons. There was no difference in adenoma detection (15.8% v. 17.4%,  $p = 0.407$ ), polyp detection (29.3% v. 28.6%,  $p = 0.802$ ), or perforation rate (0.14% v. 0.29%,  $p = 0.543$ ).

Performing over 200 colonoscopies annually improves colonoscopy completion rates but does not appear to affect adenoma detection, polyp detection, or perforation rate.

#### 46

**The impact of introducing a designated day-time operating room for acute care surgery cases. J. Bogach, F. Farrokhvar, M. Marcaccio, S. Kelly. From McMaster University, Hamilton, Ont.**

Over the last 5 years the acute care surgery (ACS) practice model has been adopted at many surgical centres to care for emergency General Surgery admissions. This care model has been shown to decrease length of stay, decrease complications, reduce costs and decrease mortality. The role of daytime operating in achieving these benefits has not previously been investigated. In May 2011 our hospital adopted an ACS model for its General Surgery emergency admissions. One year later (May 2012) designated day time operating room time for ACS cases was introduced. This study evaluates whether patient outcomes changed based on the implementation of designated daytime ACS operating time.

All operative cases of emergency general surgery between May 2011 and May 2013 were reviewed. Time and date of operation, time and date of booking and patient age were obtained from operating room records. Using the electronic medical record, patient gender, diagnosis, procedure, complications, time of emergency department arrival, time of hospital admission and time of discharge were obtained. Cases that were not managed by the ACS service were excluded. Outcomes including length of stay, time from ER arrival to admission and time from booking a case to the beginning of the operation were calculated.

Between May 2011 and May 2013, 1161 emergency general surgery cases were booked. One hundred fifty-one cases were excluded as they were not managed by the ACS service leaving 1010 operative cases (519 pre-May 2012, 491 post-May 2012). There were no significant differences in the diagnoses and procedures performed between the 2 time periods. After the introduction of daytime operating, emergency surgeries were more likely to meet their booking classification (97.4% v. 92.9%,  $p = 0.001$ ) and were more likely to start during the day (0800 h–1659 h) (65.6% v. 39.5%,  $p < 0.001$ ). The introduction of ACS daytime operating also led to a significant reduction in the time from booking an operation to starting the operation (7.76 v. 9.33 h,  $p = 0.007$ ) and patient length of stay was decreased by 4 days (11.43 v. 15.43 d,  $p = 0.04$ ). There was no change in the postoperative complication rate between the 2 time periods (18.7% v. 18.9%).

The current surgical literature demonstrates the benefits of the ACS practice model, but the importance of having available operating room time has not yet been established. Our study has shown that implementing the daytime operating room has decreased length of stay, time to OR, and has resulted in more surgeries meeting their booking classification and occurring during the daytime, rather than the evening or night.

#### 47

**Comparing Fundamentals of Laparoscopic Surgery (FLS) and LapVR evaluation metrics ability to predict intraoperative performance of junior residents using a porcine model. S. Steigerwald, J. Park, K. Hardy, L. Gillman, A. Vergis. From the University of Manitoba, Winnipeg, Man.**

Considerable resources have been invested in both low and high fidelity simulators in surgical training. The purpose of this pilot study was to establish predictive validity for the Fundamentals of Laparoscopic Surgery (FLS, low fidelity box trainer) and LapVR (high fidelity virtually reality) training systems using a porcine cholecystectomy model in an academic centre.

Fourteen postgraduate years 1–2 (PGY 1–2) general surgery and urology residents performed tasks from the FLS program and the LapVR simulator as well as a porcine laparoscopic

cholecystectomy. Performance was evaluated using standardized FLS metrics, automatic computer evaluations, and a validated global rating scale.

Overall FLS score did not demonstrate predictive validity with Objective Structured Assessment of Technical Skills (OSATS) global rating scale. One out of 5 LapVR tasks demonstrated predictive validity with OSATS.

Neither the low fidelity box trainer nor the high fidelity virtual simulator demonstrated significant predictive validity in a cohort of junior residents. Based on these results, neither can be recommended for assessment of laparoscopic skill in this group. A larger study including a more senior group of operators is required.

#### 48

**General versus technique specific technical skills assessments – the wheel reinvented. S. Steigerwald, J. Park, K. Hardy, L. Gillman, A. Vergis. From the University of Manitoba, Winnipeg, Man.**

Reliable and valid methods of evaluating operative performance are essential for surgical training programs and education research. Laparoscopic surgery entails a unique skill set, but it is unclear whether it requires a specific assessment form or whether more general assessment tools can be applied. The purpose of this study was to assess the reliability and construct and concurrent validity of 2 previously validated assessment scales. One of these scales was designed specifically to assess laparoscopic skills, and the other to assess more general surgical skills.

A total of 26 postgraduate year 1–5 general surgery and urology residents performed a live human laparoscopic cholecystectomy. Three attending surgeon raters scored their performance using the previously well-validated Objective Structured Assessment of Technical Skills (OSATS) and Global Operative Assessment of Laparoscopic Skills (GOALS) global rating scales.

The OSATS and GOALS demonstrated reliability with a Cronbach's  $\alpha$  of 0.957 and 0.957 respectively. Construct validity was demonstrated for both GOALS and OSATS with senior residents demonstrating significantly higher scores than the junior group ( $p < 0.001$ ). Pearson's correlation coefficient between GOALS and OSATS was 0.974 ( $p = 0.01$ ).

Reliability and construct validity were confirmed for both GOALS and OSATS global rating scales. The near total correlation between the 2 scales questions the need for separate laparoscopic assessment tools. This study highlights the real strengths of the original OSATS forms, the use of which allows for more consistent nomenclature and standardized skills assessment across surgical platforms.

#### 49

**Do Fundamentals of Laparoscopic Surgery (FLS) and LapVR evaluation metrics predict intra-operative performance? S. Steigerwald, J. Park, K. Hardy, L. Gillman, A. Vergis. From the University of Manitoba, Winnipeg, Man.**

Considerable resources have been invested in both low (video trainers) and high fidelity (virtual reality simulators) for surgical training and assessment. The purpose of this study was to assess the Fundamentals of Laparoscopic Surgery (FLS) low fidelity video trainer, and the LapVR (high fidelity VR simulator), for: (1) construct and (2) predictive validity using a human cholecystectomy model.

Twenty-six participants were divided into senior ( $n = 10$ ) and novice groups ( $n = 16$ ). All participants performed 4 tasks from the FLS program, 5 tasks on the virtual simulator, and a live laparoscopic cholecystectomy. Performance was evaluated using standardized FLS metrics, automatic computer evaluations, and the previously validated Objective Structured Assessment of Technical Skills (OSATS) global rating scale.

Construct validity was demonstrated for overall FLS score ( $p < 0.001$ ). Additionally 3 of the 4 individual tasks demonstrated significance. Results were mixed for the VR simulator. Construct validity was demonstrated completely for 1 of the 5 VR tasks, incompletely for 3, and not at all for 1 of the tasks.

Predictive validity was demonstrated for overall FLS score, with overall FLS score explaining 41.5% of the variation in OSATS operative score. Additionally all 4 of the individual FLS tasks demonstrated significance. Three of the 5 VR tasks were significantly associated with OSATS scores with clipping, knot tying, and cutting explaining 45.1%, 35.9% and 39.9% of the variation in OSATS operative score respectively.

Construct and predictive validity were more thoroughly demonstrated for the FLS tasks than for the virtual reality simulator. Therefore, the higher cost VR simulators should remain experimental in resource constrained surgical education programs. Efforts instead should be focused on using the well-validated, less costly low-fidelity video trainers for assessment of laparoscopic skills.

#### 50

**Pathway-based application of APACHE 4 scoring in a cohort of surgical abdominal sepsis ICU patients. T. Chan, M.S. Bleszynski, A.K. Buczkowski. From the University of British Columbia, Vancouver, BC**

Surgical abdominal sepsis (SABS) represents a special subset of the ICU population as their clinical trajectory is modulated by source control (SC) surgery. Patients with severe sepsis/septic shock requiring urgent SC take different pathways to enter the OR and ICU. As APACHE4 is a one-time calculation of predicted mortality rate (PMR) based on the first 24 hours of ICU admission irrespective of a patient's pre- or postop status, it may not be a true reflection of the patient's prognosis.

Retrospective chart review of 691 cases of adult ( $> 18$  yr) patients admitted between 2006 and 2010 to a single tertiary care hospital's combined medical/surgical ICU with a diagnosis of abdominal sepsis or open abdomen. Patients were screened for inclusion using the 2012 ACCP/SCCM criteria of severe sepsis/septic shock plus known or suspected abdominal source requiring laparotomy for source control (SC). Patients less than 18 years of age, laparoscopy without conversion to open, trauma, abdominal sepsis without SC and cases deemed non-survivable during or immediately after initial SC laparotomy were excluded. Patients were stratified into 4 pathways based on the timing of SC in relation to ICU admission. (Pathway 1:  $< 24$  h from SC to ICU admit, 2: SC after admission to ICU for  $> 4$  h and  $< 24$  h, 3: SC  $> 24$  h after ICU admit, 4:  $> 24$  h from SC to ICU admission). PMR based on APACHE 4 was calculated using the Cerner online calculator and compared with observed mortality (OM) rates for each pathway.

A total of 211 patients fulfilled inclusion criteria. Overall mortality was 28.4% ( $n = 60$ ) with a mean PMR of 54.7%. Most

common etiologies of SABS were large bowel perforation (15.6%), small bowel perforation (14.7%), bowel ischemia (14.7%), and anastomotic leak (14.2%).

Pathways:

1.  $n = 143$ , mean age 65.2 yr, OM/PMR 24.5%/41.1%, ICU

LOS 10.7 d

2.  $n = 24$ , mean age 59.3 yr, OM/PMR 37.5%/70%, ICU LOS 12.6 d

3.  $n = 36$ , mean age 56.6 yr, OM/PMR 33.3%/43.3%, ICU LOS 25.8 d

4.  $n = 8$ , mean age 57.6 yr, OM/PMR 50%/46.4%, ICU LOS 9.6 d

A lower actual mortality rate was observed compared with the PMR in Pathways 1, 2 and 3. These results suggest that APACHE4 scores in a SABS population is reflective of a patient's source control pathway but is of limited predictive accuracy.

## 51

**Predictors of 5-year local, regional and distant recurrence of breast cancer in a population-based cohort in south-central Ontario.** *F. Fung, S. Cornacchi, T. Vanniyasingam, D. Dao, L. Thabane, M. Simunovic, N. Hodgson, M. O'Brien, S. Reid, B. Heller, P. Lovrics.* From McMaster University, Hamilton, Ont.

Studies in several areas of surgical oncology have correlated surgeon specialty and case volumes with improved outcomes, including disease recurrence and mortality. The purpose of this study was to identify tumour and surgeon predictors of local or regional recurrence, distant metastasis (LR or RR or DM) and mortality after breast cancer (BC) surgery in a population-based cohort.

Consecutive BC surgical cases from 12 hospitals in Local Health Integration Network 4 between May and October 2006 were included. Data collected on chart review included patient demographics, tumour factors, surgery type, adjuvant treatment received, surgeon specialty (surgical oncologist or general surgeon), practice type (academic or community), and surgeon case volume (1–3 cases per mo or  $\geq 4$  cases per mo). Univariate analyses were performed for 5 outcomes: LR, LR or RR, LR or RR or DM, breast cancer-specific mortality and all-cause mortality. Multivariable Cox regression analysis assessed the relationship between predictor variables and 3 outcomes: the composite outcome of LR or RR or DM, BC-specific mortality and all-cause mortality.

Follow-up information was available for 402 patients (97% of sample) and median follow-up was 5.5 years. Ten percent were in situ BC and 90% invasive (T1 58%, T2 34% and T3/T4 8%). LR, RR, and DM occurred in 18 (4.5%), 10 (2.5%), and 47 (12%) patients respectively. Significant predictors of the composite outcome of LR or RR or DM were tumour size ( $p = 0.022$ ), tumour grade ( $p = 0.005$ ), nodal status ( $p = 0.008$ ), and lymphovascular invasion (LVI) ( $p = 0.003$ ). Similarly, key prognostic factors for BC-specific mortality were tumour size ( $p = 0.013$ ), tumour grade ( $p = 0.018$ ), LVI ( $p = 0.018$ ), and surgery type ( $p = 0.033$ ).

Tumour factors such as size, grade, LVI, and nodal status predicted for the composite outcome of LR or RR or DM. However, BC recurrence was not related to surgeon specialty, practice type, or surgeon case volume.

## 52

**Safe surgical checklist in a regional hospital: an alternate communication tool.** *P. Hardy, S. Bilanski.* From the Red Deer Regional Hospital, Red Deer, Alta.

An alternate communication tool (ACT) was created to facilitate implementation of the safe surgical checklist (SSL) while maintaining good workflow in a regional hospital. Literature has identified barriers to compliance with the safe surgical checklist; however, interruption of workflow in a regional hospital with minimal house staff support has not been previously emphasized.

An ACT was developed, prospectively monitoring compliance and rationale for use in a regional hospital. In cases where essential hospital responsibilities were required, the surgeon was permitted to assess the patient, then sign and apply a preprinted yellow label on the patient's chart before surgery. The surgeon did not have to be physically present at the briefing component of the SSL. Through the ACT, the content of the SSL was preserved, while allowing the surgeon to attend other duties essential to ongoing hospital workflow. Surgeon presence at the time-out and debriefing was still required.

ACT use was monitored for an initial 1 month trial period followed by ongoing study. Frequency of use varied with each specialty, the highest usage being 59% for general surgery, 50% for orthopedics and 31% for gynecology/obstetrics. The most common reason (68%) was that the surgeon was on call. Ongoing compliance with the SSL remained high at 95%–98% over a 6-month period and no adverse events occurred. The ACT use resulted in an estimated surgeon time increase of 3240 minutes reallocated to other duties in the 1-month period.

The ACT is a variation of the safe surgical checklist that emphasizes good communication while allowing surgeons to attend other essential duties throughout the hospital during the day. This practice could be used in other hospital settings of similar size where good workflow is required, without sacrificing essential goals of the safe surgical checklist.

## 53

**To CT or not to CT? The influence of computed tomography on the diagnosis and treatment of obese pediatric patients with suspected appendicitis.** *H. Roy, B. Burbridge.* From the University of Saskatchewan College of Medicine, Saskatoon, Sask.

Suspected appendicitis (SA) is a common pediatric surgical consult. However, obesity often results in nondiagnostic ultrasound (U/S), and increased likelihood of CT. Desire to limit radiation exposure led the Canadian Association of Radiologists to recommend that, when U/S is nondiagnostic and clinical suspicion is high, surgeons consider treating without further imaging (CT). Our study's aim is to evaluate this recommendation by quantifying the influence of CT on the management of pediatric appendicitis.

We performed a 2-year, retrospective case series of children of 18 years or under presenting with SA, dividing them into obese ( $O$ ;  $\geq 85$  BMI For Age Percentile [BMIFAP]) and nonobese ( $NO$ ;  $< 85$  BMIFAP) groups, and examining how often and why they received abdominal CT, and its influence on diagnosis and treatment.

Of 223 patients ( $O = 84$ ,  $NO = 139$ ), 54 received CT. Obese patients received more CTs (29%) than  $NO$  patients (22%). The

most common reason for CT was nondiagnostic U/S (O = 75%; NO = 80%), followed by abscess investigation (O = 17%; NO = 20%). A total of 65% of CTs following nondiagnostic U/S confirmed the initial diagnosis (95% CI 50%–78%), but that number jumps to 80% when only obese patients are considered (NO = 50%). Therefore, the odds that CT will change the diagnosis of an obese pediatric patient with SA are 75% lower than for a NO patient (OR 0.25; 95% CI 0.064–0.97;  $p = 0.039$ ).

Since follow-up CT confirms suspected appendicitis in only 65% of cases, surgeons should continue to judiciously use abdominal CT, based on their level of clinical suspicion, in order to sustain low false positive rates. In so doing, they should recognize that obese patients are more likely than NO patients to have a follow-up CT that confirms their suspicion of appendicitis. Therefore, when treating an obese pediatric patient with SA and a non-diagnostic U/S, surgeons with a high clinical suspicion should strongly consider foregoing CT and proceeding with treatment.

#### 54

**Surgical procedure feedback rubric for assessing resident performance in the operating room: interim results of a validity study. A. Toprak, S. Jones, A. Winthrop, L. McEwen. From Queen's University, Kingston, Ont.**

The Surgical Procedure Feedback Rubric (Rubric) is a novel assessment tool designed to document resident performance during a single, directly observed operative encounter and provide targeted feedback to support learning in a competency-based model of surgical education. It defines performance criteria by increasing complexity through the use of behavioural anchors, thus embedding standards of performance in the tool. We report here the interim results of a 1-year multiple method case study investigating the validity of the within the Department of Surgery at our institution.

The purpose of this analysis was to determine if the Rubric was able to distinguish between levels of learners. One hundred nineteen Rubrics were completed between November 2013 and March 2014 for 15 general surgery, 15 orthopedic and 5 obstetrics and gynecology residents. All postgraduate years (PGY) were represented. The number of rubrics completed per resident ranged from 2 to 15. The Rubric contains 14 items. Factor analysis of Rubric data indicated a single factor best fit the data. A total score was obtained for each Rubric by averaging item scores. Using total score as a dependent variable, a 3-way (PGY by role in surgery by program) ANOVA was conducted.

Our initial analyses demonstrated the utility of the Rubrics in distinguishing the intraoperative performance of different PGY levels ( $F_{4, 161} = 3.83, p = 0.005$ ). Specifically, post hoc analyses using a Bonferroni procedure indicated that differences were observed between junior and senior residents. Although role and program were not found to be statistically significant factors, the interaction between PGY-level and role was significant ( $F_{3, 161} = 3.67, p = 0.04$ ). Further quantitative analysis will be conducted as data becomes available. Interviews with faculty and residents to explore Rubric use, perceived effectiveness, quality of feedback, and the impact on faculty–resident interactions will compliment quantitative results in building a validity argument for the Rubric.

#### 55

**Developing a laparoscopic ventral hernia repair program: a single surgeon's 8-year experience. C. Boulanger-Gobeil, J. Gagné. From Laval University, Québec, Que.**

The efficacy and safety of laparoscopic ventral hernia repair is now widely accepted. In order to assure adequacy of surgical approach selection in patients presenting with a ventral hernia, we completed a retrospective study of all patients operated by a single surgeon in the last 8 years. The primary outcome studied was the rate of early postoperative complications. The secondary outcomes were length of stay and operative time. A retrospective systematic chart review of all patients who underwent ventral hernia repair between 2005 and September 2013 was completed. The statistical analysis was realized with SAS. A total of 159 patients underwent hernia repair, 117 laparoscopically and 42 open. Patients selected for laparoscopic repair were significantly older (62.4 v. 55.9 yr,  $p = 0.02$ ) and had a higher BMI (30.6 v. 28.4,  $p = 0.03$ ). The overall early complication rates did not differ between groups (24.8% v. 28.6%,  $p = 0.63$ ) but surgical site infection was significantly increased in the open repair group (1% v. 9%,  $p = 0.02$ ). Mean operative time (164.8 v. 139.4 min,  $p = 0.30$ ) and length of stay (6.6 v. 4.4 d,  $p = 0.25$ ) did not show significant differences. This retrospective cohort study confirms the safety of laparoscopic incisional hernia repair. Our results reflect those of the literature and confirm the risk reduction in surgical site infection associated with a laparoscopic approach.

#### 56

**Camera navigation and cannulation: validity evidence for 2 new laparoscopic tasks. Y. Watanabe, E. Bilgic, E.M. Ritter, S. Schwaizberg, P. Kaneva, J.R. Korndorffer Jr., D.J. Scott, A. Okrainec, M. O'Donnell, L.S. Feldman, G.M. Fried, M.C. Vassiliou. From McGill University, Montréal, Que.**

Experts identified camera navigation and cannulation as important laparoscopic skills that are neither taught nor assessed by the Fundamentals of Laparoscopic Surgery (FLS). The purpose of this multicentre study was to provide validity evidence for 2 new tasks: camera navigation (N) and cannulation (C), and to explore the value of adding these tasks to the FLS program.

Participants from 5 North American centres were assessed by 2 raters during performance of N and C in addition to the 5 FLS tasks. Participants completed a questionnaire about the educational value of the new tasks. Validity evidence was assessed by comparing performance between novice (PGY1/2) and experienced (PGY3 and higher) participants, and by correlating new task scores with FLS scores. The ability to predict level of training using scores was evaluated by regression analysis.

Sixty subjects participated. Interrater reliabilities for both tasks were 0.99. Novice and experienced participants scored  $74 \pm 17.8$  versus  $85 \pm 8.3$  ( $p < 0.01$ ) and  $21 \pm 17.3$  versus  $39 \pm 20.1$  ( $p < 0.01$ ) on N and C, respectively. Correlations with total FLS scores for N and C were 0.39 and 0.53, respectively. Prediction of training level using the combination of all 7 tasks was 52% ( $p < 0.01$ ), adding an additional 3% to the 5 FLS tasks. Of 55 participants with laparoscopic experience, 51% reported N to be similar in difficulty to reality. Of 28 participants who perform intraoperative

cholangiograms, 40% found C to be more difficult than reality. Around 70% of participants thought the new tasks added value to the FLS program.

This study provides validity evidence and excellent interrater reliabilities for the metrics of the new tasks. Participants found the new tasks to add educational value to FLS. However, the benefit of adding these tasks to the FLS manual skills assessment is marginal in terms of being able to predict level of training.

## 57

**Efficacy of self-assessment in evaluating performance of nonmedical expert roles in surgical residents. F. Manji, M. Ott, B. Kidane, T. MacDougall. From the University of Western Ontario, London, Ont.**

The objective of this study was to determine the efficacy of self-assessment (SA) in evaluating the performance of surgical residents in non-medical expert CanMEDS roles.

Over 2 iterations, 31 senior surgical residents underwent a 6-station OSCE evaluating non-medical expertise. Each station was evaluated by an expert examiner, standardized patient, and SA. SA and expert examiner scores were based on identical rubrics. For each station, all 3 scores were compared using related samples Friedman's 2-way ANOVA. Where SA data was sparse, only SP and expert examiner scores were compared via the Wilcoxon signed rank test. Interrater reliability was measured for each station.

Sufficient SA data were available for 3 stations. One station ("Conflict") demonstrated a difference between examiner and SA scores ( $p = 0.049$ ) as well as an overall difference in scores ( $p = 0.006$ ). The remaining stations illustrated no difference between examiners and SA or overall difference among scorers ( $p = 0.09$  and  $0.39$  for stations, respectively). Interrater reliability yielded Cronbach's  $\alpha$  of 0.61, 0.60 and 0.65, respectively.

Insufficient SA data was available for the remaining 3 stations, thus only SP and expert examiner scores were compared. No differences in scoring were noted ( $p = 0.42$ ,  $0.38$  and  $0.39$ , respectively). Interrater reliability calculations excluding SA data yielded Cronbach's  $\alpha$  of 0.39, 0.72 and 0.61, respectively.

Two stations showed no difference between SA and expert examiner scores. The remaining station (Conflict;  $p = 0.049$ ) was marginally different. Sufficient data were unavailable to draw conclusions from the remaining stations. Our results suggest that for specific non-medical expert skills, SA can be used as a valid tool in evaluating performance. If senior surgical residents are interpreted as a close approximation to practising surgeons, this may have implications for ongoing evaluation of these skills at various levels of practice. Interestingly, 5 of 6 stations showed no significant difference between SP and expert examiner scores. This suggests that with suitable design, SPs are able to effectively evaluate performance of non-medical expert CanMEDS roles. Greater use of SPs in this setting is therefore a potential avenue to reduce demand for human resources.

## 58

**Blood transfusion knowledge of surgical residents: Is an educational intervention effective? C. Champion, J. Lampron, E. Saitenberg. From the University of Ottawa, Ottawa, Ont.**

Inappropriate use of transfusions can expose patients to unnecessary risks, and the knowledge and practices of physicians with regards to blood transfusion is highly variable. Educational interventions can result in improved transfusion practices and surgical residents are often front line caregivers in ordering blood transfusions. We undertook a pilot study to assess potential effectiveness of a blood transfusion education module for surgical residents as a model for future transfusion education for residents.

Junior surgical residents underwent a knowledge assessment, in the form of a multiple choice quiz, before participating in an education session. Educational intervention consisted of a lecture and case studies. They then received the same test after the session and 8 weeks later to assess their knowledge retention.

Preliminary data analysis shows the mean knowledge assessment scores improved from the pre- to the post-session assessments by 20%. Full data analysis is underway, and results of the retention assessments are pending.

Preliminary results demonstrate that blood transfusion knowledge of junior surgical residents may be improved by a simple educational intervention consisting of a lecture and case studies. This educational approach could serve as a model for other surgical residency training programs to improve the knowledge of residents regarding blood transfusion best practices.

## 59

**Effectiveness of suction only for appendicitis. K. Okumura, T. Kubota, A. Kishida. From Tokyo Bay Medical Centre, Tokyo, Japan**

Our objective was to evaluate our strategy for appendectomy. The subjects were 212 patients who underwent open or laparoscopic appendectomy for appendicitis between April 2012 and February 2014. We retrospectively compared the effectiveness of suction alone with irrigation in the appendectomy.

A total of 212 patients were analyzed. Postoperative intra-abdominal abscess occurred in 6 (2.8%) of the patients. There were significant differences in abscess rate, which was 1.9% with suction only and 5.5% with irrigation ( $p < 0.01$ ). The complication of intra-abdominal abscess occurred 3 (5.5%) in the irrigation group and 3 (1.9%) in the suction alone. Perforated appendicitis was 28 patients and among them there were no differences in abscess rate, which was 17.6% with suction only and 18% with irrigation ( $p = 0.195$ ).

Our strategy for suctioning might not increase the risk of post-operative intra-abdominal abscess but decrease the rate of intra-abdominal abscess.

## 60

**Trends in the Canadian Surgery Forum (CSF) — analysis of the CSF program over the past decade. C. Ball, T. Eberle, E. Dixon. From the University of Calgary, Calgary, Alta.**

Numerous clinical and basic science related innovations have been presented at the CSF. The primary objective of this study was to define changes in both the content and methodology of the CSF abstract program over the past decade.

All CSF abstracts from 2004 to 2013 were reviewed by 2 investigators for volume, content and methodology. Standard statistical methodology was employed ( $p < 0.05$ ).

Of 1214 total abstracts presented at the CSF from 2004 to 2013, the volume of abstracts per year increased over time (2004: 107; 2013: 174) ( $p < 0.05$ ). Geographic distribution of abstracts was consistent during the decade (Ontario: 49% [43%–60%], Quebec: 18% [13%–21%], Alberta: 10% [9%–11%], British Columbia: 8% [6%–12%], other;  $p > 0.05$ ). Topic content was mostly consistent across years (colorectal: 26% [18%–33%], thoracics: 10% [5%–13%], upper gastrointestinal: 8%, breast: 7%, other;  $p > 0.05$ ). Three topics displayed significant increases in abstract volume per year (surgical education: 20% [8%–27%], hepatopancreatobiliary [HPB]: 9% [2%–15%], and bariatrics: 6% [1%–8%];  $p < 0.05$ ). Retrospective methodology was present in 76% (66%–81%) of abstracts and remained unchanged ( $p > 0.05$ ). Survey (12%) and prospective (12%) methodology also remained consistent ( $p > 0.05$ ). The majority (91%) of noneducation abstracts were clinical in nature ( $p > 0.05$ ). The mean number of study participants in a given abstract ( $n = 895$  patients) was also static over the study interval ( $p > 0.05$ ). The HPB abstracts were the most methodologically sound among all categories.

While the total volume of abstracts presented at the CSF has increased dramatically over the past decade, the methodological quality remains static with few randomized trials and minimal prospective work. Surgical education, HPB and bariatric topic content has increased significantly, but remains secondary to colorectal diseases.

## 61

**Coaching surgeons: culture eats strategy for breakfast.** *D. Mutabdzic, P. Patel, N. Zilbert, N. Seemann, L. Murnaghan, C. Moulton.* From the University of Toronto, Toronto, Ont.

Evidence suggests that coaching might be an effective strategy to facilitate the ongoing development of expertise after formal surgical training. For this to be successful, surgeons' cultural beliefs and attitudes toward coaching need to be more completely understood.

A constructivist grounded theory study was conducted to explore cultural beliefs and attitudes toward coaching. Semi-structured interviews were conducted with 16 surgeons from the University of Toronto purposively sampled for different experience levels. Data were coded into categories in an iterative fashion until emerging theoretical constructs were saturated.

Broad categories of expertise, assessment, and surgeon image emerged. Experienced surgeons believed that expertise is developed individually through self-assessment and that external assessment implies need for remediation. Less experienced surgeons were more open to external assessment. Both groups expressed interest in coaching if it becomes widespread practice but were concerned that requesting coaching at present would be misperceived as admitting incompetence.

Although most participant surgeons could see the benefit of coaching, they anticipated that coaching would not be accepted in the current surgical culture. The cultural practices of independent development and self-assessment conflict with the collaborative development and external assessment proposed by coaching. Seeking coaching is seen as inconsistent with a surgeon identity that emphasizes competence and confidence. Current cultural beliefs about the development of expertise, assessment, and surgeon identity may make the successful application of coaching in surgery a challenge.

## 62

**Surgical safety checklist: the Calgary experience and attitudes.** *N. Dharampal, C. Cameron, E. Dixon, W. Ghali, M.L. Quan.* From the University of Calgary, Calgary, Alta.

Following a landmark trial showing decreased morbidity and mortality by implementation of surgical safety checklist (SSC), it has been widely, though variably, adopted into perioperative policy. We sought to explore individual attitudes and beliefs surrounding the SSC that may impact its uptake in Calgary.

Qualitative methodology was used to examine factors influencing SSC use. We performed semi-structured interviews based on Rogers' diffusion of innovation theory. Purposive and snowball sampling were used to identify surgeons, anesthesiologist and operating room nurses from hospitals in Calgary. Data collection and analysis were based on grounded theory. Two individuals (ND, MLQ) jointly analyzed data and achieved consensus on emerging themes.

Generated themes included 1) the SSC has brought structure and organization to previous informal perioperative checks, 2) the checklist is most helpful when it is modified to be simple, 3) the 3 components of the checklist were felt to be redundant — the briefing was considered the most important aspect and, similar to prior "time out" pre-incision checks. Initially the SSC was difficult to implement due to a shift in time management and perioperative culture, particularly for multitasking surgeons; however, it has now assimilated into perioperative routine. Finally, though most participants agreed that the SSC might avoid some delays and complications, few believe there have been any observable improvements to morbidity and mortality.

While the SSC has been assimilated into Calgary perioperative practice, we found participants believed that previous informal checkpoints were able to circumvent most perioperative issues. Though the SSC may help with flow and equipment, participants felt it has failed to show a subjective clinically significant improvement.

## 63

**(CJS Editors' Choice Award and CAGS Science Award) Th2-polarized invariant natural killer T cells reduce disease severity in acute intra-abdominal sepsis.** *R.V. Anantha, D. Mazzuca, S. Xu, S. Porcelli, D. Fraser, C. Martin, I. Welch, T. Mele, S.M.M. Haeryfar, J. McCormick.* From Western University, London, Ont.

Sepsis is characterized by a severe systemic inflammatory response to infection that is associated with high morbidity and mortality despite optimal care. Invariant natural killer T (iNKT) cells are potent regulatory lymphocytes that can produce pro- and/or anti-inflammatory cytokines, thus shaping the course and nature of immune responses; however, little is known about their role in sepsis. We demonstrate here that patients with sepsis/severe sepsis have significantly elevated proportions of circulating iNKT cells in their peripheral blood, as compared with non-septic patients. We therefore investigated iNKT cells in mice with intra-abdominal sepsis (IAS). Our data show that iNKT cells are pathogenic in IAS, and that T helper (Th)2-type polarization of iNKT cells using the synthetic glycolipid OCH significantly reduced mortality from IAS. This reduction in mortality is associated with the systemic elevation of the anti-inflammatory

cytokine interleukin (IL)-13, and reduction of several proinflammatory cytokines within the spleen, notably IL-17. Finally, we show that administration of OCH in septic mice is associated with significantly reduced apoptosis of splenic T and B lymphocytes, as well as macrophages, but not natural killer cells. We propose that modulation of iNKT cell responses toward a Th2 phenotype may be an effective therapeutic strategy in sepsis.

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**Risk factors for mortality among Canadian patients with *Staphylococcus aureus* bacteremia: a retrospective cohort study.** R.V. Anantha, J. Jegatheswaran, D. Pepe, F. Priestap, J. Delpont, M. Haeryfar, J. McCormick, T. Mele. From the University of Western Ontario, London, Ont.

*Staphylococcus aureus* bacteremia (SAB) is a persistent and challenging disease, with few recent studies assessing its scope and burden in a Canadian population. We evaluated the magnitude of SAB in a large cohort of patients, and identified risk factors associated with increased mortality.

We retrospectively reviewed adult (> 18 yr) patients admitted with SAB between 2008 and 2012 at a regional tertiary care centre in southwestern Ontario. Hospital records were used to identify comorbidities, complications of SAB, and mortality. Multivariable logistic regression was performed to determine predictors of overall, in-hospital, and postdischarge mortality.

We identified 925 patients in our study. The proportion of methicillin-resistant *S. aureus* (MRSA) strains rose significantly during the study period ( $p = 0.045$ ), while in-hospital mortality declined significantly (29% in 2008 to 11% in 2012,  $p < 0.0001$ ). Age, MRSA, sepsis, admission to the intensive care unit, hepatic failure and metastatic malignancy were associated with overall mortality and — with the exception of MRSA — in-hospital mortality. In contrast, MRSA, hepatic failure, cerebrovascular disease, COPD and metastatic malignancy were associated with increased postdischarge mortality.

This study features one of the largest retrospective cohort studies of SAB in Canada, and identifies key factors associated with in-hospital and postdischarge mortality. Identification of these predictors may guide empiric therapy and provide prognostic clarity for patients with SAB during and after their hospital admission.

65

**Defining needs in improvement of communication: a quantitative and qualitative appraisal of interprofessional pages communications.** D. Wallace, J. Hallet, A. El-Sedfy, L. Gotlib-Conn, A.B. Nathens, A.J. Smith, N. Ahmed, N.G. Coburn. From Sunnybrook Health Sciences Centre; The Odette Cancer Centre; and the Division of General Surgery, University of Toronto, Toronto, Ont.

Traditional nurse–resident paging communication presents a challenge to both education and timely patient care. Inefficient communications are a source of suboptimal learning, workflow interruption, and potential medical error. We evaluated paging patterns on a general surgery (GS) service to develop a paging taxonomy with a view toward improving the use of and response to paging between nurses and residents.

A quantitative and content analysis was conducted of alphanumeric pages (ANP) received by GS residents over 4 weeks at a single academic institution. We looked at overall and per person

pages by number, timing, and interval. Using an inductive content analysis, 2 independent assessors classified ANP thematically.

We retrieved 2031 pages, including 876 (43%) exclusively numeric messages. Junior residents received 79.3% of pages. Pages timing was 44% weekday regular duty, 32% weekday call, 24% weekend call. Median page interval was 9.4 minutes (range 0–640) overall. Content analysis generated 5 major themes: administrative (17%), routine nonurgent medical assessment (71%), medical urgency (5%), GS consultation (7%) and patient/family communication (14%). Communication priority (required intervention time) was 54% low (61+ min), 24% moderate (16–60 min) and 4% as high (1–15 min).

Pages from the surgical unit are frequent and seldom related to urgent medical matters. New communication strategies are warranted for optimizing patient safety, educational experience, and use of residents' time, especially considering the redesign of residents' duty hours. These results will serve as basis to develop a guideline for improving interprofessional communications in GS.

66

**Catheter related bloodstream infections due to *Staphylococcus aureus*: a retrospective review.** D. Pepe, R. Anantha, J. Jegatheswaran, T. Mele, J. McCormick. From the University of Western Ontario, London, Ont.

*Staphylococcus aureus* bacteremia is an important cause of morbidity and mortality, especially in patients with indwelling venous or arterial catheters. Efforts to reduce catheter-associated bloodstream infections (CABI) remain challenging. We sought to evaluate the incidence and outcomes of CABI at a large tertiary care centre in southwestern Ontario. Between Jan. 1, 2008, and Dec. 31, 2012, we retrospectively reviewed adult inpatients with  $\geq 1$  positive blood culture for *S. aureus* and an indwelling peripheral arterial catheter or central venous catheter. We reviewed patient demographics, comorbidities, length of hospital stay, and mortality. Continuous and dichotomous variables were compared by Mann–Whitney  $U$  test or Pearson  $\chi^2$  test, respectively.  $p$  values less than 0.05 were considered statistically significant. We identified 1114 patients with *S. aureus* bacteremia; 103 patients (9.2%) had CABI. Among patients with CABI, 35% had methicillin-resistant *S. aureus* (MRSA) infection while 65% were infected by methicillin-sensitive *S. aureus* (MSSA). Attributable mortality from CABI was 25% and 34% for MRSA and MSSA infections, respectively. After the implementation of a targeted campaign to reduce CABI in 2011, mortality from MSSA CABI declined from 76% in 2008 to 20% in 2012. However, there was no reduction in mortality from MRSA CABI between 2008 (33% mortality) and 2012 (30%). Catheter-associated bloodstream infections secondary to *S. aureus* infections continue to result in significant mortality especially for MRSA infections. However, the implementation of targeted campaigns has been demonstrated to significantly reduce MSSA-related CABI. Further analysis is necessary to determine the optimal timing and duration of therapy, as well as to identify risk factors that can predispose patients to developing CABI.

67

**Does ultrasound predict intraoperative findings at cholecystectomy? An institutional review.** S. Stogryn, J. Metcalfe, A. Vergis, K. Hardy. From the University of Manitoba, Winnipeg, Man.

Ultrasound (US) is the mainstay of biliary tract imaging, but few recent studies test its ability to diagnose acute cholecystitis (AC). Our objective was to determine how well an US diagnosis of AC correlates with the intraoperative diagnosis. We hypothesize that US under calls the diagnosis of AC leading to unexpected findings in the operating room (OR).

This retrospective review included all patients admitted to the acute care surgical service of a tertiary hospital in 2011 with suspected biliary pathology who underwent an US and subsequent cholecystectomy. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of US were determined using the intraoperative diagnosis as the gold standard. Further analysis identified which US findings were most predictive of an intraoperative diagnosis of AC. Logistic regression was used to analyze the effect of patient demographics, time to OR, and degree of wall thickness on US reliability. A recursive partitioning method with random forests was used to identify unique combinations of US findings which, together, are most predictive of AC.

Of 288 patients receiving an US for biliary symptoms, 152 were diagnosed with AC, and 143 (94%) then underwent emergency surgery (median time to OR 23.03 h). Ultrasound predicted intraoperative findings with a sensitivity (73.22%), specificity (85.48%) and PPV (93.71%). Negative predictive value (51.96%) was quite low. The false negative rate of US was 48.04%. The US indicators most predictive of AC were a thick wall, a positive sonographic Murphy's, and cholelithiasis. Logistic regression showed that selected patient demographics, time to OR, and degree of wall thickness had no significant effect on the accuracy of US diagnosis. Recursive partitioning demonstrated that a positive sonographic Murphy's is independently predictive of high risk of intraoperative AC. Ultrasound is highly sensitive and specific for diagnosing AC. The poor NPV confirms our hypothesis that US can under call AC.

## 68

**Unplanned admission following day care laparoscopic cholecystectomy.** *N. Seyednejad, D.E. Konkin, M. Goecke.* From the University of British Columbia, Vancouver, BC

Laparoscopic cholecystectomy is the standard of care for symptomatic cholelithiasis. Many institutions have developed the practice of day care laparoscopic cholecystectomies. However, there is a low rate of adverse complications, which result in unplanned admissions following this procedure. The objective of this study was to recognize the factors that are associated with an increase in unplanned admissions in order to better identify the cohort of patients suitable for daycare laparoscopic cholecystectomies. In addition, we identified the time interval over which most unplanned admissions occur.

A multicentred, case-controlled study design was performed using retrospective charts. Data was collected from Jan. 1, 2009, to Dec. 31, 2011, on consecutive patients undergoing planned laparoscopic cholecystectomy in 3 hospitals. Patient demographics, surgical details, and postoperative details were obtained and analyzed.

Over this time period, 1256 daycare laparoscopic cholecystectomies were performed. One-hundred twenty-one (9.6%) required unplanned admission the day of surgery. Forty-three

(3.4%) were admitted within 1 month of surgery. The median time from surgical procedure to unplanned admission was 218 ± 143 minutes. Compared with case-controls, the unplanned admitted patients were older (54.6 v. 45.1 yr,  $p < 0.005$ ), and had ASA III scores after anesthesia assessment (24.0% v. 3.0%,  $p < 0.005$ ). The comorbid conditions that resulted in unplanned admissions included patients with hypertension (40.5% v. 25.7%, OR 1.97), diabetes (18.2% v. 4.3%, OR 4.96), and chronic pain (76.0% v. 48.6%, OR 3.36).

Day care cholecystectomy for symptomatic cholelithiasis has been adopted by many centres and has been beneficial for both patients and health care institutions. While many patients can be successfully managed with day care surgery, a standard observation time following surgery needs to be established to assess the need for unplanned admissions and allow for early intervention when adverse complications occur. We found that patients with increased age, higher ASA scores, hypertension, diabetes and chronic pain were at an increased risk of unplanned admissions following laparoscopic cholecystectomies. These factors should be taken into account when assessing patients' appropriateness for day care surgery.

## 69

**Laparoscopic versus open surgical management of perforated peptic ulcer — a comparison of outcomes.** *L. Ambrosini, F. Saleh, M. Jimenez, J. Byrne, J. Gnanasegaram, F. Quereshy, T. Penner, T. Jackson, A. Okrainec.* From the University Health Network, Toronto, Ont.

The objective of this study was to investigate the outcomes of patients with perforated peptic ulcer treated (PPU) laparoscopically as compared with those treated by open surgery.

We performed a retrospective review of all patients managed surgically for PPU at our institution between January 2005 and October 2012. Data abstracted included patient demographics, comorbidities, and operative details. Outcomes collected included short-term postoperative morbidity and mortality, reoperation, and length of stay (LOS). The laparoscopic group included patients with conversion to open. Univariate analysis and multivariate logistic regression provided a comparison of the rates of complications between both groups.

A total of 105 patients managed surgically for PPU were included in our study. 36 patients (34.2%) were treated with initial laparoscopy, while 69 had conventional open surgery. While the laparoscopic group tended to be younger (mean age 54.2 v. 61.8 yr,  $p = 0.036$ ), there were no significant differences with respect to sex (72.2% v. 63.8% males,  $p = 0.383$ ) or the presence of important comorbidities, history of previous operation, or use of steroids ( $p > 0.05$ ). Of the 36 patients initiated laparoscopically, 7 (19.4%) were converted to the open approach. The overall complication rate was significantly lower in those treated with laparoscopic surgery (59.4% v. 30.5%,  $p = 0.005$ ), while our multivariable logistical regression, adjusting for important patient characteristics, confirms a significant reduction in the odds of adverse outcome (OR 0.27, 95% CI 0.08–0.93,  $p = 0.037$ ). Median length of stay was shorter in those treated with laparoscopy (median of 5 v. 9 d,  $p = 0.009$ ).

Treatment of patients with PPU by an initial laparoscopic approach appears to be safe, and was associated with a reduction

in adverse outcomes as compared with conventional open management as well as a reduction in length of stay. The laparoscopic approach may be considered a therapeutic tool in cases of suspected perforated ulcer. Further research is needed to better understand appropriate patient selection and predictors of successful laparoscopy.

## 70

**The effect of blocked versus random task practice schedules on the acquisition and retention of surgical skills. J. Rivard, A. Vergis, B. Unger, L. Gillman, K. Hardy, J. Park. From the University of Manitoba, Winnipeg, Man.**

When learning multiple tasks, trainees can practise in blocked or random schedules. Blocked practice involves repeatedly performing a single task before moving on to the next task. Random practice involves never repeating the same task on successive trials. The motor learning literature suggests that random practice may be more effective for long-term learning, but the applicability to surgery has received little study. Popular surgical skills programs like the Fundamentals of Laparoscopic Surgery (FLS) continue to endorse blocked practice schedules. We assessed the effects of blocked and random schedules of task practice on the acquisition and retention of laparoscopic skills.

Laparoscopic novices ( $n = 36$ ) were randomized to practise 4 FLS tasks using 1 of 3 practice schedules: blocked, random or controls (no additional training). The blocked and random groups practised the same number of trials for each task. Participants performed an immediate post-test to assess skill acquisition, followed by retention tests 6 weeks later to assess skill learning. Outcomes included previously validated FLS and hand-motion efficiency (HME) scores.

Both blocked and random groups had significantly higher FLS and HME scores over baseline on the immediate post-tests for each task ( $p < 0.05$  for both blocked and random groups' FLS and HME scores). Both blocked and random groups also had significantly higher overall FLS and HME scores than controls on the retention tests ( $p < 0.05$  for both blocked and random v. control groups' FLS and HME scores). No difference was seen between the blocked and random groups in the amount of skill acquired or skill retained.

Both blocked and random training formats had a positive effect on skill acquisition and improved skill retention, but we did not demonstrate an advantage to one over the other. Both schedules can be considered as valid training options to allow each program and learner to tailor training to their individual needs.

## 71

**Surgical abdominal sepsis (SABS): insight into inflammatory cytokines in peritoneal fluid and serum during initial source control surgery. M. Bleszynski, T. Chan, A. Buczkowski. From the University of British Columbia, Vancouver, BC**

Retrospective surgical abdominal sepsis (SABS) data (unpublished) has shown in severe sepsis/septic shock a significant difference in mortality between primary abdominal closure (PAC) (38.7%) and vacuum assisted closure (VAC; 22.8%), even though VAC is reserved for increased clinical severity of sepsis. There is no definitive inflammatory cytokine distinguishing between severity of sepsis or mortality in order to guide the decision for

PAC or VAC at initial source control laparotomy (SC1). Hepatocyte growth factor (HGF) is released in response to systemic inflammation.

The goal of this study was to determine if concentrations of serum or peritoneal fluid (PF) cytokines are able to differentiate between PAC and VAC.

Prospective case series of patients screened preoperatively to fulfill criteria of severe sepsis/septic shock according to 2012 ACCP/SCCM criteria requiring emergent SC1. Surgeon at time of SC1 determined the decision for PAC or VAC. In OR blood samples obtained via an arterial line pre- and postoperatively of SC1. PF samples were obtained via 10cc syringe after abdomen opened before any other intra-abdominal manipulation. Samples kept on ice, centrifuged within 1 hour at 1500g for 5 minutes, supernatant collected and frozen at  $-70^{\circ}\text{C}$ . Serum/PF fluid analyzed with a Human Cytokine 30-Plex Panel. Observed concentrations reported as pg/mL. Mann-Whitney  $U$  test used to compare PAC and VAC.

Twelve patients, 4 PAC and 8 VAC cases from SC1. The PAC mortality was 25%, septic shock before SC1 was 75% and mean age was 68.5 years. VAC mortality 37.5%, septic shock before SC1 100%, and mean age was 56.5. PF concentrations of IL-6, IL-17, (pro-inflammatory cytokines), IL-5 and HGF; 9746, 1.45, 3.68 and 613, respectively, in PAC compared with 17176, 6.2, 12.8 and 4350 in VAC ( $p < 0.05$ ).

PF concentrations of IL-6, IL-17, IL-5, and HGF significantly differentiated between VAC and PAC cases and also indicated that VAC cases had a more severe sepsis at the time of SC1.

## 72

**Compliance with evidence-based guidelines in acute pancreatitis: an audit of practices in 8 academic teaching hospitals. J. Greenberg, J. Hsu, A. Nathens, M. Bawazeer, N. Coburn, J. Friedrich, J. Marshall, H. Huang, R. McLeod. From the University of Toronto, Toronto, Ont.**

Acute pancreatitis (AP) is a common illness in Canada, with 15 000 new cases each year costing \$120 million. To optimize patient care, an evidence-based institutional guideline for the management of AP was developed. A review of clinical practice at 8 teaching hospitals was undertaken to determine if a current gap in care exists before implementation of the guideline.

A retrospective review of 248 patients admitted between Jan. 1, 2010, and Dec. 31, 2011, at 8 affiliated teaching hospitals was conducted, including all AP patients admitted to the ICU, and a random sampling of 25 non-ICU AP patients admitted to each site. Demographic, etiologic, diagnostic, and management data were reviewed, and compared with guideline recommendations.

Only 56 patients (22.6%) had serum lipase as their sole biochemical test. Ultrasound was performed on admission in 174 (70.2%) patients, but 86 (34.6%) also underwent CT scan without indication. Of 196 non-ICU patients, 158 (80.6%) were maintained *nil per os* on admission for an average of 1 day. Of 52 patients admitted to the ICU, 20 (38.5%) patients received enteral nutrition, starting an average of 11.9 days after admission. Fifty-six (28.5%) non-ICU patients and 37 (71.2%) ICU patients received antibiotics without confirmed infection. Only 24 of 106 patients (22.6%) with gallstone pancreatitis underwent index admission cholecystectomy. Just 16 (31%) patients with biliary obstruction on ultrasound underwent

ERCP, and although 82 patients with gallstone pancreatitis were discharged without cholecystectomy, only 18 (22%) underwent a preventative ERCP with sphincterotomy.

Currently, there are significant gaps in the care of patients presenting with AP in the areas of diagnosis, nutrition, antibiotic use, and management of gallstone specific pancreatitis. A tailored knowledge translation strategy is required to improve compliance with guideline recommendations, optimize clinical care, and conserve valuable healthcare resources.

### 73

**The use of computed tomographic gastrography to aid with laparoscopic gastric resection. M. Khokhotva, A. Zalev, T. Grantcharov. From St. Michael's Hospital, University of Toronto, Toronto, Ont.**

This study aimed to assess the clinical utility of preoperative computed tomographic gastrography (CTG) in developing optimal approach to laparoscopic resection of gastric tumours.

Twenty-one patients were included in this case series. All underwent CTG as part of the preoperative investigation of their gastric lesions. Scanning was performed in supine, prone, and decubitus positions after administration of intravenous contrast, oral effervescent agent, and an antiperistaltic medication. Multiplanar reformatting was created and endoluminal images were obtained. The tumours were localized and distances to the gastroesophageal junction and the pylorus were calculated. CT angiograms were created by reconstructing relevant arterial and venous imaging for 13 patients. All patients underwent upper gastrointestinal endoscopy and laparoscopic exploration with curative intent.

Twenty patients underwent complete resection. Thirteen had laparoscopic wedge resections for gastrointestinal stromal tumours (GISTs) (9), aberrant pancreas (1), Castleman disease (1), hyperplastic polyp (1), neuroendocrine tumour (1). One patient had a laparoscopic-assisted wedge resection for GIST. Three patients had laparoscopic-assisted subtotal gastrectomies for adenocarcinoma. Three patients had laparoscopic-assisted total gastrectomies for adenocarcinoma (2) and GIST (1). One patient with adenocarcinoma had extensive peritoneal carcinomatosis and did not undergo resection of the primary lesion. Computed tomographic gastrography provided accurate localization of the tumours and their relation to anatomic landmarks and gastric vasculature. Endoluminal images could be readily accessed intraoperatively and were a reliable adjunct when tumour localization was difficult with laparoscopy or gastroscopy.

In these series, CTG was particularly useful in cases of laparoscopic resection of proximal and posterior gastric subepithelial lesions. Overall, this imaging modality may aid operative planning and intraoperative decision making in laparoscopic gastric resections.

### 74

**Engaging nurses in the implementation of an enhanced recovery after surgery (ERAS) program. M. McKenzie, M. Aarts, L. Gotlib, S. McCluskey, A. Okrainec, E. Pearsall, N. Siddiqui, R. McLeod. From the University of Toronto, Toronto, Ont.**

The objective of this study was to assess the overall satisfaction of nurse champions (NC) in implementing ERAS at their hospital and to understand what aspects of the knowledge translation (KT) strategy were most effective. The primary KT strategies included standardized order sets, clinical pathways, workshops and conference calls.

The survey included 15 items which assessed their satisfaction with the support of the central team, value of various methods of communication, and their role and support locally. Items could be rated from strongly agree to strongly disagree and comments could be added.

Eleven NC (73%) responded to the online survey. All NC agreed or strongly agreed that they received adequate support from the central team and the central team is approachable. All NC like the monthly conference calls and 91% feel they are part of a community practice. Being able to share best practice (82%), asking questions and getting updates (100%) were reported to be the most important aspects of the monthly conference calls. While they reported strong support from the central team, only 45% felt that site visits and workshops were useful to assist in implementation. Locally, all reported that they have regularly scheduled or ad hoc meetings with their teams and feel they have adequate support. They also commented that they like the patient contact, collaboration and networking with nurses and other disciplines as well as the improved patient outcomes and satisfaction. Reported frustrations include lack of time and conflicting priorities, ensuring all members of the team are engaged and poor staff engagement.

The nurse champions are an integral part of the implementation of an ERAS program. Overall they are satisfied with their role in the iERAS program.

### 75

**The identification of critical moments in surgery: How consistent are we? N. Zilbert, L. St-Martin, D. Mutabdzic, S. Gallinger, G. Regehr, C.A. Moulton. From the University of Toronto, Toronto, Ont.**

The ability to appropriately interpret intraoperative information is a critical aspect of surgical expertise. This study was undertaken to explore how general surgeons interpret videos of laparoscopic cholecystectomies.

Ten general surgeons were asked to think aloud while viewing edited videos of 4 laparoscopic cholecystectomies. Sessions were audiotaped and transcribed. Moments of Concern (MCs), defined as moments when a participant felt the operator's action was unsafe, were identified. The participants were then asked to watch the videos a second time. This time the videos were paused at each previously identified MC and the participants were asked to rate their degree of concern using a 7 point scale (1 = "No Concern. This is safe", 7 = "Maximum concern. High risk of iatrogenic complication").

A total of 37 MCs were identified across the 4 cases. Each MC was identified by between 1 and 8 participants. Relatively few MCs (11 of 37, 30%) were identified by 6 or more participants. The single rater intraclass correlation coefficient (ICC) for the ratings of concern was 0.26, indicating that any one surgeon rating their concern at these MCs would not be represented by our sample's performance.

However, the average rater ICC for our sample was 0.78, indicating overall consistency for the concern ratings by our participants.

Individual surgeons appear to be idiosyncratic in their identification of MCs and their rating of concern at each MC. As a group our sample was consistent in their ratings of concern. These findings add to increasing evidence that there is significant variation among individual expert surgeons in a variety of domains. Future work will compare these responses to those of surgical residents and explore the consequences of this variability in expert performance.

## 76

**Advanced graduate trauma education and quality patient safety programs. United efforts achieve sustained improvements in clinical outcomes. Observations from a rapidly developing country. R. Peralta, A. Parchani, R. Consunji, A. ElMenyar, H. Abdelrahman, A. Zarour, H. Al Thani. From the Hamad General Hospital, Doha, Qatar**

Trauma is the leading cause of death in Qatar. Trauma centres are associated with improved patient outcomes through robust continuing medical education and performance improvement programs. This study will describe the effect of implementation of a Trauma and Surgery Critical Care Fellowship Program with an established trauma performance improvement program in a trauma centre by reducing hospital mortality for the injured patients in Qatar.

A retrospective analysis of data from the trauma registry was conducted for the years 2010 to 2012. Comparisons of process and outcome measures were done and the number of physicians undergoing advanced training in our program were computed and compared during the study period.

There was a 40% reduction in hospital trauma mortality rate from year 1 to 2 of the study period, from 5% to 3%. The sustained mortality reduction persisted into year 3 of the study. A 30% reduction of length of stay for our severely injured patients was also observed.

The implementation of an advanced postgraduate training program in trauma and critical care medicine in conjunction with a robust trauma performance improvement program resulted in reduced rates of trauma mortality in the second year and this effect was sustained in its third year.

## 77

**Variability in the use of bowel exteriorization for penetrating colon injury: results from the American College of Surgeons Trauma Quality Improvement Program (ACS-TQIP). D. Li, C. de Mestral, A. Alali, A. Nathens. From the University of Toronto, Toronto, Ont.**

Trauma guidelines recommend primary repair or resection without bowel exteriorization (stoma) in treating penetrating colon injuries, for stable patients with minimal associated injuries and comorbidities (level I-II evidence). We sought to characterize the extent of practice variability in stoma usage across centres.

Adults undergoing surgery for penetrating colon injury at ACS-TQIP centres in 2010 to 2011 were included; those surviving under 48 hours were excluded from analysis. Standard-

ized stoma rates were compared across hospitals to evaluate practice variability while adjusting for case-mix. Determinants of variation were explored using multilevel regression modeling.

We identified 1399 patients treated at 130 centres. Mean age was 32 years, 90% males, 84% were due to firearm injuries, and the median injury severity score was 17. The mortality rate was 3.4%; 22% of patients received a stoma. Median volume over the 2-year period was 8 cases per centre (IQR 3–13). Centres varied significantly in rates of stoma use (median 17%, IQR 0%–29%); this persisted after adjusting for patient factors and injury severity. In evaluating the standardized diversion rate using observed to expected ratios, 41 hospitals fell below and 3 hospitals above the 95% CI. The median odds of receiving a stoma were 1.48 times higher for the same patient treated at one randomly selected centre versus another. There was no mortality difference between low- and medium-high rate centres (2% v. 3%,  $p = 0.59$ ). Patient factors alone accounted for 29% of the variability in stoma use; 36% is accounted for by patient and hospital characteristics in a multilevel regression model. Measured hospital factors such as volume and teaching status did not predict stoma use.

There is significant institutional variability in the use of bowel exteriorization for penetrating colon injuries. Further research is needed to understand the basis for inter-hospital variability, and to inform strategies for practice standardization.

## 78

**Examining the learning curves of incoming surgical trainees: a national cross-sectional study. M. Louridas, E. Shore, N. Seemann, T. Grantcharov. From the University of Toronto, Toronto, Ont.**

Changes in surgical education have resulted in fewer cases completed by trainees by the time of graduation, potentially threatening achievement of technical competence. Thus, an awareness of the rate at which trainees acquire technical skill is becoming increasingly more important. The purpose of this study was to examine the learning curves for 2 simulated laparoscopic tasks in candidates pursuing surgical training.

All applicants to the postgraduate General Surgery or Obstetrics and Gynecology programs at a large academic institution in 2014 were approached to participate in the study. Participants completed between 8 and 10 timed repetitions of the laparoscopic circle cut (CC) task on a box trainer, and the lift and grasp (LG) task on a virtual reality simulator. Learning curves were examined for both tasks using linear regression analysis.

Eighty-one participants were enrolled and completed both tasks. Large variability was seen within the cohort (CC range 54–300 s and LG range 35–137 s). Four distinct learning curves were seen: high performers with strong innate ability (CC 6% of cohort and LG 9% of cohort), rapid learners (CC 33%, LG 38%), mid performers (CC 45%, LG 31%) and poor performers with low innate ability (CC 20%, LG 22%). The high performers with strong innate ability and rapid learners were most consistent in their performance across the tasks.

A large range of innate technical aptitude and early learning ability is present among incoming surgical residents. Stratifying technical skill using learning curves upon entry to

residency may be beneficial in tailoring individual technical skill coaching.

## 79

**Assessing technical competence in surgical trainees: an international surgical education directorates perspective.** *P. Szasz, M. Louridas, S. de Montbrun, K. Harris, T. Grantcharov.* From the University of Toronto, Toronto, Ont.

Competency-based education is being integrated into surgical training programs worldwide. However, the implementation of meaningful competency-based assessments has proven difficult. The objective of this study was to assemble an international perspective on: 1) current practices for assessing technical competence across all the stages of surgical training and 2) barriers to the adoption of such assessments as a required component of surgical society certification.

An open-ended online questionnaire was distributed to 10 education directorates of their respective surgical societies. Seven responses were received, with representation from Canada, England, Ireland, Denmark, Hong Kong, Sweden and the Netherlands.

Two major issues were identified. First, assessing technical competence across the full spectrum of training was seen as important by a majority of directorates. Few countries, however, utilize such assessments during selection (2) or certification (2) compared with during training (6). Second, the major barriers to the adoption of assessments differ depending on the time point of training. Common barriers include: lack of evidence for use in selection (6), financial limitations for test administration during training (4) and a combination of both with respect to certification (3).

Based on our results, a void exists in assessing the technical competence of trainees, in particular at the selection and certification stages of training. Increasing the adoption of assessment will require addressing financial and resource barriers to their implementation. Moreover, despite the emergence of several assessment tools, further knowledge translation efforts are needed to disseminate them to the surgical education community.

## 80

**Retention of ultrasound education: A survey of surgical residents.** *R. Hilsden, B. Moffat, M. Ott, N. Parry.* From the Western University, London, Ont.

At Western University, formal ultrasound education training was first provided to all postgraduate year 1 (PGY-1) surgical residents during the principles of surgery (POS) course in 2010. All residents completed a pre-education intervention survey, which evaluated their ultrasound knowledge, followed by a didactic and hands on session after which the same survey was repeated. These PGY-1 residents were resurveyed again 1–2 years after completion of the course to evaluate their retention of ultrasound knowledge.

A total of 111 surveys were completed in 2013. Forty-eight PGY-1 residents, representing 2 consecutive PGY-1 cohorts, constituted the pre-education group. Twenty-three of a possible 63 residents who had participated in ultrasound education during POS in previous years were surveyed, and constituted the delayed retention group.

Residents scored an average of 65.5% (95% CI 59.8%–71.3%) before the POS ultrasound education session and 90.2% (95% CI 93.5%–86.9%,  $p < 0.001$ ) immediately after. Upper year residents that had participated in the ultrasound education session 1 to 2 years prior scored 85.3% (95% CI 79.8%–90.7%). This represents a significant and persistent improvement compared with the pre-education group ( $p < 0.001$ ). PGY-2 and PGY-3 residents who indicated they use ultrasound on a regular basis scored significantly higher compared with residents that did not frequently use ultrasound (92.3% CI 88.2–96.4 v. 80.7% CI 72.8–89.3,  $p = 0.023$ ).

This educational survey demonstrates that the implementation of a didactic and hands on educational session has resulted in long-term retention of ultrasound concepts. This retention was durable among residents that do not use ultrasound on a regular basis as part of their residency education.

## 81

**Laparoscopic versus open surgical management of adhesive small bowel obstruction: a comparison of outcomes.** *J. Byrne, F. Saleh, L. Ambrosini, C. Jimenez, J. Gnanasegaram, F. Quereshey, T. Jackson, A. Okrainec.* From the University of Toronto, Toronto, Ont.

While laparoscopic management of small bowel obstruction (SBO) has gained much acceptance within the realm of acute care surgery, controversy remains regarding safety. The objective of this study was to compare outcomes in patients undergoing emergency surgery for adhesive SBO by laparoscopic versus open surgery.

We performed a retrospective review of patients who underwent emergency surgery for adhesive SBO at our institution between April 2005 and September 2013. Patients who underwent laparoscopic-converted-to-open surgery were included in the laparoscopic group with view to intention-to-treat analysis. The primary outcome of this study was overall complications, while secondary end points included operative and short-term postoperative outcomes. Univariate and multivariate analyses provided comparison of outcomes between groups. Multivariable logistic regression was used to examine the relationship between overall complications and surgical approach.

A total of 303 patients underwent surgery for acute adhesive small bowel obstruction during this period. A total of 218 patients (71.9%) underwent open surgery, while 85 (28.1%) were managed laparoscopically. Within the laparoscopic group, 32 (37.6%) were converted to open surgery. While mean operative time was comparable between groups, there was significant reduction in intraoperative blood loss with laparoscopy (51.9 v. 87.4 mL,  $p = 0.030$ ). Time to recovery of gastrointestinal function, as indicated by passage of flatus, was shorter in the laparoscopic group (3.0 v. 3.9 d,  $p = 0.003$ ). Median length of stay was also shorter (5 v. 7 d,  $p = 0.033$ ). In-hospital mortality was significantly lower in the laparoscopic group (1.2% v. 7.3%,  $p = 0.036$ ), as was the overall complication rate (28.2% v. 46.3%,  $p = 0.004$ ), with an associated reduction in the odds of an adverse event through multivariable logistic regression (OR 0.40,  $p = 0.003$ ).

Treatment of patients with adhesive SBO by laparoscopic approach is safe, associated with quicker recovery, and reduction in adverse outcomes compared with open surgery. Further analysis is required to determine predictors of successful laparoscopic completion.

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**Early clinical experience and approach with POEM procedure for achalasia. D. Hong, R. Pescarus, R. Khan, M. Anvari, M. Cadeddu. From McMaster University, Hamilton, Ont.**

Per oral endoscopic myotomy (POEM) is a viable option to standard Heller's myotomy for surgical treatment of achalasia. Outcomes from USA, Europe and Asia have been reported. This is the first reported data from a Canadian-initiated centre for POEM.

All patients with achalasia were enrolled in a REB-approved pilot study. The surgeons learned the POEM procedure in a systematic manner that included visiting experts in POEM, practice in an animal laboratory and mentoring from POEM experts. Preoperative evaluation included manometry, 24-hour pH, barium swallow, endoscopy, Eckhardt and Achalasia Severity Symptom Score (ASSS). All patient had postoperative gastrografin swallow on postoperative day 1. Patients were re-evaluated with Eckhardt score and ASSS on postoperative day 14.

Six patients underwent POEM procedure. All 6 patients had previous treatments (5: balloon dilatation, 1: botox). Mean preoperative Eckhardt score was 9. Mean preoperative ASSS was 50. No intraoperative or postoperative complications occurred. Mean operative time was 140 minutes. No postoperative complications occurred. Mean length of hospital stay was 1 day. On postoperative day 14, mean Eckhardt score was 1.25 and mean ASSS was 13.

Our approach to POEM introduction was systematic and deliberate. Our early results are consistent with current literature.

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**(CAGS Science Award) "Being cordial" and "being competent": surgeon's roles in the operating theatre. C. Mui, M. A. Martimianakis, S. Espin, L. Robinson, P. Patel, G. Lorello, T. Everett, M.L. Murnaghan, C.A. Moulton. From the University of Toronto, Toronto, Ont.**

The way surgeons act in the operating room (OR) is not purely driven by cognitive factors, but is often influenced by the underlying socio-cultural context. Previous studies suggest that surgeons felt various forms of "social pressures" in the OR, such as ego, reputation, or need to create a fun OR. Thus, this study further explored surgeons' perceptions of these social pressures, how OR team members might contribute to these pressures, and the effects this might have on surgeons.

Using a constructivist grounded theory approach sensitized by Goffman's Impression Management theory, we conducted 24 semi-structured interviews (10 surgeons, 8 OR nurses, and 6 anaesthetists). OR observations (60 h; 14 cases) and perioperative interviews informed the interview template and refined the developing conceptual framework. Purposive sampling was used to include participants of both sexes and various experience levels; theoretical sampling was used to explore emergent themes. Data were analyzed iteratively and reflexively.

Surgeons described 2 distinct images they tried to portray in the OR. They stressed the importance of performing an image of "competence" as their reputation in the surgical community "ha[d] to do with clinical outcomes." In the secondary performance, surgeons suggested the need to appear collaborative to nonsurgical team members, as they perceived they were judged on their ability to "be nice" and "remember people's names." Some surgeons described feelings frustration and inauthenticity

when simultaneously maintaining both images: "[the OR is] not a fully democratic team...nor should it be. However, if you want to get along with other people, you've got to act as though it is."

Surgeons negotiated their image in response to the demands of their audiences. Further understanding of the potential tension between these images and their impact on individual and team performance may lend better understanding to interprofessional collaboration and education.

84

**Policy and prevention: Can provincial legislation influence risk of major injury among Canadian children and youth? N. Yanchar, M. Havenga, M. Butler. From Dalhousie University, Halifax, NS**

Trauma kills more children and youth (C&Y) in Canada than any other disease process combined. Prevention requires a multimodal approach to influence education, engineering and safety policies. We sought to determine the association of comprehensiveness of policies around motor vehicle safety and ATV safety and risk of major injury in 9 Canadian provinces. All C&Y under 20 years old hospitalized in Canada (2002–2012) for injuries related to motor vehicle crashes (MVCs) and ATV incidents between 2002 and 2012 were studied. Provincial legislation related to C&Y ATV safety was graded as poor, fair or good. Similar grades were developed to reflect commitment to safety in motor vehicles using a composite score of graduated driver licensing and booster seat legislation. Associations between injury severity from MVCs and ATV-related trauma (admission to the ICU and length-of-stay) and corresponding provincial policy grade were determined.

Relative to provinces with fair legislation, patients that incurred an ATV-related injury in provinces with good legislation were 18% less likely to be admitted to an ICU (OR 0.82, 95% CI 0.61–1.11,  $p < 0.001$ ) while those in provinces with poor legislation were 1.51 times more likely (OR 1.51, 95% CI 1.26–1.80). Compared with those patients in provinces with fair motor vehicle legislation, patients were more likely to be admitted to an ICU in both the good legislation group (OR 1.45, 95% CI 1.27–1.67) and the poor legislation group (OR 1.42, 95% CI 1.26–1.59). No associations were found with length-of-stay.

Provincial legislation related to ATV safety appears to be associated with reduced risk of C&Y major ATV-related trauma. Risk of major injury from MVCs is influenced by many factors, including policy, engineering and education. Lack of association between injury risk and evidence-based motor vehicle legislation suggests need for targeting other factors that confound the efficacy of such policies.

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**Compliance with evidence-based guidelines of intra-abdominal infections. M. Maggisano, E. Pearsall, H. Huang, A. Nathens, A. Morris, S. Nelson, R. McLeod. From the University of Toronto, Toronto, Ont.**

To assess if there is a gap in care with respect to antibiotic choice and duration in the management of intra-abdominal infections (IAIs) in concordance with local and Canadian practice guidelines recommendations.

A retrospective review of 291 patients admitted between 2005 and 2009 at 6 academic hospitals was performed. Demographic

information, source of infection, and class of IAI were collected. IAIs were classified as community acquired or health care associated and subdivided into uncomplicated versus complicated, and low versus high risk. Biliary associated IAIs were classified as mild or high risk. Concordance with recommendations based on the local Best Practice in General Surgery (BPIGS) and Canadian Surgical Society (CSS) clinical practice guidelines (CPGs) for type of antibiotic and duration of use was assessed.

The average age of patients was 66.1 years of age, with 167 males and 124 females. Persons with biliary tract infections, both high severity and mild-moderate, were not compliant with CSS nor BPIGS CPGs ( $n = 13$ , 0%). Persons with uncomplicated community-acquired infections (cIAI) were 25% compliant with CSS and BPIGS guidelines ( $n = 3$ ). Those with complicated IAIs were more compliant with both CSS ( $n = 119$ , 73%) and BPIGS CPGs ( $n = 20$ , 12%). Persons with health care-associated IAIs were 56% ( $n = 57$ ) compliant with the CSS CPG and 42% ( $n = 43$ ) compliant with BPIGS CPG. Overall, the duration of antibiotics was compliant in 52% of patients.

Overall there is a gap in care and strategies are required to increase appropriate antibiotic usage based on guideline recommendations in patients with intra-abdominal infections.

## 86

**Outcomes and costs associated with ICU admission among older adults undergoing emergency abdominal surgery. J. Bailey, P. Davis, A. Levy, M. Molinari, P. Johnson. From Dalhousie University, Halifax, NS**

Health care spending in Canada has been increasing faster than the rate of gross domestic product (GDP), with a large proportion allocated to care of older adults. While the ICU is a resource intense setting, the outcomes associated with ICU care of older adults is not well studied. The purpose of this study was to describe the outcomes and costs associated with ICU admission among older adults undergoing emergency abdominal surgery.

Over a 15-month period, all patients over 70 years of age who underwent nonelective abdominal surgery were prospectively enrolled. Data were collected regarding patient demographics, investigations, treatments and outcomes. Patient-level resource tracking was used to calculate direct hospital health care costs (\$2012 CAD). The associations between ICU admission and mortality, loss of independence and cost were assessed using univariate nonparametric tests, multiple linear and multiple logistic regression.

During the study period 212 patients underwent surgery (median age 78 yr [range 70–97]). Of those 46 (21.7%) were admitted to the ICU. The hospital mortality rate was 6.6% overall and 28.3% among ICU patients. The median cost of care was \$9166 (IQR \$13 241) for all patients, compared with \$24 286 (IQR \$24 546) for those admitted to the ICU. At discharge, more patients experienced a loss of independence if they were admitted to ICU (42% v. 21%,  $p = 0.0131$ ). However, most patients returned to their preadmission living arrangement by 6 months (87% v. 91%). In multivariate analyses, ASA score (OR 3.7 [1.97–6.95]) and frailty (OR 1.6 [1.15–2.21]) were significantly associated with ICU admission.

Intensive care unit admission after nonelective abdominal surgery in older adults is associated with high healthcare costs,

high mortality and loss of independence at discharge. The ASA and frailty index could identify patients more likely to be admitted to ICU.

## 87

**General surgery graduates feel prepared for practice, but is there a practice available? A. Nadler, N. Ahmed, J. Escallon, F. Wright. From the University of Toronto, Toronto, Ont.**

Given concerns regarding current training models and underemployment among general surgeons in Canada, current perceptions of graduating general surgery (GS) residents in regards to their residency training and job prospects were sought.

A questionnaire was developed by a panel of experts with experience in postgraduate education focusing on residency training and job prospects. It was distributed to graduating GS residents at a national review course in 2014.

Fifty-one of 93 graduating Canadian residents responded (55% response rate). Of the respondents, 55% were men. Eighty-two percent of residents felt that their current training had adequately prepared them to enter directly into practice. However, the majority of residents (80%) believe that it will be difficult or very difficult to find a job. Only 10% of residents had a secured job directly after graduation, although many were pursuing fellowship training before looking for a job. A lack of job availability and older surgeons not retiring were cited as the most common impediments to finding jobs. Most graduating residents (74%) would still choose GS if they had to pick their residency again, with 44% of those commenting stating they would choose it again because they “love it.” Of the 13% who indicated that they would not choose a GS residency again, 75% of those that commented stated it was because there are no jobs.

Graduating GS residents feel well trained and the majority is satisfied with their residency training. However, there are major concerns regarding the job market following graduation with a disturbing trend of taking advantage of underemployed graduates to take call with no promise of an elective practice. Hospital policies need to be implemented to establish a balance between elective practice and call requirements for older surgeons and new graduates. Otherwise resources need to be allocated to hire new surgeons or fewer surgeons need to be trained to alleviate current job concerns.

## 88

**Oncostatin M modulates early inflammatory responses in a fluid resuscitated model of sepsis. P. Young, S. Salim, C. Compston, T. Mueller, R. Khadaroo. From the University of Alberta, Edmonton, Alta.**

Sepsis is a significant contributor to morbidity, mortality in patient populations throughout the world. The pathogenesis of sepsis remains poorly understood. Oncostatin M (OSM) is an immunomodulatory cytokine in the IL-6 family. Prior research in our laboratory demonstrated the detrimental effects of OSM receptor (OSMR) deficiency in a murine model of intestinal ischemia reperfusion injury. The objective is to study the role of OSM in inflammatory cell recruitment and end organ injury in a murine model of sepsis.

Littermate OSMR<sup>+/+</sup> and OSMR<sup>-/-</sup> B6.129S-Osmr mice were studied in a fluid-resuscitated variant of the cecal ligation and

puncture (CLP) model of sepsis. Animals were examined for 12, 24 and 48 hours following CLP with saline administration. Following the end point of the fluid-resuscitated groups, peritoneal lavage was performed. Tissue and blood samples were obtained. Cultures of spleen homogenate and whole blood were performed.

All animals ( $n = 42$ ) survived to the end points with fluid resuscitation. Without fluid resuscitation, identical animal groups had 50% and 33% mortality at 48 hours, for OSMR<sup>+/+</sup> and OSMR<sup>-/-</sup>, respectively ( $n = 6$  each). Fluid resuscitation was demonstrated to be adequate, with no significant difference in serum blood urea nitrogen and renal *Ngal* between all fluid-resuscitated groups. Assessment of bacterial translocation in blood showed higher mean bacterial counts in OSMR<sup>-/-</sup> animals at 24 and 48 hours (65-fold and 25-fold higher colony counts, respectively). Peritoneal lavage yielded no significant differences in overall cells counts. Serum levels of OSM increased rapidly after the onset of CLP, with > 2-fold increase compared with sham at 0.5 hours ( $p < 0.05$ ).

Signalling through the OSM/OSMR axis begins early in the onset of CLP. Oncostatin M modulates deficiency results in increased bacterial translocation in the setting of intra-abdominal sepsis. Understanding this signaling cascade can provide novel strategies for treating intra-abdominal sepsis.

## 89

**Evaluating 30-day return to hospital following acute care surgery: a quality improvement study.** *N. Hoffman, A. Okrainec, F. Queresby, A. Tse, T. Jackson.* From the University of Toronto, Toronto, Ont.

Readmission within 30 days of an index surgical procedure is a growing area of interest to mark of quality-of-care and a tool to direct quality improvement initiatives. While recent studies have examined reasons for readmission following general sur-

gery procedures, little attention has been paid to outcomes of urgent/emergent acute care surgery or subsequent unplanned ED visits. The objective of this study was to determine what factors may be associated with unplanned readmissions and ED visits within 30 days of an acute care surgery. Data obtained by our institution for the ACS NSQIP database was used to examine unplanned return to hospital after acute care surgery (ACS; 2012–2014). Patients who underwent an urgent/emergent procedure were retrospectively followed for 30 days after the index surgery. Univariate analyses were used to compare variables between the groups. Of the 546 patients who underwent an ACS procedure, 85 (15.6%) returned within 30 days of the index surgery. Emergency room visits accounted for 59 (69.4%) of the unplanned returns, while 26 (30.5%) were readmissions. Patients who returned to hospital had similar demographic profiles, preoperative comorbidities, ASA class, index procedures and admission length. A total of 13.6% of ER visits had a postoperative complication during admission, compared with 28% of readmitted patients. Postoperative complications after discharge were higher in both ER (25.9%;  $p < 0.001$ ) and readmitted patients (60%;  $p < 0.001$ ). Sepsis/septic shock, organ/space surgical site infections and genitourinary complications were related to readmission. Wound complications were higher in both readmitted and ER patients, compared with patients without 30-day return to hospital. Mean number of days between discharge and return to hospital were 9.2 and 7.3 for readmitted and ER patients, respectively. Risk factors for unplanned return to hospital after ACS are independent of baseline characteristics and preoperative comorbidities. Postoperative complications could identify patients at higher risk for a returning to hospital. Quality improvement initiatives that target patients early after discharge, particularly patients those at high risk for surgical site infections, may help reduce the burden of 30-day returns in the ACS population.

# Canadian Hepato-Pancreato-Biliary Association

## Canadian Hepato-Pancreato-Biliary Association

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**Treatment of unresectable intrahepatic cholangiocarcinoma with yttrium-90 radioembolization: a systematic review and pooled analysis.** *D.P. Al-Adra, R.S. Gill, S.J. Axford, X. Shi, N. Kneteman, S. Liau.* From the University of Alberta, Edmonton, Alta.

Radioembolization with yttrium-90 microspheres offers an alternative treatment option for patients with unresectable intrahepatic cholangiocarcinoma (ICC). However, the rarity and heterogeneity of ICC makes it difficult to draw firm conclusions about treatment efficacy.

The goal of the current study is to systematically review the existing literature surrounding treatment of unresectable ICCs with yttrium-90 microspheres and provide a comprehensive review of the current experience and clinical outcome of this treatment modality.

We performed a comprehensive search of electronic databases for ICC treatment and identified 12 studies with relevant data regarding radioembolization therapy with yttrium-90 microspheres.

Based on pooled analysis, the overall weighted median survival was 15.5 months. Tumour response based on radiological studies demonstrated a partial response in 28% and stable disease in 54% of patients at 3 months. Seven patients were able to be downstaged to surgical resection. The complication profile of radioembolization is similar to that of other intra-arterial treatment modalities.

Overall survival of patients with ICC after treatment with yttrium-90 microspheres is higher than historical survival rates and shows similar survival to those patients treated with systemic chemotherapy and/or trans-arterial chemoembolization therapy. Therefore, the use of yttrium-90 microspheres should be considered in the list of available treatment options for ICC. However, future randomized trials comparing systemic chemotherapy, TACE and local radiation will be required to identify the optimal treatment modality for unresectable ICC.

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**Conventional transarterial chemoembolization for unresectable liver malignancies: How does it compare with other locoregional therapies? A single-institution experience and review of the literature.** *J. Levy, R. Garfinkle, E. Camlioglu, T. Vanounou.* From McGill University, Montréal, Que.

Drug-eluting bead chemoembolization (DEB-TACE) and yttrium-90 radioembolization (Y-90) are newer locoregional therapies that may offer superior survival to patients with unresectable liver malignancies than conventional transarterial chemoembolization (cTACE). However, their higher costs and lack of government coverage have precluded their use at our institution. The aim of this study is 2-fold; first, to evaluate our experience with cTACE, and second, to review the results of newer locoregional therapies.

This study included all patients who underwent cTACE therapy at our institution between October 2009 and October 2013 for unresectable liver malignancies. Tumour response was evaluated using RECIST criteria 7 weeks after therapy. Median survival from the time of first cTACE treatment was calculated using the Kaplan–Meier method. Our review of DEB-TACE and Y-90 in similar malignancies consisted of all relevant peer-reviewed studies published in the last 10 years.

In total, 29 patients underwent 46 cTACE procedures (mean 1.6 [range 1–5]) — 11 had colorectal cancer liver metastases (CRCLM), 9 had hepatocellular carcinoma (HCC), 5 had intrahepatic cholangiocarcinoma (IHC), and 4 had neuroendocrine tumour liver metastases (NETLM). Median follow-up was 7 months (range 1–37). On CT scan 7 weeks posttreatment, 13.6% showed partial response, 50.0% stable disease, and 36.3% progressive disease. Malignancy-specific median survivals were 9.2 months (CRCLM), 12.5 months (HCC), 8.2 months (IHC), and 19.8 months (NETLM). According to the studies reviewed, DEB-TACE offers survivals ranging from 8.0–22.0 months (CRCLM), 13.4–32.2 months (HCC), and 10.5–30 months (IHC). It has not been studied adequately in the treatment of NETLMs. In comparison, Y-90 offers survivals ranging from 8.3–32.8 months (CRCLM), 11.2–16.4 months (HCC), 9.3–22 months (IHC) and 22.0–70.0 months (NETLM).

In conclusion, cTACE is a safe and well-established therapy for unresectable liver malignancies, but may fall short of the survival potential offered to patients with other locoregional therapies.

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**The association of posthepatectomy hypophosphatemia with recovery from initial liver insufficiency.** *J. Hallet, F. Zih, J. Wong, E. Cheng, S. Hanna, N. Coburn, P. Karanicolas, C. Law.* From Sunnybrook Health Sciences Centre; The Odette Cancer Centre; and the Division of General Surgery, University of Toronto, Toronto, Ont.

Hypophosphatemia (HP) is frequent following liver resection, and thought to represent use of phosphate during liver regeneration. Transient decrease of liver function — Initial Liver Insufficiency (ILI) — following resection is common but recovers in most cases. Early predictor of postoperative liver function recovery is lacking. We sought to evaluate the association of posthepatectomy hypophosphatemia with recovery from ILI.

Liver resections were retrospectively reviewed from 2008 to 2012 at a single institution. Primary outcomes were occurrence of ILI (peak bilirubin  $\geq 50$   $\mu\text{mol/L}$  or INR  $\geq 1.7$  within 5 d of resection) and in-hospital recovery of ILI. Secondary outcomes were 30-day major morbidity (Clavien grade 3–4 complications) and 30-day mortality. Outcomes of posthepatectomy hypophosphatemia patients (nadir serum phosphate  $\leq 0.65$   $\text{mmol/L}$  within 72 h) were compared with normophosphatemia ones (NP).

Among 402 patients, 223 (55.5%) experienced HP. Median nadir serum phosphate was 0.6  $\text{mmol/L}$  (IQR 0.5–0.75). Initial

liver insufficiency occurred significantly more often with HP than NP (19.7% v. 11.2%;  $p = 0.02$ ). However, more HP patients experienced recovery from ILI than NP (90.9% v. 65.0%;  $p = 0.03$ ). Length of stay, postoperative morbidity and mortality did not differ between HP and NP.

Posthepatectomy HP is associated with increased incidence of ILI and more frequent recovery from ILI highlighting efficient liver regeneration. Morbidity and mortality was not increased in HP patients. Further studies should explore the usefulness of the trend of phosphate drop for early identification of patients likely to recover from ILI, in order to track them faster through the postoperative course.

### 93

**Getting started with minimally invasive pancreaticoduodenectomy: lessons learned and comparison to open surgery.** *S. Liang, S. Jayaraman.* From the University of Toronto, Toronto, Ont.

This study evaluates the safety of introducing minimally invasive pancreaticoduodenectomy (MIPD) to a surgeon's practice.

All MIPD performed between December 2011 and July 2013 were compared with open (OPD) cases by the same surgeon. The primary outcome was safety defined as mortality, major morbidity, and reoperation. Secondary outcomes were perioperative and oncologic outcomes. MIPD include total laparoscopic (TLPD), and laparoscopic-assisted (LAPD) pancreaticoduodenectomy, where a small incision is used for reconstruction. Bivariate comparisons of outcomes were performed using non-parametric tests.

In total, 44 pancreaticoduodenectomies were performed: 15 MIPD (2 TLPD and 13 LAPD), and 29 OPD. One death occurred in each group. Major complications were not significantly different (MIPD 33% vs open 17%,  $p = 0.22$ ); however, there was a trend toward more reoperation after MIPD compared with OPD (20% v. 3%,  $p = 0.07$ ). The incidence of pancreatic leak (MIPD 20% v. open 14%), biliary leak (0% v. 7%), abscess formation (27% v. 14%), intra-abdominal hemorrhage (13% v. 3%), ileus (0% v. 3%), pneumonia (0% v. 2%), and pulmonary embolism (13% v. 7%) were not significantly different. MIPD achieved equivalent oncologic outcomes with 100% R0 margin and adequate lymph node retrieval ( $p = 0.09$ ). There was no significant difference with respect to median operative time (MIPD 342 min v. open 358 min,  $p = 0.99$ ), and median length of stay (8 v. 9 d,  $p = 0.61$ ).

Minimally invasive and open pancreaticoduodenectomy had similar safety in this introductory series. However, a trend toward a higher rate of reoperation for pancreatic leak suggests the need for caution in introducing this novel technique.

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**Starting a new laparoscopic liver surgery program: initial experience and improved efficiency.** *S. Liang, S. Jayaraman.* From the University of Toronto, Toronto, Ont.

This study evaluates the safety and outcomes of introducing a laparoscopic liver program to a hospital.

This is a retrospective review of a prospectively acquired database of all laparoscopic liver resections between August 2010 and July 2013 at St. Joseph's Health Care Centre, Toronto. The primary outcome was safety defined as mortality, major morbidity,

and negative margins. Secondary outcomes included other perioperative outcomes. Nonparametric tests were used to compare the first (group A) and second (group B) 18 months of the experience.

There were 19 patients in group A, and 25 in group B with 8 major resections in group A, and 5 in group B. Group A had the only mortality due to portal and hepatic vein thrombosis resulting in liver failure. There was no statistical difference between the groups in major complications (10.6% v. 16%,  $p = 1$ ), or length of stay (3 v. 4 d,  $p = 0.59$ ). In each group, there was 1 case that required intraoperative margin revision. One case in group B had a positive parenchymal margin on final pathology. There was a significant decrease in operative time (210 v. 164 min,  $p = 0.013$ ) between the groups, explained by improvement in the operative times of major resections (296 v. 193 min,  $p = 0.048$ ). Furthermore, there was a significant increase in procedures performed for malignancy (34% v. 84%,  $p = 0.002$ ).

This study demonstrates that laparoscopic liver resection can be safely introduced into a hospital. The decrease in operative time despite increasingly complex cases is likely a reflection of increased efficiency with major resections.

### 95

**Activation status of liver transplant patients does not predict ICU volume management in first 24 hours after transplantation.** *T. Chan, K. DeGirolamo, M. Bleszynski, V. Dhingra, S.W. Chung, C.H. Scudamore, A.K. Buczkowski.* From the University of British Columbia, Vancouver, BC

Liver transplant patients require ongoing volume resuscitation after transplant. Activation status at the time of the surgery is considered an independent factor of patient outcome. Liver failure patients undergoing transplantation are a heterogeneous group of individuals with variable severity of organ failure heading into surgery. Higher status patients are expected to require more aggressive volume resuscitation to survive the surgery and the immediate postoperative period.

Two hundred consecutive liver transplantation cases between 2007 and 2011 at a single provincial transplant centre were identified. Random sampling of 100 cases was reviewed retrospectively. Child Pugh, MELD score and activation status were obtained from the British Columbia Transplant database. Intraoperative records and ICU volume charting was reviewed to capture fluid losses and administration volume, in the OR and first 24 hours in the ICU post operatively. Cases were stratified according to activation status at time of transplant from 1 to 4 (CanWAIT criteria). Simple linear regression was used to determine the impact of listing alone on fluid requirements in OR and ICU. Differences in volume resuscitation and losses were compared using ANOVA.

Complete data sets were achieved in 100 patients. There was unequal distribution between the 4 groups with status 1 (S1,  $n = 57$ ), status 2 (S2,  $n = 32$ ), status 3 (S3,  $n = 2$ ), status 4 (S4,  $n = 9$ ). There was no statistical difference in total volume resuscitation during surgery (S1 = 11L, S2 = 13.3 L, S3 = 10.8 L, S4 = 11.8 L). However, time-corrected RBC transfusion was significantly higher in S2 compared with S1 (15.5 v. 9.6 mL/min,  $p = 0.009$ ). Postoperatively there was no significant difference in total resuscitation volume in the 24 hours in ICU (S1 = 4.8 L, S2 = 5.5 L, S3 = 3.7 L, S4 = 6.6 L). A shift was observed in the pattern of

fluid use from blood products in OR to preferential use of colloids in ICU. Listing status was poorly predictive of fluid requirements in OR ( $R^2 = 0.009$ ,  $p = 0.34$ ) and ICU ( $R^2 = 0.02$ ,  $p = 0.16$ ). Intraoperative volume resuscitation is not a predictor of overall volume requirements in the first 24 hours of ICU post-liver transplant. Severity of pretransplant liver activation status does not correlate with higher postoperative volume requirements.

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**The impact of pancreaticogastrostomy compared with pancreaticojejunostomy reconstruction after pancreaticoduodenectomy on pancreatic fistula: a meta-analysis of randomized controlled trials.** *F. Zih, J. Hallet, R. Deobald, A. Scheer, C. Law, N. Coburn, P. Karanicolas.* From Sunnybrook Health Sciences Centre; The Odette Cancer Centre; and the Division of General Surgery, University of Toronto, Toronto, Ont.

Pancreatic fistula (PF) remains a common source of morbidity following pancreaticoduodenectomy (PD). Despite numerous studies, the optimal conduit for pancreatic remnant reconstruction is controversial. To compare the impact of pancreaticojejunostomy (PJ) with pancreaticogastrostomy (PG) on PF after PD.

We systematically searched 5 electronic databases and the grey literature for randomized controlled trials (RCTs) comparing PJ and PG after PD. Two reviewers independently selected studies, extracted data, and assessed methodological quality. Primary outcome was pancreatic fistula based on International Study Group on Pancreatic Fistula (ISGPF) grade B or C, or the primary study's definition if the ISGPF was not reported. We pooled results from the studies using a random-effects model, evaluated heterogeneity and explored potential explanations for heterogeneity, including high (soft gland or small duct) versus low (hard gland or large duct) risk pancreas. We summarized results using GRADE classification to rate the strength of evidence.

We included 7 RCTs including 1133 patients. Patients who underwent PG experienced significantly fewer PF (relative risk [RR] 0.60, 95% CI 0.44–0.82) and bile leak (RR 0.18, 95% CI 0.05–0.60). Delayed gastric emptying, overall major postoperative morbidity and mortality did not differ between groups. Absolute risk reduction of PF was 5.4% (95% CI 4.0–7.4) for low-risk compared with 12.6% (95% CI 9.2–17.2) for high-risk if undergoing PG instead of PJ. (RR 0.56, 95% CI 0.36–0.89). Quality of evidence for PF outcome was moderate according to GRADE classification.

Pancreaticogastrostomy reconstruction decreases the rate of PF when compared with PJ. Surgeons should consider reconstructing the pancreatic remnant following PD with PG, particularly in patients at high risk of PF.

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**A comprehensive approach to the prediction of acute calculous cholangitis — the Qatar Experience.** *H. Allam, M. Al Dosouky, A. Farooq, A. El Nagar, A. Vijay.* From the Hamad Medical Corporation, Qatar

Of the common complications of gallstones, acute cholangitis (AC) is the most lethal entity, making accurate diagnosis and early treatment imperative. Studies that report on the risk factors for developing AC secondary to bile duct stones are rare. The aim of the present study is to identify clinical, laboratory and radiological

factors that can predict which patients may develop cholangitis.

The study is a retrospective case controlled study based on patients admitted to Hamad General Hospital from June 2006 to November 2010 with a diagnosis of AC secondary to CBD stones. The control subjects were patients admitted during the same period with obstructive lithiasic jaundice, but not complicated by cholangitis. Both study groups were compared and analysed with respect to demographics, previous medical/surgical history, laboratory investigations and surgical/endoscopic procedures.

A total of 112 patients of 24 different nationalities (70 men and 42 women) were included in the study. Fifty-three patients (43.4%) presented with AC (case group), and 59 (56.6%) admitted for management of obstructive jaundice. Although Asians had a greater prevalence of cholangitis (57.4%) compared with Middle Easterners (35.7%) and Africans (33.3%), this was not statistically significant ( $p = 0.066$ ). Laboratory tests significantly correlated to AC where leucocytosis ( $p = 0.001$ ), elevated serum creatinine ( $p = 0.001$ ), and BUN ( $p = 0.001$ ). In univariate analysis the logistic regression model showed that dark urine, fever, elevated WBC and BUN were strongly associated with cholangitis.

Typical clinical signs of acute cholangitis, history of liver disease together with certain biochemical criteria are strongly associated with occurrence of acute lithiasic cholangitis. A larger prospective study may probably confirm these findings and help create a reproducible and simple scoring system able to predict and consequently facilitate early intervention in such cases.

98

**Laparoscopic hepatectomy in patients with liver cirrhosis.** *Y. Luo, J. Shaw, M. Moser, R. Kanthan.* From the University of Saskatchewan, Saskatoon, Sask.

Liver resection in cirrhotic patients is a clinical challenge. Liver cirrhosis used to be a relative contra-indication for laparoscopic surgeries. However, this situation is changing due to advances in surgical techniques and technologies. Our initial experiences in laparoscopic hand-assist liver resection in cirrhotic patients are described.

Three male patients and 1 female patient, aged 32 to 65 years, underwent hand-assisted laparoscopic liver resections for HCC (hepatocellular carcinoma) in 2013. All patients had background liver cirrhosis (Child A). Hepatectomies included 2 single segmentectomies, one bisegmentectomy and one trisegmentectomy. All instruments and devices used were already locally available at our Hospital for other laparoscopic surgeries, including endovascular stapler, laparoscopic harmonic dissector, hand-assist port and intraoperative ultrasound (U/S). Follow-up time was 3–8 months.

Operation time averaged 258 minutes (116–390 min). Endovascular stapler was used to divide liver parenchyma. Blood transfusion was required in 2 patients (2 units and 4 units). Pathological clear margin was achieved in all cases. Intraoperative U/S was performed in 2 cases without difficulty. There was no postoperative bleeding, infection or liver failure. One patient stayed in ICU postoperatively for 2 days. Hospital stay averaged 7.43 days (5–13 d). There was no perioperative 90-day mortality. However, asymptomatic bile leak occurred in 1 patient, but healed without surgery. One recurrence happened 4 months after surgery.

Although our initial experience of laparoscopic liver resection in cirrhotic patients was limited, we definitely sensed significant advantages of laparoscopic liver resection (e.g., intraoperative

preresection thorough exploration with/without intraoperative U/S, meticulously management of surgery, smaller incision and less postoperative pain, at no loss of oncological control of the disease). Hand-assist technique not only facilitated intraoperative manoeuvres including U/S, the hand-port incision also helped to deliver the specimen. This technique allowed us to use already locally available instruments and devices including intraoperative U/S which was used in our open surgeries (i.e., no extra expenses on instruments and devices). Intraoperative and postoperative morbidity was not found different from those of our open liver resections.

Laparoscopic hand-assist hepatectomy in cirrhotic patients, including laparoscopic intraoperative U/S, can be safely and successfully performed with presently available instruments and devices in our local Hospital. Further study is certainly warranted.

## 99

**Intraoperative ultrasound and surgical strategy in hepatic resection: What difference does it make? R. Jreaz, R. Hart, S. Jayaraman. From the University of Toronto, Toronto, Ont.**

With modern advancements in preoperative imaging for liver surgery, intraoperative ultrasound (IOUS) may be perceived as superfluous. Our aim was to determine if IOUS provides new information that changes surgical strategy in hepatic resection.

From a single institution, 111 consecutive patients who underwent 121 liver resections were analyzed. Preoperative CT and/or MRI determined the surgical strategy. Comparisons between the number, size, and location of lesions were compared between IOUS and preoperative imaging. Reasons for changes in surgical strategy were documented. Pathology reports were analyzed for margins. Continuous variables were compared using parametric *t* tests and categorical variables were compared using the  $\chi^2$  test for independence. The *p* values of less than or equal to 0.05 were considered statistically significant.

Intraoperative ultrasound was used in 88 of 121 procedures. Intraoperative ultrasound changed the surgical plan in 15 (17%) cases. Additional tumours were detected in 10 (11%) cases. A change in tumour size and location were detected in, 2 (2%) and 3 (4%) cases respectively. Surgical plans were altered in 7 (8%) cases for reasons not related to IOUS. Intraoperative ultrasounds helped demarcate the resection plane in the remaining 55 (75%) of cases. In the 33 cases where IOUS was not used, the surgical plan changed 12 (36%) times. 8 (24%) cases were aborted due to distant metastases. 2 (6%) cases required additional resection due to tumour extension. Conversion from laparoscopic to open due to adhesions and liver abscess changed 1 (3%) case each. The average margin was 1.09 cm (1.18) for IOUS and 1.18 cm (1.05) for non-IOUS. There were no significant differences in margin length (*p* = 0.74) between the groups.

Surgical strategy was directly altered due to IOUS in a substantial number of cases. Intraoperative ultrasound guided resection planes resulted in R0 resections in nearly all procedures. The best operative plan in hepatic resection includes intraoperative ultrasound.

## 100

**Predictors of recurrence of primary sclerosing cholangitis after liver transplantation: a single-centre experience over 20 years. B. Lowry, W. El Moghazy, G. Meeberg, N. Kneteman. From the University of Alberta, Edmonton, Alta.**

Liver transplantation (LT) is the only therapeutic option for primary sclerosing cholangitis (PSC), however, recurrence of PSC (rPSC) post-LT occurs at rates ranging from 9%–47%. In this study, we aimed to define risk factors for rPSC post-LT and evaluate the impact of early recurrence (in the first 2 years post-LT) on patient survival.

A total of 101 liver transplants were done for 94 patients diagnosed with PSC over a period of 20 years. The Kaplan–Meier curve was used to calculate survival and Cox's proportional regression hazard model was used to identify risk factors. A *p* value of < 0.05 was considered significant.

Age of patients at time of transplant ranged from 6 to 72 years old with a mean of 41 years. Liver grafts were obtained from deceased-donors in 82 transplants and from live-donors in 19 transplants. The overall patient survival was 81% during the follow-up period; survival at 1 year was 95%, at 5 years was 89% and at 10 years was 85%. rPSC occurred in 42 patients and overall recurrence free survival was 56%. The overall graft survival was 76%; graft survival at 1 year was 89%, at 5 years was 83% and at 10 years was 78%. Univariate analysis revealed that younger recipient age at time of transplant, previous biliary surgery, low serum albumin, positive cross-match, and older donor age are potential predictors of recurrence. Multivariate analysis revealed that positive cross-match (HR 3.316, 95% CI 1.021–10.772), and donor age (HR 1.043, 95% CI 1.005–1.082) are independent predictors of PSC recurrence. Early recurrence did not affect patient survival (*p* = 0.972).

In conclusion, LT remains the best management for end-stage PSC. Positive cross-match and older liver grafts are predictors of rPSC post-LT and early recurrence of PSC does not affect patient survival.

## 101

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

Intraoperative ultrasound (IOUS) of the liver is commonly performed in the setting of metastatic disease to ensure that there are no occult metastases which would compromise the curative intent of resection. While IOUS is generally performed by surgeons with variable training in this modality, IOUS performed by a radiologist represents theoretical best practice for both identifying lesions and participating in operative planning. The aim of this study is to report on the frequency and details of any change in operative plan as a result of radiologist performed IOUS at a single institution

A retrospective chart review was completed for all patients who underwent liver resection for metastases from January 2011 to December 2013. Clinic notes and operative notes were reviewed to identify when any decision to change the operative plan was made.

Forty liver resections for 36 patients were performed during the time interval of this study. Mean age was 63.5 years. In 5 cases, patients had liver metastases from neuroendocrine tumours, 31 had colorectal cancer metastases. All but 3 patients underwent preoperative CT (3 had MRI). The mean interval of time between preoperative imaging and surgery was 43 days. All but 1 procedure had documented radiologist performed IOUS. For 2 cases, a change in operative plan was not related to the use

of IOUS. The operative plan was amended in 14 of 37 procedures (37.8%) based on the results of the IOUS: the extent of resection was changed in 7 cases, the procedure was aborted in 4 cases, and a decision to change from a single resection to a staged approach was reached for 3 patients. Radiofrequency ablation was applied in 4 cases.

Results of IOUS at our institution are comparable to previously reported studies with near 40% change in operative plan. These results provide the basis for a prospective study with precise documentation and interdisciplinary collaboration to clearly elucidate the utility of radiologist performed IOUS and provide information on best practices for surgical planning of hepatic metastatectomy.

## 102

**Arterial resection for cancer of the pancreas (ARCAP) – expanding the resectability criteria for pancreas adenocarcinoma is safe and effective in selected patients. M. Segedi, P. Serrano Aybar, K. Leung, N. Dhani, J. Kim, S. Gallinger, M. Moore, D. Hedley, M. Kryzanowska, I. McGilvray. From the University of Toronto, Toronto, Ont.**

Locally advanced pancreatic cancer (LAPC) is by definition unresectable and involves vascular structures including the superior mesenteric artery (SMA), celiac artery (CA), portal vein (PV) and/or superior mesenteric vein (SMV). Up to 30% of all newly diagnosed pancreatic cancer patients have LAPC. Although arterial invasion has traditionally been a contraindication to resection, the definition of resectable disease is currently changing with the advances in surgical techniques and systemic and radiation therapy. This study aimed to determine whether Arterial Resection for Cancer of the Pancreas (ARCAP) is safe.

A retrospective chart review was carried out on LAPC patients admitted from January 2009 to December 2013 who were deemed resectable according to the institution protocol. Criteria for resectability were having no metastases AND 1 of (1) less than 65 years with SMA involvement extending NOT beyond proximal jejunal artery OR (2) less than 70y with CA involvement reconstructible to a single artery. Surgical complications were graded according to the Clavien–Dindo Classification (CDC). Major complications were defined as CDC grade  $\geq 3$ . The primary outcome was the surgical complication rate. Secondary outcomes included the rate of R0 resection, disease free survival (DFS) and overall survival (OS). The study was approved by the institutional research ethics board.

A total of 15 patients underwent ARCAP. Median follow-up was 15 months (IQR 10.3–18.3). Median age at the time of operation was 57 years (IQR 51.5–62.5), and 6 of 15 (40%) of patients were female. A total of 9 of 15 (60%) patients received neoadjuvant chemoradiation therapy, and 10 of 15 (66.7%) had adjuvant chemotherapy. All the patients had preoperative radiologic indication of arterial involvement, with 8 of 15 (53%) undergoing arterial resection at the time of operation. All patients had venous resection and reconstruction. Major complications were present in 4 of 15 (25.7%) patients, 3 of 15 (20%) of whom needed reoperation on same admission. Vascular complications were present in 5 of 15 (33.3%) patients and included SV thrombosis, SMA pseudoaneurysm, and common hepatic artery stenosis. Pancreatic fistulas were present in 3 of 15 (20%) patients. Rate of R0 resection was 93.3% (positive PV

margin). Median OS was 14 months (IQR 8.3–17.0). Median DFS was 12 months (IQR 8.1–16.5).

Among patients who have LAPC and meet strict criteria for resectability, ARCAP has acceptable complication rates. A prospective clinical trial of neoadjuvant chemoradiation therapy followed by surgical resection for patients with LAPC is warranted.

## 103

**Outcomes of pylorus-preserving versus conventional whipples' pancreaticoduodenectomy: insights from the ACS-NSQIP database. J. Abou Khalil, P. Chaudhury, J. Barkun. From McGill University, Montréal, Que.**

Two surgical techniques are used for resectable tumours of the pancreatic head: the conventional Whipples' pancreaticoduodenectomy (CW), and the pylorus-preserving pancreaticoduodenectomy (PP). Proponents of PP argue that the less invasive extent of resection leads to shorter operative times and less intraoperative blood loss, whereas its detractors express concern that it predisposes patients to delayed gastric emptying (DGE), increasing length of stay. We set out to compare the outcomes of PP and CW within ACS-NSQIP, with attention to operative times, transfusions, and length of stay as a surrogate for DGE.

We used CPT codes 48150, 48152, 48153 and 48154 In the ACS-NSQIP 2005–2011 database to identify patients having undergone PP and CW. We used a propensity-score adjusted multivariate quantile regression to compare length of stay between the 2 groups. We excluded postoperative deaths from the analysis to avoid a competing-risks model and restricted the analysis to pancreatic adenocarcinoma.

We identified 4899 PP and 6817 CW. Patient characteristics were similar between the 2 groups. There was no difference in mortality or in the generic surgical complications collected by ACS-NSQIP. There was no difference in operative times (358.5 and 368 min for PP and CW, respectively,  $p = 0.09$ ) or perioperative transfusion. Length of stay was 9 and 10 days for PP and CW, respectively ( $p = 0.000$ ). At multivariate propensity-score adjusted quantile regression, PS remained associated with a decreased median length of stay ( $-0.7$  d,  $p = 0.001$ )

Within ACS-NSQIP, patients with PP had shorter LOS and similar morbidity than patients undergoing CW, suggesting DGE did not weigh heavily on their postoperative morbidity.

## 104

**Revisiting randomized trials comparing pancreaticogastrostomy versus pancreaticojejunostomy after pancreaticoduodenectomy: a systematic review and meta-analysis. J. Abou Khalil, S. Dumitru, C. Ball, E. Dixon, J. Barkun. From McGill University, Montréal, Que.**

Pancreatic fistula (PF) is a major cause of morbidity and mortality following pancreaticoduodenectomy, and the technique for reestablishing pancreatico-enteric continuity that best mitigates this risk is unclear. Initial randomized trials largely failed to support this finding. The recent publication of large, well designed randomized trials promises to alter this prospect. We set out to re-examine this question in light of the new evidence.

We searched Medline, Embase and the Cochrane Central Register of Controlled Trials until Nov. 29, 2013 using MeSH terms “Pancreatectomy” OR “Pancreaticoduodenectomy” AND

“Pancreaticojejunostomy” and the modified Cochrane Highly Sensitive hedge for RCTs. Two reviewers independently screened the publications for inclusion and extracted the data. Study quality was assessed using the Cochrane Risk of Bias tool. Meta-analysis was performed using a random-effects model.

Six hundred studies were retrieved by the search strategy; 7 studies fulfilled the inclusion criteria. Meta-analysis showed a protective effect of pancreatico-gastrostomy (PG) with regards to PF (RR 0.67, 95% CI 0.52–0.85,  $p = 0.02$ ) and intra-abdominal collections (IAC; RR 0.55, 95% CI 0.35–0.89,  $p = 0.01$ ), but no demonstrable difference with other outcomes, namely total complications (RR 0.95, 95% CI 0.82–1.11,  $p = 0.53$ ), mortality (RR 0.86, 95% CI 0.46–1.6,  $p = 0.63$ ), delayed gastric emptying (RR 1.01, 95% CI 0.61–1.67,  $p = 0.97$ ). Studies had low to moderate statistical heterogeneity but were marked by significant heterogeneity of clinical parameters and individual risk of bias. Studies using ISGPF definitions and those with low risk of bias were more likely to identify a protective effect of PG.

Pancreatico-gastrostomy results in less PF and IAC than PJ but meta-analyzed effect measures are clouded by significant study heterogeneity; High quality studies demonstrated the superiority of PG, whereas studies with high risk of bias did not. This finding has broad implications on the choice of reconstructive options after PG and highlights the critical role of the quality of surgical randomized trials.

#### 105

**Acute appendicitis mimicking cholecystitis: case reports and medicolegal aspects.** *E.A. Abdelhafid, F. Chagnon, F. Sestier.* From the University of Montréal, Montréal, Que.

The overall accuracy for diagnosing acute appendicitis is approximately 80%, which corresponds to a mean negative appendectomy rate of 20%. Diagnostic accuracy varies by sex, with a range of 78%–92% in male patients and 58%–85% in female patients. Since 1949, simultaneous presentation of acute appendicitis and acute cholecystitis have been described.

The role of sonography in screening of acute appendicitis in patients admitted to an infectious disease unit for suspected acute cholecystitis has been widely proved by many studies.

In laparoscopic surgery for inflammatory diseases, in particular acute cholecystitis, exploration of the entire abdomen should be more than cursory.

#### 106

**Canadian practice patterns for pancreaticoduodenectomy.** *D. Cyr, J. Truong, J. Lam-McCulloch, S. Cleary, P. Karanicolas.* From the University of Toronto, Toronto, Ont.

Discordant practice patterns may be a consequence of evidence gaps or deficiencies in knowledge translation. This study aimed to examine the current strategies employed by hepato-pancreatico-biliary (HPB) surgeons in Canada for the perioperative management of pancreaticoduodenectomy (PD).

A web-based survey was generated with a focus on the perioperative measures surrounding PD. The survey was distributed to all members of the Canadian Hepato-Pancreatico-Biliary Association and responses were collected anonymously. Survey data were descriptively analyzed.

The survey was distributed to 74 surgeons with a response rate of 50%. Surgeons reported many similarities in their techniques,

for example the majority reconstruct the pancreas with pancreatico-jejunostomy (86.5%) rather than pancreaticogastrostomy. In contrast, variable techniques were reported regarding the use of peritoneal drainage tubes, PJ anastomotic stents, octreotide, and other intraoperative modalities. Most surgeons reported that their patients frequently (75.7%) required preoperative biliary drainage, yet there was minimal agreement with the designated criteria. Variability was also seen regarding postoperative care including use of epidural analgesia and timing of postoperative oral nutrition.

In conclusion, heterogeneity was identified among Canadian HPB surgeons, suggesting a number of evidence-practice gaps within specific domains of pancreatic resections. Future research in these focused areas may facilitate technical agreement and improve patient outcomes following PD.

#### 107

**Surgical trends following the institution of provincial standards for pancreatic cancer resections: a quality assurance study.** *D. Sisson, D. Jalink, S. Nanji.* From Queen's University, Kingston, Ont.

Surgical treatment of pancreatic disease is a complex process with significant peri- and postoperative complications. Provincial standards for hepatobiliary (HPB) surgery were developed in 2006 and recommendations included a minimum of 2 HPB surgeons at a designated centre. This retrospective quality assurance study examines the impact of adding a second HPB surgeon, specifically trends in number and type of resections performed, pathology of tumours removed, and postoperative complications.

All pancreatic surgeries performed between 2007 and 2012 were reviewed. Pancreaticoduodenectomy (PD) and distal pancreatectomies (DP) performed for oncologic resection were included, totalling 65 cases. The second surgeon joined in 2010; therefore cases were divided into 2007 to 2009 and 2010 to 2012 cohorts. Final pathology reports and operative notes were reviewed and adverse postoperative events were categorized by Clavien–Dindo classification. Results from 2007 to 2009 and 2010 to 2012 were compared using Student  $t$  test, with  $p < 0.05$  determining statistical significance.

A 62.5% increase in case volume was noted between 2007 and 2009 and 2010 and 2012 (24 v. 39 patients). There were no statistically significant differences in the rate of complication by Clavien grade I through V. There were no statistically significant differences in stage, grade, rate of node positive disease or R1 resections between groups. There was a trend toward a higher rate of PV/SMV resection in PD performed in 2010 to 2012 (20.7% v 4.8%,  $p = 0.055$ ).

Higher operative volume, including an increased rate of vascular resections, was successfully realized at this centre following the recruitment of an additional surgeon to comply with provincial HPB standards. These data suggest the centre was able to offer potentially curative surgery to a larger volume of patients, with a wider range of resectability, with no increase in the rate of perioperative complications.

#### 108

**Hospital readmission after pancreaticoduodenectomy in a high volume center.** *J. B. Rose, F. Rocha, A. Alseidi, T. Biehl, S. Helton.* From Virginia Mason Medical Center, Seattle, Wash.

Thirty day hospital readmission is a new quality metric that will be used to reduce hospital reimbursement in the future. The aims of this study were to identify predictors of readmission following pancreaticoduodenectomy and to estimate health care resource dollars saved from avoidable readmission.

The electronic medical record and hospital financial database were used to retrospectively identify all patients undergoing pancreaticoduodenectomy between 2008 and 2012 in a high-volume tertiary hospital. Patient demographics, hospital charges, perioperative outcomes, and discharge disposition were determined. Readmission rate, corresponding etiologies, and associated charges were established. Predictors of readmission were determined by logistic regression analysis.

Of the 380 patients that underwent pancreaticoduodenectomy between 2008 and 2012, 69 (18%) were readmitted within 30 days (median 7 d). Readmissions accounted for an additional 458 hospital days (median 5 d per readmission). Age, sex, Charlson comorbidity index, operative indication, length of operation, length of stay, discharge disposition, payer status, or hospital charges were not predictive of readmission. However, having a complication before discharge was a risk factor (OR 2.5 [1.5–4.3];  $p \leq 0.001$ ). Hospital mortality and complication rates were 0.5% and 32% respectively. The most common causes for readmission were: infection (52%), gastrointestinal-related (16%), dehydration (10%), and pain (3%). Twelve readmissions (17%) were determined to be avoidable, accounting for 65 additional hospital days and associated charges totaling \$231 000.

Early identification of patients at risk for avoidable readmission following pancreaticoduodenectomy has great potential to reduce health care expenditures in high volume hospitals performing these complex operations.

#### 109

**Experienced based design (EBD) improves the delivery of care to patients with pancreatic cancer. R. Heneghan, S. Haufe, A. Hagensen, K. Leicester, M. Cranny, A. London, S. Helton. From the Virginia Mason Medical Center, Seattle, Wash.**

Experience based design (EBD) is a philosophy and set of methods focused on understanding the experiences and emotions of those involved in receiving and delivering health care services in an effort to better deliver patient-centred care. This study describes how we used EBD to transform our delivery of care to patients with PC.

Over a 6-month period, we observed 6 patients with PC and their family members through their entire episode of care: referral, diagnosis, treatment, and follow up. Sixty structured interviews were held with patients and their families and health care staff. A total of 120 questionnaires were collected from previously treated patients with PC. One focus group with patients was held. Five themes were identified that best defined the PC experience for all parties: communication, prognosis, education, team, and support services. Three codesign workshops were held to identify and then prioritize opportunities for improving the patient experience. Opportunities were consolidated into 3 areas and addressed by 3 subgroups: 1) understand and document patient values and goals; 2) provide better

resources and support for family caregivers; and 3) improve support services and care coordination.

Four codesigned improvements in care were developed and refined by the EBD team: 1) A “know me form” which communicates patients’ needs, beliefs, values and therapeutic goals; 2) a personalized resource and education folder that conveys important information at the right time and in the right amount desired and prescribed by the patient; 3) a redefined role for the patient navigator; and 4) the creation of a personalized multidisciplinary clinic for PC patients. Patients and family members became increasingly engaged because of the opportunity to define and shape processes of care that matter most to them. As a result, members of the EBD team created an advisory group that meets monthly to further improve the patient experience.

Experience based design is an effective way for creating and delivering highly valued, personalized care to patients with PC.

#### 110

**Determining the natural history of pancreatic cystic neoplasms: a Canadian provincial cohort study. J. Broughton, A. McKay, J. Lipschitz, M. Cantor, D. Moffatt, A. Abdoh. From the University of Manitoba, Winnipeg, Man.**

Most pancreatic cystic neoplasms (PCN) are thought to harbor a low malignant potential. Observation of small (< 3 cm) lesions, in the absence of worrisome features such as mural nodule, solid component or main pancreatic duct (PD) dilatation, is a thought to be a safe treatment option. This study attempts to describe the natural history of these lesions in a provincial cohort, to assess the safety of nonsurgical management.

This was a retrospective cohort study and included all adult patients (age 18+ yr) seen with PCN between 2000 and 2012 by the 2 main institutions in a single province. PCN were separated as high and low risk, which dictated initial treatment plan (surgery or observation). Predictors of initial surgical treatment, delayed surgery in the observation group and the clinical/radiological predictors of malignancy were assessed. The primary outcome measure of interest was the rate of malignancy, which was defined as the presence of high-grade dysplasia or invasive carcinoma.

A total of 497 patients were included in this study. Forty-three (8.7%) high-risk lesions underwent initial surgery, with 13 (30.2%) cases of malignancy discovered. A total of 450 (90.5%) low-risk cysts were observed for a median of 17.3 months (range 0.00–142.3). Twenty-nine (6.4%) cases of delayed surgery occurred, with malignancy discovered in 4 (13.8%). In these cases of malignancy, the median time to delayed surgery was 17 months (95% CI 0.00–63.71). Malignancy was associated with jaundice ( $p \leq 0.001$ ), PD dilatation (> 6 mm,  $p = 0.025$ ; > 10 mm,  $p = 0.016$ ) and nonincidental finding ( $p = 0.001$ ). Size was not a significant predictor of malignancy.

This study supports current selection criteria. Due to the low incidence of malignancy in low-risk PCN (< 1%), it would appear that long-term observation of these lesions is safe, and should be the treatment modality of choice in the absence of high-risk features.

111

**Risk factors for perioperative red blood cell transfusions in liver resection — the importance of operative and intraoperative care.** *E. Cheng, I. Kulyk, J. Hallet, J. Truong, S. Hanna, C. Law, N. Coburn, J. Tarshis, Y. Lin, P.J. Karanicolas.* From Sunnybrook Health Sciences Centre, The Odette Cancer Centre, Division of General Surgery, University of Toronto, Toronto, Ont.

Blood loss remains a significant concern with liver resection. Perioperative red blood cell transfusion (RBCT) carries risk of increased morbidity and worse oncologic outcomes. We sought to assess the factors associated with perioperative RBCT after hepatectomy.

We reviewed charts of all patients undergoing hepatectomy for primary or secondary liver disease at a single academic institution from 2003 to 2012. Primary outcome was perioperative RBCT (during and 30 d following surgery). Secondary outcomes included intra-operative estimated blood loss (EBL). After descriptive and univariate comparisons, multivariate analyses were conducted to identify factors associated with RBCT.

Of 723 patients, 29.3% (212/723) received RBCT. Among RBCT patients, female sex (34.3% v. 25.7%;  $p = 0.01$ ), preoperative anemia (43.6% v. 19.4%;  $p < 0.001$ ), and major liver resection (32.0% v. 23.5%;  $p = 0.02$ ) were more common. Transfused patients presented lower preoperative platelets ( $p = 0.027$ ) and albumin ( $p < 0.001$ ) levels. Mean EBL was 1L higher ( $p < 0.001$ ) and operating time 1.06 hours longer ( $p < 0.001$ ) in cases of RBCT. Independent factors associated with RBCT included preoperative anemia (OR 4.48;  $p < 0.001$ ), intraoperative central venous pressure (OR 1.10;  $p < 0.001$ ), nadir systolic blood pressure (OR 0.94;  $p = 0.003$  fluid balance (OR 0.25;  $p < 0.001$ ), volume intake (OR 5.24;  $p < 0.001$ ), and urine output (OR 0.14;  $p = 0.005$ ).

Likelihood of RBCT is independently associated with preoperative anemia, and intraoperative hemodynamics. These factors highlight the need to focus on management of preoperative anemia, low intraoperative central venous pressure, and optimized fluid administration to minimize the need for RBCTs and mitigate their repercussions for patients undergoing hepatectomy.

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**(CJS Editors' Choice Award) Simultaneous resection of primary colorectal cancer and synchronous liver metastases: a population-based study.** *S. Nanji,\*† J.J. Biagi,† J. Chen,‡ W.J. Mackillop,†§ C.M. Booth.†§* From the \*Departments of Surgery, †Oncology and ‡Pathology, Queen's University, and the §Division of Cancer Care and Epidemiology, Queen's University Cancer Research Institute, Kingston, Ont.

Surgical resection of colorectal cancer liver metastases (CRC LM) with curative intent is now the standard of care for fit patients with resectable disease. The role of combined resection of primary tumours and synchronous liver metastases is gaining interest but remains controversial. Here we report clinical features and outcomes in patients with CRC LM undergoing simultaneous resection in routine clinical practice.

All cases of CRC in Ontario who underwent surgical resection of liver metastases in 2002 to 2009 were identified using the

population-based Ontario Cancer Registry and linked treatment records. Pathology reports were obtained and abstracted to provide details regarding extent of disease, surgical procedure, and pathologic findings. The cohort of interest included those patients who underwent combined resection of the primary tumour and liver metastasis.

During 2002 to 2009, 1711 patients underwent resection of CRC LM in Ontario; pathology reports were obtained for 1480. Eighty-three (6%) patients underwent simultaneous resection. Mean age (62 and 63 yr), number of liver lesions (1.6 and 2.0); size of the largest lesions (3.2 and 2.4 cm) and R1 resection rate (8% and 8%) were comparable between those patients treated with combined resection and all other patients with resected CRC LM. Among those patients treated with combined resection the primary tumour was left sided in 47% of cases, right-sided in 40%, and rectal in 13%. With respect to the liver resection, 20% had a major anatomic ( $\geq 3$  segments) resection (primary tumour right-sided in 69% and left-sided in 31%), and 80% had either a wedge or minor anatomic resection (primary tumour left-sided in 41%, right-sided in 33%, rectal in 26%). Five-year overall survival of patients with combined surgery was 45% (95% CI 34%–56%). The 5-year OS of all other cases of resected CRC LM in Ontario was 50% (95% CI 47%–53%).

A substantial proportion of patients in the general population treated with combined resection of the primary colorectal tumour and liver metastases have long-term survival.

113

**Lateral approach in laparoscopic distal pancreatectomy is safe and potentially beneficial compared with the traditional medial approach.** *D. Abramowitz, J. Hallet, M. Strickland, V. Liang, C. Law, S. Jayaraman.* From Sunnybrook Health Sciences Centre; The Odette Cancer Centre; Saint Joseph Health Centre; and the Division of General Surgery, University of Toronto, Toronto, Ont.

Laparoscopic distal pancreatectomy has become widely accepted for the treatment of left-sided pancreatic lesions, with a traditional medial approach. To facilitate dissection and spleen-preservation, technical reports of a lateral approach recently surfaced. Data on this technique remain sparse and inconclusive and it has never been compared with the traditional approach. We sought to compare the outcomes of lateral laparoscopic distal pancreatectomy (LLDP) to medial laparoscopic distal pancreatectomy (MLDP).

We reviewed the charts of patients undergoing laparoscopic distal pancreatectomy at 2 teaching hospitals, from July 2009 to June 2013. Primary outcomes were operating time and estimated blood loss. Secondary outcomes were success of spleen-preserving procedures, length of sacrificed pancreas parenchyma, margins status, 30-day major morbidity (Clavien grade 3, 4 and 5), and length of stay (LOS). We performed comparative analysis between LLDP and MLDP.

We retrieved 43 cases (19 LLDP, 24 MLDP). Four conversions occurred with MLDP as opposed to 1 with LLDP ( $p = 0.36$ ). Median operative time was shorter with LLDP (166 v. 190 min;  $p = 0.03$ ). Median blood loss was lower with LLDP (50 v. 250 mL;  $p < 0.01$ ). The proportion of spleen-preserving procedures did not differ ( $p = 0.63$ ). All margins were negative with LLDP compared with 2 positive margins (8.3%) with MLDP.

There was no difference in the median length of resected pancreatic parenchyma (LLDP 6.9 cm v. MLDP 7.1 cm;  $p = 0.70$ ). We observed a trend toward shorter median LOS with LLDP (4 v. 5 d;  $p = 0.35$ ). Major morbidity did not differ (LLDP 21% v. MLDP 25%;  $p = 0.76$ ).

Our initial experience indicates that LLDP is a safe approach for distal lesions of the pancreatic tail, associated with shorter operative time and decreased blood loss compared to traditional MLDP. Observed trends highlight potential shorter LOS with LLDP. These hypotheses need to be confirmed on larger cohorts.

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**Surgical resection for pancreatic head cancer: How well are we doing? A retrospective institutional experience. H. Emmerton-Coughlin, M. Meschino, A. Mujoomdar, O. Bashir, K. Leslie, R. Hernandez-Alejandra. From the University of Western Ontario, London, Ont.**

The objectives of this study were to assess our rate of complete histopathologic (R0) resection in pancreatic head adenocarcinoma, the radiographic predictability of R0 resection, and the effect of R0 resection on patient survival.

Our institution's 5-year case series of surgically managed pancreatic head adenocarcinoma was reviewed. Tumours were rated as radiographically resectable, borderline or unresectable according to published criteria. Rate of successful R0 resection, survival, and the predictive value of CT were assessed using the Kaplan-Meier method and logistic regression.

A total of 122 patients who underwent exploratory laparotomy for pancreatic head adenocarcinoma were reviewed. 45 patients (36.9%) were deemed unresectable at the time of laparotomy and underwent palliative procedures, while 77 patients underwent curative intent procedures. Of these, successful R0 resection was achieved in 46 (59.7%), while 31 patients (40.3%) had non-R0 resections. Among those undergoing curative-intent procedures, mean survival in patients with R0 resection was 45 months (95% CI 35–55), significantly higher than in those not achieving R0 resection (mean survival 16 mo, 95% CI 13–21). Of 7 tumours rated unresectable on CT, 6 (87%) were confirmed at laparotomy; however, 1 tumour was completely resected following administration of neoadjuvant chemotherapy. Twenty-two of 45 patients with radiographically resectable tumours achieved R0 resection, yielding a positive predictive value for CT of 48.9%. Radiographically borderline tumours had an R0 resection rate of 25.8%. None of age, sex, Ca 19–9 or any radiographic criterion were found to reliably predict R0 resection.

R0 resection confers significant survival benefit in pancreatic head cancer. Standardized radiographic assessment may assist in the identification of unresectable tumours; however, it does not reliably predict resectability.

#### 115

**Similar outcomes of sterile versus infected walled off pancreatic necrosis treated with combined endoscopic and percutaneous drainage. F. Rocha, M. Gluck, S. Irani, S.-I. Gan, M. Larsen, R. Kozarek, A. Ross. From Virginia Mason Medical Center, Seattle, Wash.**

Infected walled-off pancreatic necrosis (WOPN) is an indication for surgical débridement and is thought to be worse than symp-

tomatic sterile WOPN. We have developed a minimally invasive drainage procedure by combining endoscopic and percutaneous dual modality drainage (DMD) that has reduced hospitalization, resource utilization, and eliminated pancreatic-cutaneous fistulae compared with percutaneous drainage alone. We sought to determine if infected necrosis was associated with different outcomes than sterile necrosis following DMD.

We reviewed an IRB approved, prospective database of all WOPN treated by DMD from 2008 to 2013. Infected necrosis was defined as culture positive aspirates of the WOPN. Clinical variables were collected. Student  $t$  tests were used to compare continuous variables and  $\chi^2$  test was used for categorical data.

One hundred thirty consecutive patients with WOPN underwent DMD, 69 with sterile and 61 with infected WOPN. Severity based on CT index, CRP, ASA grade, and ICU treatment was greater in the infected cohort. Infected patients were older (51 v. 59,  $p < 0.01$ ), had longer hospital stays (15 v. 25 d,  $p < 0.009$ ), had more percutaneous drains (1.1 v. 1.4,  $p < 0.02$ ), and more endoscopies (1.0 v. 1.5,  $p < 0.04$ ). Both groups had equivalent CT scans and drain tube studies until completion of therapy. Complications including pseudoaneurysm, enteric fistulae, and abscesses were rare and not different between cohorts. Two deaths occurred before removal of drains in each group. No operations for nonresolving WOPN, persistent fistulae, or other causes were needed in either group.

Although patients with infected WOPN were older, had higher clinical severity status, and required longer hospital stays, they had a similar outcome to sterile WOPN following DMD. Infected WOPN can be managed safely and effectively with non-surgical techniques although they may require additional endoscopic and percutaneous interventions for resolution.

#### 116

**Pancreatic adenocarcinoma in young patients: a single institution experience over 32 years. J. Koller, F. Alemi, S. Damle, T. Biehl, A. Alseidi, B. Lin, V. Picozzi, S. Helton, F. Rocha. From Virginia Mason Medical Center, Seattle, Wash.**

Pancreatic adenocarcinoma (PDAC) typically presents in an older population and little is known about its prognosis in younger patients. The current study sought to evaluate the epidemiology, treatments, and outcomes in a cohort of PDAC patients under 50.

All PDAC patients aged 50 years or younger at diagnosis evaluated at a single institution from 1980 to 2012 were identified from administrative databases and medical records. Clinicopathologic parameters including demographics, staging, surgical and oncologic therapy was collected. Survival analysis was performed using the Kaplan-Meier method.

Two hundred twenty-six patients were identified, 59% male and 41% female. The distribution by ages was 30–34 years, 35–39 years, 40–44 years, 45–50 years was 8, 22, 49 and 147, respectively. Primary tumour location was 83% in the head or uncinete process, and 17% in the neck, body, or tail of the gland. The median overall survival (OS) was 11.0 months (95% CI 8.8–12.8) during a median follow-up of 12.0 months. Median OS by decade was 6.4 months (95% CI 3.6–8.7) for 25 patients in 1980s, 8.1 months (95% CI 6.1–11.8) for 44 patients in 1990s, and 13 months (95% CI 10.6–17.3) for 157 patients in the 2000s. Forty-six (23.3%) underwent pancreatectomy with a median OS of 25.7 months (95% CI 19.9–32.8) for AJCC stage 0 ( $n = 3$ ), IA ( $n = 1$ ),

IB ( $n = 4$ ), IIA ( $n = 2$ ), IIB ( $n = 21$ ), III ( $n = 3$ ) and IV ( $n = 1$ ) disease. Fifty-nine patients (29.9%) presented with locally advanced, unresectable disease while 92 (46.7%) had metastatic disease with a median OS of 12.3 months (95% CI 10.4–16.7) and 7.3 months (95% CI 5.6–8.8) respectively. Of resected patients, 21.7% were treated with neoadjuvant chemotherapy, 84.7% received adjuvant chemotherapy, and 63.0% underwent adjuvant chemoradiation.

The majority of PDAC patients younger than 50 present with inoperable disease. These patients have a similar prognosis to the general PDAC population despite their younger age, ability to undergo pancreatectomy and tolerate adjuvant therapy.

### 117

**Factors predictive of pancreaticojejunostomy stenosis post pancreaticoduodenectomy (Whipple's procedure).** *K. Bertens, T. Clancy, R. Swanson.* From Brigham and Women's Hospital, Boston, Mass., and the University of Western Ontario, London, Ont.

Following pancreaticoduodenectomy (PD), 2%–11% of patients will develop PJS, and the management is complicated by the altered anatomy. Placement of internal and external stents at the time of PD has been hypothesized to cause injury to the pancreatic duct causing stenosis of the anastomosis.

This is a retrospective cohort study of patients who underwent PD at Brigham and Women's Hospital between January 2004 and October 2012. A prospectively collected database was queried to identify 326 adult patients that had PD. The electronic medical record (EMR) was then reviewed to identify those who had at least 6 months of clinical and radiologic follow-up. A total of 249 patients meeting the follow-up inclusion criteria were identified. The outcome of interest is radiologic or clinical evidence of PJS. Univariate and multivariate logistic regression were used to identify factors associated with the development of PJS.

Seventeen (6.9%) patients meet the diagnostic criteria for PJS. In univariate analysis both a previous history of pancreatitis ( $p = 0.001$ ) and postoperative pancreatic leak ( $p = 0.031$ ) increase the likelihood of developing PJS. The odds of developing a stricture at the PJ anastomosis was highest when acute pancreatitis occurred in the perioperative period (OR 6.98 95% CI 2.01–24.28). Neither the presence of an external pancreatic anastomotic stent ( $p = 0.247$ ) nor the length of time the stent is in place ( $p = 0.324$ ) impacted the risk of developing PJS. In multivariate analysis, only postoperative pancreatic leak remained predictive of the development of PJS following PD.

An episode of acute pancreatitis in the perioperative period and postoperative PJ anastomotic leak significantly increases the odds of developing PJS post-Whipple procedure. Stenting of the PJ anastomosis does not appear to have any impact of the development of PJS.

### 118

**Hepatobiliary scintigraphy (HBS) for the assessment of the future liver remnant (FRL) in associating liver partition and portal vein ligation for staged hepatectomy (ALPPS): Does volume equal function?** *J. Hawel, K. Pineda, G. J. Romsa, R. Hernandez Alejandro.* From the University of Western Ontario, London, Ont.

Surgical resection offers the only chance for cure in the setting of hepatic metastases. Despite advancements in surgical techniques

and perioperative care, post-resection liver failure, due to inadequate FRL, remains a major cause of morbidity and mortality. Liver resection can usually be safely performed when FRL volume is greater than 30%. Extended liver resections often require techniques to induce hypertrophy of the FRL before resection. Hepatobiliary scintigraphy is a relatively new technique that results in rapid hypertrophy of the FRL. However, it is not yet known if this rapid increase in size correlates with an equivalent increase in function. HBS has been shown to be a potential surrogate for function. Using HBS and CT volumetry, the functional increase of the partitioned liver in ALPPS can easily be measured and compared with the size increase.

A pilot study of 4 patient charts was carried out. Each patient had an ALPPS for hepatic metastases and had HBS and CT volumetry preoperatively, and again before proceeding with the second stage of their resection. Data abstracted for each patient included patient demographics, FRL proportion of size and function (preop and prestage II ALPPS), as well as INR and bilirubin (preop, in-hospital and at 30-day follow-up).

The mean increase in the size of the FRL was 68.3%. The mean increase in function of the liver was 84.3%. The mean hypertrophy time between the first and second stage was 7.7 days. There were no major perioperative complications. Maximum bilirubin in the study group was 95.2  $\mu\text{mol/L}$  and maximum INR was 1.8.

Function appears to correlate with volume of the FLR, although the function of the FLR after partition was higher than volumes. Further areas of study could include long-term follow up to see if this trend persists outside of the perioperative setting. HBS is promising as an additional tool in the assessment of FRL in ALPPS. Our study is limited by small sample size, as ALPPS remains an infrequently performed operation. We need prospective studies, ideally multicentre, to further delineate the role of HBS in the assessment of the FRL.

### 119

**Quality of pancreatic cancer in Nova Scotia using quality indicators.** *S. Hurton, G. Porter, A. Levy, M. Molinari.* From Dalhousie University, Halifax, NS

The prognosis of patients with pancreatic cancer (PC) continues to be poor. In addition to late diagnosis and aggressive tumour biology, poor survival in PC patients may be due to suboptimal care and low rates of cancer-directed therapy. The aim of this study was to retrospectively analyze the quality of care and outcomes of PC patients in a single province over a 10-year period.

All patients with resectable pancreatic adenocarcinoma from 2001–2011 were identified using provincial prospectively maintained databases linked with chart review data. We tested the results from our population with international standards from Sabater et al. (mean [95% CI]) for perioperative mortality (pancreaticoduodenectomy [PD]: 2% [0%–4%]; distal pancreatectomy [DP]: 1% [0%–3%]), R1 resection rate (36%, [29%–42%]), 1, 3, and 5-year survival (63% [57%–69%]; 28% [22%–34%]; 16% [11%–21%]) and number of lymph nodes retrieved (19 [17–21]).

Surgical resection was performed on 109 (9.6%) patients. Pancreaticoduodenectomy was performed in 84 patients (77%), DP in 12 (11%), and total pancreatectomy in 1. Perioperative mortality occurred in 7 patients (6.42%, 95% CI 1.8%–11.0%). R1 resection was performed on 40 patients (36.7%, 27.7%–45.8%). The

1-, 3- and 5-year survival were 55% (95% CI 45.7%–64.3%), 18.5% (95% CI 11.4%–26.8%), and 9.4% (95% CI 8.54%–22.3%), respectively. Mean lymph nodes retrieved were 8.8 (95% CI 7.7–10). Our population appeared to fall outside international standard only for the number of lymph nodes retrieved when compared with established quality of care indicators. In our province, the percentage of patients who underwent surgical resection and the number of lymph nodes retrieved seems to be suboptimal. Although the overall survival of resected PC patients was not affected significantly, further studies are required to examine discrepancies with international standards.

## 120

**Variations in medical oncology utilization practices by pancreatic cancer patients in Nova Scotia. S. Hurton, G. Porter, M. Walsh, M. Molinari. From Dalhousie University, Halifax, NS**

Population-based studies in the USA have shown that pancreatic cancer (PC) has one of the lowest rates of cancer directed therapy among solid organ malignancies. Socioeconomic factors, referral patterns and unequal access to health care might be responsible. There is a lack of data on PC patients living in regions where health care is uniformly available. The main aim of this study was to assess PC directed therapy in a cohort of patients diagnosed with PC in a single Canadian province.

A cohort of 1069 patients with PC was identified using the provincial cancer registry over a 10-year period (2001–2011). Demographic, clinical and socioeconomic data were extracted from the linkage of multiple administrative databases. Predictors of medical oncology health care utilization in PC patients were explored by multivariate regression analyses.

Curative resection was performed in 136 patients (12.7%) and palliation in 996 (87.3%). Of all resected patients, 50% had a medical oncology visit for adjuvant therapy. In addition, only 37.5% of all resected patients visited medical oncology within 10 weeks. Among the unresected patients, 36.6% were referred for palliative chemotherapy. There was greater attrition between referral to medical oncology and actual visit to medical oncology in resected patients versus unresected patients (16.9% v. 4.4%). Upon multivariate analysis, only advanced age ( $p = 0.0026$ ) and ( $p = 0.0477$ ) were the only significant factors pre-

dictors for failure of medical oncology visit. Socioeconomic status was not significant predictors of medical oncology visit for chemotherapy consideration.

The majority of patients with PC did not receive cancer directed therapy, despite the availability of universal health care services. Socioeconomic characteristics and distance to medical centres did not have a significant effect in potential utilization of adjuvant or palliative oncological treatments in our population.

## 121

**Perioperative morbidity and mortality after pancreatectomy: a systematic review of prediction scores, models and nomograms. G. Martel, J. Aubin, F.K. Balaa, R. Lapointe, F. Vandenbroucke-Menu. From the University of Ottawa, Ottawa, Ont.**

Pancreatic resection is associated with a high rate of postoperative morbidity and mortality. Numerous scoring systems and predictive models have been developed to forecast the postoperative course of individual patients.

A systematic review of the literature pertaining to perioperative morbidity and mortality risk prediction scores after pancreatic resection was carried out. A review protocol was used. Papers presenting or using prediction scores, models and nomograms were retrieved. The characteristics of each score were reviewed, as were their validation history.

A total of 788 de-duplicated studies were screened. Fifty studies fit the criteria for inclusion, yielding 46 different scores or prognostic models. The majority of scores (52.2%) are based on preoperative variables. A total of 104 different variables were used across all scores. Outcomes predicted were morbidity and mortality (20 scores), morbidity alone (8 scores), mortality alone (10 scores) and postoperative pancreatic fistula (7 scores). The POSSUM score was most reported, followed by P-POSSUM and E-PASS. Few studies report on external validation.

This work identified 46 different scores to predict postoperative morbidity and mortality after pancreatectomy. Many scores were generic, while others pertained to specific populations or outcomes. The overall degree of validation was poor. Further prospective studies are needed to validate the remaining scores. The usefulness of individual scores and their ability to predict an outcome of interest was highly variable.

# Canadian Society of Surgical Oncology

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**Defining the neuroendocrine tumors landscape: a 15-year population-based analysis of incidence, outcomes and therapies.** *J. Hallet, S. Singh, R. Saskin, N. Liu, C. Law.* From Sunnybrook Health Sciences Centre; The Odette Cancer Centre; Division of General Surgery, University of Toronto; and the Institute of Clinical Evaluative Sciences, Toronto, Ont.

Neuroendocrine tumours (NETs) are poorly understood malignancies. We sought to define epidemiologic characteristics and outcomes, and describe chemotherapy, interventional and surgical therapies use for NETs.

We conducted a population-based retrospective cohort study of all adult patients with NETs in Ontario from 1994 to 2009, linking prospective databases linked at the Institute of Clinical Evaluative Sciences. We looked at incidence, proportion of metastatic disease, overall survival (OS), and use of chemotherapy (CT), liver embolization (LE), and surgery.

We identified 5619 NET cases. Incidence of NETs increased from 2.48 to 5.86 per 100 000 per year. Synchronous metastases were found in 20.8% and metachronous metastases in 38%. Incidence and metastases varied according to primary NET site. Around time of diagnosis (60 d pre/postdiagnosis), 56.8% did not consult a surgeon and 97.2% did not see a medical oncologist. Initial primary site resection was performed in 63.9% bronchopulmonary (BP), 57.1% gastrointestinal (GI) and 46.4% pancreas (PA) NETs ( $p < 0.001$ ). A total of 53.7% of all liver metastases were resected. Chemotherapy was used in 46% of PA, 23.2% GI and 25.4% BP NETs, and LE in 8.1% BP, 11.9% GI, and 19.2% PA NETs. Ten-year OS was 42.8%, with independent predictors of worse OS being: advanced age, male sex, low socioeconomic status, rural living, and pancreas and small intestine sites.

Neuroendocrine tumours incidence has markedly increased over 15 years, with outcomes disparities based on demographics, social, and tumour characteristics. Patterns of care for NETs were irregular and sporadic. Numerous NETs were not assessed by a surgeon, indicating worrisome potential under treatment and non-optimal management. Future work is needed to define mechanisms explaining this portrait in order to improve outcomes through early diagnosis, more frequent surgical referrals and standardization of therapies.

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Withdrawn

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**Repeat cytoreductive surgery and hyperthermic intraperitoneal chemotherapy for patients with peritoneal carcinomatosis from appendiceal and colorectal cancers.** *A. Bouchard-Fortier, W.J. Temple, L.A. Mack.* From the University of Calgary, Calgary, Alta.

Peritoneal recurrences after cytoreductive surgery and hyperthermic intraperitoneal chemotherapy (CRS/HIPEC) for appendiceal and colon cancers are frequent. This study aimed to evaluate short-term and long-term results of repeat CRS/HIPEC in patients with recurrent peritoneal carcinomatosis.

We identified 301 patients that were treated for peritoneal carcinomatosis with CRS/HIPEC in our centre. Of these 301 patients, 25 with appendiceal and colon cancers had a repeat CRS/HIPEC. An analysis of their baseline characteristics, procedures details, morbidity, disease-free survival and mortality was conducted.

Twenty-five patients with peritoneal carcinomatosis (18 appendiceal and 7 colorectal cancers) underwent a total of 52 CRS/HIPEC. From these 52 procedures, there was no 30-day mortality and 19 of 25 patients (76%) had a complete second cytoreduction (CC0-1). When compared with the first CRS/HIPEC, the second procedure was associated with significantly lower peritoneal carcinoma index (15.8 v. 27.0,  $p < 0.005$ ), blood loss (544 v. 1760 mL,  $p < 0.005$ ), operating time (314 v. 435 min,  $p < 0.005$ ) and a nonsignificant decrease in grade III-IV complications. For patients with a complete second cytoreduction, median disease-free survival was 15.1 months and median overall survival for all patients was 36.5 months.

Repeat CRS/HIPEC procedures for peritoneal carcinomatosis from appendiceal and colorectal cancers are safe in well selected patients without increased morbidity or mortality and are associated with significant long-term survival.

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**Patient navigation reduces time to care for patients with breast disease.** *E. McKeivitt, Carol Dingee, J. Pao, R. Warburton, C. Brown, U. Kuusk.* From Providence Health Care, Vancouver, BC

Diagnostic pathways for breast disease are currently under review in British Columbia. In 2009 a Multidisciplinary Breast Clinic (MBC) was opened at our hospital. Navigated care through the clinic demonstrated significantly shorter time to definitive care when compared with the traditional system (TS). Since 2009 many breast radiology facilities have introduced facilitated care pathways for patients with breast pathology. Our objective was to determine if this change in diagnostic imaging availability had eliminated the advantage in time to definitive care previously shown for the MBC.

All patients seen in the MBC and office based TS in November to December 2012 were included in this analysis. A retrospective chart review tabulated demographic, surgeon, pathology, and radiologic data, including time intervals to definitive care for all patients. Data were analyzed comparing MBC to TS in 2012 and then compared with the similar data collected in 2009.

In 2012, 176 patients with breast pathology were assessed by 4 surgeons via MBC or TS. Time from presentation to surgeon evaluation was still significantly shorter in the MBC group (74 v.

37 d,  $p < 0.0001$ ). For a malignant diagnosis, the difference was less pronounced but still significant (55 v. 31 d,  $p = 0.008$ ). For benign referral diagnosis, MBC patients were seen over 1 month sooner (80 v. 45 d,  $p = 0.0003$ ). In patients managed via MBC, all imaging was more likely to be conducted at a single centre (89% v. 63%,  $p = 0.002$ ). Time to care for cancer patients in the TS is unchanged from 2009 and longer than currently recommended targets.

In conclusion, patient navigation and the coordination of imaging and clinical care reduces time to definitive care in patients with breast pathology. Patient navigation should be incorporated into breast patient management in Canada.

## 126

**Predictive ability of blood neutrophil-to-lymphocyte and platelet-to-lymphocyte ratio in gastrointestinal stromal tumours (GIST).** *J.M. Racz, M.C. Cleghorn, M.C. Jimenez, E.G. Atenafu, T.D. Jackson, A. Okrainec, L. Venkat Raghavan, F.A. Quereshy.* From the University Health Network, University of Toronto, Toronto, Ontario.

The inflammatory response, specifically the neutrophil-to-lymphocyte ratio (NLR), has recently been shown to be prognostic in untreated, primary GIST. Moreover, the platelet-to-lymphocyte ratio (PLR) has been shown to predict outcome in several gastrointestinal tumours; however, no studies have examined its predictive ability in GIST. This study serves to evaluate the prognostic utility of NLR and PLR in patients undergoing surgical resection for GIST.

All patients who underwent surgical resection for primary, localized GIST from 2001 to 2011 were identified from a prospectively maintained database. NLR and PLR were assessed preoperatively. Survival curves were calculated by the Kaplan–Meier product limit method and compared by the log-rank test. Univariate and multivariable Cox proportional hazard regression models were used to identify associations with outcome variables. High/low NLR ( $\geq 2.04$ / $< 2.04$ ) and PLR ( $\geq 245$ / $< 245$ ) were determined using optimization techniques.

A total of 93 patients were included. Platelet-to-lymphocyte ratio was associated with recurrence-free survival (RFS) on univariate (HR 0.271, 95% CI 0.078–0.938,  $p = 0.039$ ) and multivariable analysis (HR 0.048, 95% CI 0.003–0.884,  $p = 0.041$ ). Patients with low PLR had 2- and 5-year RFS of 94 and 84%, compared with 57 and 57% in those with high PLR. RFS in patients with mitotic rate  $\leq 5/50$  HPF with low PLR was significantly longer than in those with high PLR ( $p = 0.007$ ). Similarly, RFS in patients with tumour size under 5 cm with low PLR was significantly longer than in those with high PLR ( $p = 0.004$ ). NLR was not associated with either RFS ( $p = 0.226$ ) or overall survival ( $p = 0.994$ ).

While there was no association between NLR and survival, a low PLR was associated with improved RFS especially in tumours with mitotic rate  $\leq 5/50$  HPF or  $< 5$  cm. The independent prognostic ability of PLR to predict disease recurrence in these patients suggests that it may play a role in risk stratification schemes when deciding which patients will benefit from adjuvant therapy.

## 127

**Mucocele of the appendix: an intriguing condition.** *M.E. Rabie, A. Hummadi, M. Al Shuraim, M.S. Al Skaini, S. Al Qahtani, A.S. Al Qahtani, I. Elhakeem.* From the Armed Forces Hospital, Southern Region, Khams Mus-hait, Saudi Arabia

Mucocele of the appendix is a condition with no clear management protocols. We reviewed the operative and pathology reports for all cases with diagnosis of mucinous neoplasm of the appendix. We aimed at analyzing our management of this condition and highlighting the pitfalls and how to avoid them. A total of 9 cases were retrieved, 3 males and 6 females, with a median age of 62 years. The presenting diagnosis ranged from large bowel obstruction in one case to abdominal pain for investigations in 3 cases. CT was done in 8 cases and in only one was the diagnosis suspected. Open appendectomy was done in 2 cases of mucinous cystadenoma with no further surgery performed. Laparoscopic appendectomy was done in 3 cases. Exploratory laparotomy was done in 3 cases: of these, synchronous right hemicolectomy was done, in the other 2 cases appendectomy only was done for mucinous hyperplasia with carcinoid tumour of the appendix in one and mucinous tumour of unknown malignant potential in the other. In the last case, the condition was discovered upon laparoscopy for cholecystectomy, pseudomyxoma peritonii and appendiceal mucocele was found, and laparoscopic appendectomy with peritoneal biopsy was performed. Mucocele of the appendix should be considered when dealing with cystic lesions in the appendix on radiology or intraoperative finding. For mucinous cystadenocarcinoma, right hemicolectomy is needed, whereas for hyperplasia and adenoma, appendectomy usually suffices if the margins are free. In tumours of uncertain malignant potential, the decision is not as simple.

## 128

**Does a multidisciplinary approach improve outcomes in sacral chordoma?** *M.E. Tsang, A.J. Cannell, C.J. Swallow, P.W. Chung, B.C. Dickson, A.M. Griffin, R.S. Bell, J.S. Wunder, P.C. Ferguson, R.A. Gladdy.* From the University of Toronto, Toronto, Ontario.

Chordomas are slow-growing notochord sarcomas traditionally treated with surgery alone. Complete resection may require removal of adjacent pelvic organs. Our centre has developed a multidisciplinary approach including preoperative radiation with resection and reconstruction involving multiple surgical specialties. The goal of this study is to report the short- and long-term outcomes of this comprehensive approach.

Patients with a histologically confirmed diagnosis of sacral chordoma from 1989 to 2012 were identified in our prospective database and a retrospective chart review was performed. Data were analyzed using SPSS.

Twenty-three patients were treated with curative intent. Historically, the operation began in a decubitus position, followed by prone sacrectomy (D+P;  $n = 6$ ). More recently, an anterior/posterior approach (lithotomy then prone, A+P;  $n = 17$ ) has been performed. Patient characteristics and radiation treatment were similar. The latter group had smaller tumours (11.0 cm and 8.1,  $p = 0.02$ ). Median operative time was 9.9 hours in D+P versus 14.0 hours in A+P group ( $p = 0.03$ ). Median intraoperative and postoperative transfusions, need for IR drains, TPN use and length of stay were similar. Wider margins were achieved with the A+P approach. Five-year overall (OS) and local recurrence free survival (LRFS) were 85% and 60% in D+P versus 100% and 70% in the A+P group (OS:  $p = 0.24$ , LRFS:  $p = 0.42$ ).

Neoadjuvant radiation with abdomino-sacral resection of sacral chordoma entails acceptable perioperative morbidity and may improve OS and LRFS.

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**Why women are choosing mastectomy: influences beyond the surgeon. A. Covelli, N. Baxter, M. Fitch, F. Wright. From the University of Toronto, Toronto, Ont.**

Rates of both unilateral (UM) and contralateral prophylactic mastectomy (CPM) for early stage breast cancer (ESBC) have been increasing. We sought the perspectives of patients and treating surgeons to understand why mastectomy rates have been increasing.

We completed a qualitative study to examine the surgeon's practice and the patient's decision making that resulted in the choice for UM ± CPM. Purposive sampling identified women across the Greater Toronto Area, Canada who were suitable candidates for breast conserving therapy (BCT) but underwent UM ± CPM. Academic and community breast surgeons from across Ontario, Canada and the United States were also recruited. Data were collected through semi-structured interviews, this continued until saturation was reached. Constant comparative analysis identified key ideas.

A total of 29 patients and 45 surgeons completed interviews. The dominant theme was "desire for control"; women strived to improve their cancer outcomes by undergoing more extensive surgery. Surgeons described BCT and UM as equivalent treatment options for ESBC, and frequently recommended BCT; despite this, women initiated the request for UM + CPM. Contralateral prophylactic mastectomy was discouraged by the surgeons describing no survival advantage.

The most influential factor in women's request for CPM was their cancer experiences with family and friends, not the surgical consultation. A previous negative experience with breast cancer translated into an overestimated risk of recurrence, contralateral cancer and subsequent mortality. Women chose UM + CPM to ensure they would "never go through this again." Despite feeling confident in their choice most women had ongoing issues with disturbed skin sensation and cosmesis.

Previous cancer experiences were extremely influential in the choice for UM + CPM. As many women had long-term pain and issues with cosmesis after UM ± CPM, we suggest women may benefit from education including exposure to other patients' postoperative concerns to aid in their decision making.

130

**A patient-centred approach toward wait times in the surgical management of breast cancer in the province of Ontario. E. Cordeiro, M. Dixon, N. Coburn, C. Holloway. From the University of Toronto, Toronto, Ont.**

Wait time for breast cancer is an important contributor to cancer outcomes and overall patient satisfaction. We defined a patient-centred wait-time by measuring the time from first abnormal imaging to definitive surgery, and identified factors which independently prolong this time.

This is a retrospective analysis of prospectively maintained databases held at the Institute for Clinical and Evaluative Sciences (ICES) in Ontario, Canada. We evaluated women diagnosed with invasive breast cancer in Ontario from 2003 to 2011. The median wait time between the first abnormal imaging and the date of definitive surgery was calculated. Univariate and multivariate analyses were then performed to identify characteristics of the patients, treating institution and diagnostic pathway that contrib-

ute significantly to the wait time experienced by the patient.

After applying inclusion and exclusion criteria we defined a final cohort of 42 179 women. Of these, 31 837 (75%) had breast conserving surgery and 10 342 (25%) underwent mastectomy. The median wait time from first abnormal imaging to definitive surgery was 52 days (IQR 35–76). On multivariate analysis the following factors independently prolonged average time to definitive surgery by more than 5 days: age over 69 years, later operative year, additional preoperative imaging, additional biopsies, preoperative consultations, surgery at a higher breast surgical volume centre and geographic location of the treating institution.

We defined a novel patient-centred measure of surgical wait time. Many common preoperative interventions significantly impacted overall wait time experienced by the patient. Evidence-based quality initiatives to coordinate appropriate investigations are needed to reduce wait times.

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**Results of resection for recurrent or residual retroperitoneal sarcoma after failed primary treatment. T. Hamilton, A. Cannell, M. Kim, C. Catton, M. Blackstein, B. Dickson, R. Gladdy, C. Swallow. From the University of Toronto, Toronto, Ont.**

Local recurrence after complete resection of retroperitoneal sarcoma (RPS) is a common and difficult problem. Gross residual disease following incomplete resection is a particular treatment challenge. We reviewed our experience with recurrent RPS (RC) or residual RPS (RD) patients referred for consideration of surgical management.

Patients seen at our centre from 1996 to 2013 who had resection of primary RPS at an outside institution were identified from our prospective database. Survival curves were generated by the Kaplan–Meier method and compared by log rank analysis.

A total of 45 patients referred with RC (33) or RD (12) comprise the study cohort. Median age was 61 years and 71% had liposarcoma. Prior to primary surgery, cross-sectional imaging (CT/MRI) was obtained in 30 patients (67%) and core biopsy in 8 patients (18%). At referral, 15 patients were deemed inappropriate for resection due to distant metastases (7), multifocality (4), poor performance status (2) or technical unresectability (2). The median overall survival (OS) in this group was 15 months. Thirty patients (22RC, 8RD) were managed surgically with at least one re-resection. The majority of patients who had re-resection received preop radiation therapy (77%). Postop mortality was 0 in the RC group, and 25% (2 of 8) in the RD group ( $p = 0.02$ ). In the 30 patients with re-resection, median and 5-year OS were 53 months and 50%. OS was better in the RC than RD group (median 77 v. 41 mo,  $p = 0.02$ ). Median time to local re-recurrence was 49 months and 35 months in the RC and RD groups, respectively ( $p = ns$ ).

Durable disease control and prolonged survival can be achieved in selected patients with recurrent RPS. Resection of residual RPS after initial incomplete gross resection was associated with high postop mortality and inferior OS. These data suggest that the undiagnosed retroperitoneal mass should be referred to a specialized centre, to facilitate preop recognition of RPS and minimize incomplete resections.

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**Diagnostic delays: A problem for young women with breast cancer? J. Austin, N. Lam, R. Quinn, M.L. Quan. From the University of Calgary, Calgary, Alta.**

Young age is an independent predictor of recurrence and mortality for women with breast cancer. Delays in diagnosis and treatment may contribute to the worse outcomes observed in this population. The purpose of this study is to determine if there was diagnostic delay for women aged  $\leq 35$  years with breast cancer in Alberta at the population level.

We conducted a retrospective review of all women  $\leq 35$  diagnosed with breast cancer between 2007 and 2010 in Alberta identified from the Alberta Cancer Registry. Patient demographics, diagnostic modality, and time to treatment (surgery and radiation) were abstracted.

“Diagnostic” and “treatment” delay were defined as  $\geq 90$  days from first imaging to pathologic diagnosis and pathologic diagnosis to surgery.

A total of 101 women  $\leq 35$  with breast cancer were identified during the study period. Mean age at diagnosis was  $31.6 (\pm 3.3)$  years.

Initial imaging modality was mammogram and ultrasound in 49.5% and 46.5% of women. The median time from imaging to pathologic diagnosis was 6 days (range 0–502). Of these, 11 (10.1%) women experienced diagnostic delay, with a median delay of 131 days (range 95–502). The stage at diagnosis was not significantly different for women with and without diagnostic delay ( $p = 0.47$ ). For women with diagnostic delay, the initial imaging findings were most often reported as likely benign or recommended only follow up imaging. Mean time from diagnosis to surgery was  $25 (\pm 14)$  days. Of patients undergoing surgery, 25 (24.8%) had breast conserving surgery. Radiation therapy occurred at a median of 48 (range 25–204) days postoperatively or post-chemotherapy.

Ten percent of women  $\leq 35$  with breast cancer experienced a diagnostic delay. Diagnostic delay most often occurred due to initial imaging reports of benign or negative findings. Further studies are required to determine the impact of diagnostic delay on patient outcomes.

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**Real-time electromagnetic navigation for breast tumour resection: proof of concept. G. Gauvin, C. Yeo, T. Ungi, G. Fichtinger, S. Nanji, J. Rudan, J.Engel. From Queen's University, Kingston, Ont.**

Breast cancer is ideally treated during its early stages with breast-conserving surgery. Accurate delineation of the tumour margin is difficult as lesions are commonly not physically palpable, and breast tissue moves and deforms during surgery. Current strategies, including the gold-standard wire-localization, have positive margin rates as high as 47% after initial excision.

We propose using real-time electromagnetic (EM) tracking to 3-dimensionally delineate and track the tumour resection volume, allowing the surgeon to navigate around the tumour and improve the precision of the resection. This method has the potential to reduce the incidence of positive margins, while reducing the amount of healthy tissue removed and improving cosmesis. An EM navigation system has been constructed to utilize ultrasound

to register the tumour resection volume from a tracked needle fixed in the tumour, allowing tumour movement to be followed in real time during surgery.

Ten surgeons were recruited to resect nonvisible, nonpalpable tumours implanted in synthetic breast models. Each participant resected an equal number of tumours using the wire-localization method (control group  $n = 21$ ) and the EM navigation method (EM group  $n = 21$ ).

The resected volumes were analyzed for presence of tumour at the edge of the resection, and size and weight of the resected volume. The positive margin rate in the control group was 42.9%, and the positive margin rate in the EM navigation group was 19.0% ( $p = 0.18$ ). The relative amount of tissue resected with each method was similar ( $p = 0.87$ ).

This proof of concept study demonstrates that EM navigation in breast-conserving therapy could provide real-time feedback to surgeons that alters treatment outcome; EM navigation results in a decreased positive resection margin rate. This encouraging result will be extended to inform the next phase of research which includes testing on cadaveric tissue, followed by clinical trials.

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**Papillary thyroid cancer: epidemiology and clinical implications of bilateral disease. S. Moore, K. Kasaian, S. Jones, A. Melck, S. Wiseman. From the University of British Columbia, Vancouver, BC**

Papillary thyroid cancer (PTC) is a highly prevalent endocrine malignancy with favourable long-term outcomes. The incidence of clinically undetectable PTC in the contralateral lobe is estimated at 50%–60%, but the impact of this has been debated. This study has investigated the epidemiology of bilateral papillary thyroid cancer, and by comparing with the MACIS prognostic score, has evaluated its clinical significance.

The pathology results of patients who underwent total thyroidectomy between 2000 and 2012 at St. Paul's Hospital, Vancouver, BC were reviewed. Demographic and histopathologic risk factors and MACIS scores were compared between patients with unilateral and bilateral PTC; statistical significance was determined using  $\chi^2$  analysis.

A total of 203 patients were identified as having PTC, 40.4% of whom had bilateral disease. Of those with bilateral disease, the majority were female (67.0%), and were  $\geq 45$  years of age (62.2%). More patients with bilateral PTC were found to have vascular invasion (19.5% v. 1.7%,  $p = 0.0001$ ), smaller tumours  $\leq 1$  cm (26.8% v. 0%,  $p < 0.0001$ ), and multifocal disease (98.8% v. 2.5%,  $p < 0.0001$ ) when compared with the unilateral cohort. A higher incidence of extrathyroidal extension (38.8% v. 35.0%,  $p = 0.78$ ), nodal metastases (43.2% v. 32.2%,  $p = 0.36$ ), distant metastases (3.8% v. 0.8%,  $p = 0.52$ ) and MACIS scores under 7 (91.1% v. 90.8%,  $p = 1.00$ ) occurred in patients with bilateral disease. Of those with multifocal tumours, 61.7% had multifocal deposits ipsilateral to the main site of disease.

Significant correlations were identified between bilateral PTC and vascular invasion, and multifocal disease. Smaller tumours were more likely to be bilateral. No correlations were seen with other markers of poor disease prognosis, including higher MACIS scores. No associations were identified between having tumour deposits ipsilateral to the main site of disease and other predictors of poor disease prognosis.

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**Mastectomy, contralateral prophylactic mastectomy and immediate breast reconstruction: an institutional review.** *R. Warburton, J. Pao, E. McKeivitt, C. Dingee, E. Bovill, N. Van Laeken, U. Kuusk.* Providence Health Care, Vancouver, BC

Concern has been raised regarding rates of mastectomy (TM) and contralateral prophylactic mastectomy (CPM). Many factors influence this including access to immediate breast reconstruction (IBR). National data show the rate of TM at 39%, CPM 6% and IBR 7%. We hypothesize that our TM and CPM will be higher than the national average but we will have higher rates of IBR.

Between Jan. 1, 2012 and Dec. 31, 2013, 1604 breast cancer surgeries were performed at our institution. A total of 1076 primary cancer surgeries were performed on 996 patients; 408 (41%) had TM and 588 (59%) had breast conserving surgery (BCS). Of the 588 who attempted BCS, 113 (19%) required additional surgery to obtain negative margins — 51 of 113 had completion mastectomy (CM). In 408 patients, 445 TM were performed and 114 (28%) patients chose CPM. Of the 445 TM, 205 (46%) TM had IBR (175 skin sparing mastectomy, 30 nipple sparing mastectomy). Of the IBR patients, acellular dermal matrix (ADM)/implant 52%, tissue expander 28% and autologous in 20%. In the CPM group over 80% had IBR most commonly with ADM/implant (62%). Since April 2013, the decision for mastectomy was reported: 40% tumour to breast ratio, 30% patient preference, 29% multifocal/multicentric disease, 1% contraindication to radiation.

Our rate of TM (41%) was slightly higher than the national average (39%). The rate of reoperation after BCS was lower (19% v. 23%). Our CPM rate was almost 5 fold the national average (28 v 6%) but our IBR was high than average (46 v. 6%). Access to IBR will increase the rate of TM and CPM and further study will be needed to identify other reasons for increased rate of CPM.

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**The Specimen Margin Assessment Technique (SMART) trial: a novel 3D method of identifying the most accurate method of specimen orientation in breast cancer surgery.** *A. Arnaout, J. M. Aubin, M. Namazi, S. Robertson, D. Gravel, Y. Ayroud, G. Rockwell.* From the Ottawa Hospital Research Institute, Ottawa, Ont.

Achieving negative margins remains one of the most important determinants for local recurrence following breast-conserving therapy. In the event of a positive margin, the re-excision of that specific margin is recommended in order to reduce recurrence. Inaccuracies in margin labelling or orientation during surgery translates into additional unnecessary surgery for re-excision, additional emotional distress for patients, delays in subsequent adjuvant therapy for breast cancer, and associated additional health care costs from undergoing a second surgery. There are 2 commonly used techniques that surgeons use to label margins of breast specimens: intraoperative specimen inking versus suturing. We report the results of the world's first prospective clinical trial that evaluates the accuracy of both techniques on the same lumpectomy specimen, in a blinded fashion, using a novel 3D technique,

with the aim of identifying the most accurate method of specimen orientation.

We hypothesize that intraoperative specimen inking increases accuracy in margin identification and specimen orientation.

A prospective clinical trial was performed under ethics approval. All patients undergoing prophylactic mastectomy or breast reduction underwent a sham lumpectomy within the prophylactic mastectomy or the breast reduction tissue that was removed. Spatial orientation was noted and the specimen was inked intra-operatively by the surgeon using special phosphorescent inks that dry clear but glow under black light. In addition, specimen suturing using 2 labelled sutures was performed by the surgeon as per usual on the same lumpectomy specimen. A third "mystery" suture was placed; the location of which is known only to the surgeon but blinded to the pathologist.

The primary outcome was a discordance rate between the surgeon and the pathologist in the mystery suture identification on the lumpectomy specimen. Secondary outcome: discrepancy in the surface area for each margin as defined by the pathologist versus the surgeon.

Assuming a 15% discordant rate as being clinically significant rate, a 95% exact, 2-sided confidence interval will required a minimum of 32 patients. Accounting for 10% screen failure, we attempted to accrue 35 patients.

Thirty-three patients were accrued for the study, of which 16 were patients undergoing prophylactic mastectomy and 16 were patients undergoing breast reductions. Mean lumpectomy volume was 48 cm<sup>3</sup>. Discordance in the identification of the "mystery" suture location between surgeon and pathologist occurred in 14 of 33 specimens (42%). Discordance in identification of surface area of a margin occurred in 25 of 33 specimens (76%). With special focus on the anterior margin, a median of 2 and a maximum of 4 additional "surgeon identified" margins were included in the "pathologist identified" margin.

Specimen disorientation and margin discordance occurs 42% of the time with intraoperative suturing of margins. Discordance between the surgeon and the pathologist in margin orientation would influence the accuracy of margin identification and the subsequent directed re-excisions, as well as subject patients to unnecessary surgeries. In the case of the pathologist identified anterior margin, inaccuracies which would have affected the potential need for re-excisions should the anterior margin be positive.

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**Impact of perioperative red blood cell transfusions on outcomes after liver resection.** *I. Kulyk, E.S. Cheng, J. Hallet, J. Truong, S. Hanna, C. Law, N. Coburn, J. Tarshis, Y. Lin, P.J. Karanicolas.* From Sunnybrook Health Sciences Centre; The Odette Cancer Centre; Division of General Surgery, University of Toronto; and the Institute of Clinical Evaluative Sciences, Toronto, Ont.

Red blood cell transfusions (RBCTs) remain common after hepatectomy due to risk of blood loss. We sought to explore the association between RBCTs and posthepatectomy perioperative outcomes.

We reviewed the charts of patients undergoing liver resection at a single academic institution from 2003 to 2012. Primary outcome was 30-day major morbidity (MM, Clavien grade III to V). Secondary outcomes included length of stay

(LOS). Preoperative characteristics, operative and hemodynamics data, and postoperative course were explored. Multivariate analyses were used to define association between RBCT and outcomes.

During the 10-year period we included 712 patients with 208 (29.2%) receiving RBCT and 120 (16.9%) experiencing MM. Patients with MM were older (mean 65.3 v. 62.1 yr;  $p = 0.01$ ), had a longer operative time (5.97 v. 4.73 h,  $p < 0.01$ ), higher estimated blood loss (1.56 v. 1.10 L,  $p = 0.03$ ), more often underwent major liver resection (18.7% v. 12.7%,  $p = 0.049$ ), and experienced more intraoperative complications (30.4% v. 15.8%,  $p = 0.03$ ). After adjusting for preoperative and intraoperative variables, RBCT was independently associated with risk of MM (OR 2.93,  $p < 0.01$ ). Patients who received RBCT had significantly longer LOS than those who did not (21.30 v. 8.14 d,  $p < 0.01$ ).

Red blood cell transfusion is independently associated with increased postoperative MM and prolonged LOS following hepatectomy. These findings highlight the need to minimize blood loss during liver resection and restrict RBCT to optimize postoperative outcomes.

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**The impact of a critical look at the consequences of preoperative MRI in breast cancer patients.** *C. Yeung, M. Namazi, V. Deslauriers, F. Hagggar, A. Arnaout.* From the Ottawa Hospital, Ottawa, Ont.

Despite the fact that routine use of preoperative breast MRI for breast cancer has not been shown to improve oncologic outcomes, it is still an exceedingly popular test. Due to low MRI specificity, patients may be subjected to additional invasive test. There have been few studies specifically evaluating the outcomes from these additional tests and its implications on the health care system. The objective of this study was to critically evaluate the impact of performing a preoperative MRI on breast cancer patients at our institution.

A retrospective chart review was performed on all female breast cancer patients diagnosed and awaiting surgery (2010–2012). Based on extracted data, indications for preoperative breast MRI were established for our institution (2013). Adherence to these guidelines was then assessed over the next year.

In 2010 to 2012, 1159 of 1674 breast cancer patients underwent a preoperative breast MRI. The MRI group was younger ( $p < 0.0001$ ), but not different in histologic subtype ( $p = 0.06$ ) or biomarker status (0.61). A total of 421 of 1159 (36%) of MRI patients underwent at least one additional MRI induced imaging test (ultrasound, mammogram, 6 month MRI) following the MRI. 35% (415 of 1159) of patients underwent an additional

MRI-induced biopsies, 52% of which were benign in the breast and 62% of which were benign in the axilla. Post-MRI biopsies resulted in upstaging (DCIS to invasive cancer; node negative to node positive) in 25 of 1159 (2%) of patients.

Preliminary data assessing local guideline adherence demonstrated that 188 of 349 (54%) of new breast cancer patients underwent a preoperative MRI. Locally accepted indications for MRI use included: dense breast (26%); assessment of tumour extent; (19%); lobular carcinoma (16%); assessment of locally advanced cancer (16%). A total of 71% of MRI studies were ordered by the radiologist. 22% of patients had no obvious indication for MRI according to our local guidelines. MRI-induced biopsies occurred in 76/189 (40.2%) of patients, 60% of which were benign in the breast and 71% of which were benign in the axilla.

We have critically evaluated the impact of preoperative breast MRI on a large volume of patients. Often, MRI results did not result in significant treatment change. Barriers to guideline evidence based care implementation continue to exist in the setting of multidisciplinary breast cancer care. We must continue to work together to best counsel our patients and effectively manage our health care cost, in keeping with the Choosing Wisely campaign.

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**Axillary reverse mapping in breast cancer: a Canadian experience.** *U. Kuusk, N. Seyednejad, E. McKeivitt, C. Dingee, S. Wiseman.* From the University of British Columbia, Vancouver, BC

The objective of this study was to evaluate the axillary reverse lymphatic mapping (ARM) procedure for reducing the risk of arm lymphedema after breast cancer surgery.

The ARM procedure was carried out with a subareolar injection of technetium 99 sulfur colloid the morning of surgery, and a patent blue dye injection into the upper inner arm after anesthesia.

Fifty-two women made up our study population. Thirty-seven patients underwent sentinel lymph node biopsy (SLNB) and 15 patients underwent an axillary lymph node dissection (ALND) for known nodal metastasis. The sentinel lymph node was identified in 36 of the 37 cases who underwent SLNB alone and in 12 of 15 patients who underwent on ALND. In 13 patients both blue and radioactive lymph nodes or lymphatics were clearly identified (25%) and 5 patients had a clear crossover with nodes being both blue and hot. Only a single patient with crossover lymphatics had metastases present in their sentinel node.

The ARM technique did not prevent identification of the SLN and we identified much greater crossover than reported. We had a single patient, who underwent a sentinel node biopsy, with mild arm lymphedema (1.9%) after 2 years of follow up.

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**Comparing outcomes of open versus flexible and rigid transoral endoscopic techniques for the treatment of Zenker's diverticulum.** D. Jones, A. Aloraini, S. Gowing, J. Cools-Lartigue, M. Leimanis, R. Tabah, L. Ferri. From McGill University, Montréal, Que.

Open surgical cricopharyngeal myotomy (CM) is considered the standard of care for Zenker's diverticulum (ZD), a common cause of dysphagia and aspiration pneumonia in the elderly. Less invasive trans-oral endoscopic approaches are coming into favour, including rigid stapling device (RigidCM) and electro-surgical needle knife via gastroscope (FlexCM). We sought to compare outcomes between OpenCM, RigidCM and FlexCM for ZD.

All patients undergoing treatment for ZD at a single university-affiliated hospital from May 1992 to May 2013 were reviewed. Patient demographics, ZD size, postoperative complications (Clavien–Dindo classification), and length of stay (LOS) were compared between OpenCM, RigidCM, and FlexCM. Dysphagia scores (DS) (0: best–4: worst) and pneumonia incidence were assessed preoperatively and postoperatively. Data presented as median (IQR).  $\chi^2$ , nonparametric ANOVA and multilinear regression were performed.

Fifty-two patients underwent open (33 of 52 [63%]) or endoscopic (19 of 52 [37%]): 8 Rigid/11 Flexible) CM. Transoral CM (FlexCM 4 cm [2.5–4], RigidCM 4 cm [2–4]) had slightly larger ZD than OpenCM (3 cm [2–3]) (NS). CM reduced DS for all approaches (OpenCM: 2 [2–3]–0 [0–0]; RigidCM: 2 [2–2]–0 [0–0],  $p \leq 0.05$ ; FlexCM: 3 [3–3]–0 [0–0],  $p \leq 0.05$ ). Major postoperative complications (> grade 2 Clavien–Dindo) occurred in 3 of 33 (9%) OpenCM, 1 of 8 (12%) RigidCM, and 0 of 11 (0%) FlexCM (NS). Pneumonia incidence post-CM was comparable between groups (NS). Length of stay was lower in FlexCM (2 d [1–2]) versus RigidCM (3 d [3–6],  $p \leq 0.05$ ) and OpenCM (5 d [4–7],  $p \leq 0.05$ ), but did not differ between RigidCM and OpenCM. Accounting for age, sex, and postoperative complications FlexCM remained a significant determinant of LOS ( $p \leq 0.05$ ).

Cricopharyngeal myotomy is a highly effective method to manage ZD with comparable postoperative outcomes between techniques. However, FlexCM is associated with a significant reduction in LOS compared with other approaches and could be considered the preferred method of treatment for patients with moderate to large Zenker's diverticulum.

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**Transthoracic, extracorporeal gastric conduit preparation: a simple alternative to mini-laparotomy in minimally invasive, Ivor-Lewis esophagectomy.** A. McGuire, S. Sundaresan, A. Seely, D. Maziak, J. Villeneuve, S. Gilbert. From the University of Ottawa, Ottawa, Ont.

During totally minimally invasive esophagectomy (MIE), the gas-

tric conduit is typically constructed via laparoscopy. Trauma from laparoscopic instruments, inability to palpate the gastroepiploic arcade, and challenges in optimal positioning the stomach for intra-abdominal stapling have led to widespread use of laparotomy as part of hybrid MIE procedures. Our objective was to evaluate the safety of transthoracic, extracorporeal gastric conduit preparation. We hypothesize that this alternative technique is equivalent to the laparoscopic approach.

The gastric conduit was fashioned through the intercostal access incision (6–8 cm) normally used to retrieve the surgical specimen and insert the EEA stapler during Ivor-Lewis MIE. Retrospective comparison with laparoscopic gastric conduit preparation was performed with emphasis on anastomotic and respiratory outcomes.

From June 2010 to May 2013, there were 30 MIEs (extracorporeal conduit = 15; laparoscopic conduit = 15) (see Table). Mean age (58.6 v. 67 yr;  $p = 0.59$ ), tumour location (gastroesophageal junction v. middle and lower esophageal;  $p = 0.27$ ), histology (adenocarcinoma v. other 26.7%;  $p = 0.68$ ) were similar between groups. Anastomotic technique and location, and operating surgeon were the same for all patients. Patients in the laparoscopic gastric conduit group were slightly more likely to have undergone induction chemoradiotherapy (40% v. 80%;  $p = 0.030$ ). There was no significant difference between groups with respect to anastomotic complications, including anastomotic leak and anastomotic stricture (20% v. 13.3%;  $p = 0.70$ ). There was a trend toward fewer respiratory complications in the transthoracic conduit preparation group (8% v. 12%;  $p = 0.09$ ).

Transthoracic, minimally invasive gastric conduit preparation is a safe alternative to hybrid esophagectomy with laparotomy. It

Table, abstract 141

Outcome	Group; no. (%)		p value
	Extracorporeal transthoracic conduit, n = 15	Intracorporeal laparoscopic conduit, n = 15	
Mean age, yr	58.6	67.0	0.59
Sex			1.0
Female	3 (20.0)	2 (13.3)	
Male	12 (80.0)	13 (86.7)	
Tumor location			0.27
Gastroesophageal junction	5 (33.3)	6 (40.0)	
Middle or distal esophagus	10 (66.7)	9 (60.0)	
Histology			0.68
Adenocarcinoma	10 (66.7)	12 (80.0)	
Other	5 (33.3)	3 (20.0)	
Preoperative chemoradiation	6 (40.0)	12 (80.0)	0.030
Anastomotic complications			0.70
Leak	2 (13.3)	1 (6.7)	
Stricture	1 (6.7)	1 (6.7)	
Respiratory complications	8 (53.3)	12 (80.0)	0.09

overcomes shortcomings of the laparoscopic approach. This technique allows the surgeon to commit to Ivor-Lewis esophagectomy only once resectability of the thoracic esophagus has been confirmed.

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**Superiority of video-assisted thoracic surgery (VATS) over open lobectomy: Is this due to the approach or due to the surgeon? A. Kuritzky, B. Aswad, J. Machan, T. Ng. From Brown University, Providence, RI**

Propensity-matched studies have shown video-assisted thoracic surgery (VATS) to be superior to thoracotomy. However, these studies do not control for institution or surgeon expertise and do not compare VATS strictly with muscle sparing thoracotomy (MST).

From a single institution, patients undergoing lobectomy for clinical stage I non-small cell cancer were evaluated. Data were from a prospective database, derived from a single surgeon with experienced in both VATS and MST. VATS was chosen if the patient requested this approach, otherwise MST was used. Short-term and long-term outcomes were compared.

From 2007 to 2012, 298 patients were evaluated, 74 (25%) VATS and 224 (75%) MST. There was no difference in patient demographics, chest tube days and postoperative complications. Operative time was longer for VATS (median min 130 VATS v. 90 MST,  $p < 0.001$ ). Hospital-days was longer for MST (median d 4.5 VATS v. 5 MST,  $p = 0.007$ ). There was no difference in disease-free survival (5-yr 75.5% VATS v. 77.8% MST,  $p = 0.446$ ) and overall survival (5-yr 80.4% VATS v. 78.9% MST,  $p = 0.84$ ) for clinical stage I disease. Stratifying for pathologic stage IA and IB, there was no difference in disease-free survival and overall survival between the 2 groups. Multiple logistic regression revealed low % FEV1 and transfusion to be risk factors for postoperative complication. Multiple proportional hazards Cox regression revealed male sex, pathologic stage and low DLCO to be adverse risk factors for disease-free and overall survival.

Our current comparison of VATS versus MST lobectomy, from a single surgeon experienced with both approaches, found operative time (favouring of MST) and hospital days (favouring VATS) to be the only difference between the 2 groups; while major outcomes such as postoperative complications, disease-free survival and overall survival were not different. In the absence of a multicentre randomized trial, both approaches for lobectomy should be considered equivalent.

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**Predictors of malignant pathology and the role of trans-thoracic biopsy in solitary fibrous tumours of the pleura. A. McGuire, H. Sekhon, S. Gilbert, D. Maziak, S. Sundaresan, P. Villeneuve, A. Seely, F. Shamji. From the University of Ottawa, Ottawa, Ont.**

Solitary fibrous tumours of the pleura (SFTP) are rare neoplasms with unpredictable behaviour. Lack of unifying criteria for benign or malignant disease has resulted in reports of SFTP exhibiting malignant behaviour years after complete surgical resection (despite benign initial diagnosis). Additionally, the role of trans-thoracic needle biopsy in initial management of SFTP is unclear. Understanding predictors of malignancy identifies patients at unacceptably high risk for nonsurgical primary

therapy, and for recurrence despite complete surgical resection.

The primary objectives were to identify clinicopathological predictors of malignancy and recurrence in SFTP. The secondary aim was to determine the role of trans-thoracic needle biopsy in the management decision algorithm of SFTP.

Retrospective chart review was conducted (January 1983–December 2013) at the Ottawa Hospital for pathologically confirmed SFTP. Data was collected on biopsy-related, clinical, histopathological and immunohistochemistry (IHC) variables. Appropriate tests of statistical inference were conducted for all variables.

Pathologically confirmed SFTP was identified in 26 cases. Transthoracic needle biopsy was conducted in 22 (84.6%); 16 (72.7%) diagnostic of SFTP with IHC; 3 (13.6%) malignant. Primary management was surveillance in 3 and complete surgical resection in 23. Surgical pathology reported 15 (65.2%) benign and 8 (34.8%) malignant cases. Local recurrence occurred in 3 and distant recurrence in 1. Initial pathology was benign in 3 (75%) with recurrence. Clinicopathologic variables analyzed did not predict recurrent disease. IHC features did not differ between malignant and benign pathology. Predictors of malignant pathology included: infiltrative cellular pattern ( $p = 0.042$ ), nuclear crowding ( $p = 0.006$ ), nuclear pleomorphism ( $p < 0.001$ ) & over 4 mitoses/10 high power field ( $p < 0.001$ ).

Because the numerous variables analyzed did not predict recurrent disease, long-term follow-up of SFTP is warranted regardless of benign or malignant initial histology. Histologic (not IHC) features predicted malignant pathology. Transthoracic needle biopsy did identify malignant SFTP; however, its main use should be to differentiate SFTP from other pleural neoplasms using IHC.

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**MicroRNA expression of bronchoalveolar lavage and sputum to distinguish early stage NSCLC patients from cancer-free matched controls. S. Gazala, J. Kim, W. Roa, R. Razzak, S. Gosh, L. Guo, A. Joy, T. Nijjar, E. Wong, E. Bedard. From the University of Alberta, Edmonton, Alta.**

70% Non-small cell lung cancer (NSCLC) patients are diagnosed with either locally advanced or metastatic stages for which survival is poor. Hastening the diagnosis of NSCLC is therefore a potential strategy to improve the clinical outcomes of patients with NSCLC. MicroRNAs (miRNAs) are a group of recently discovered, small, non-protein coding RNA molecules that possess a myriad of roles in the regulation of cellular processes. There is considerable interest in the use of miRNA expression profiling as a diagnostic tool for NSCLC. To date, groups have investigated the use of miRNA expression profiles for NSCLC patients using their tumour tissue samples, serum, and sputum with early but promising results

To assess the ability of microRNA (miRNA) expression profiling of bronchoalveolar lavage (BAL) fluids and sputum samples to distinguish early stage NSCLC cases from cancer-free controls.

The expression levels of 3 miRNAs (miR-21, miR-210, miR-372) in were quantified in BAL fluids and sputum, normalized to an endogenous control (U6) relative to a MRC-5 reference sample, using RNA reverse transcription and Quantitative real-time Polymerase Chain Reaction (RT-aPCR). All sputum samples were collected by a single spontaneous expectoration while BAL fluids were obtained just before surgical resection. Unsupervised hierarchical cluster analysis was performed on the experimental-normalized miRNA expression profiles using within-group

linkage and cosine correlation similarity.

From April 2011 to January 2012, 21 eligible cases and 10 controls were entered into this study. The median age of cases was 70 years. Thirteen cases had adenocarcinoma, 5 had squamous cell carcinoma, and 3 had large cell carcinoma. Eleven cases had stage I and 9 had stage II NSCLC. The median short axis diameter of the primary tumour among cases was 1.6 cm. With exception of one case, endobronchial lesions were not detected on inspection by flexible bronchoscopic examination before BAL fluid collection. The vast majority of cases were smokers (20 of 21). The median age of the control group was 58.5 and 5 were healthy without active medical conditions while 5 had COPD. Six controls had prior or current histories of smoking while 4 were never smokers.

Cluster analysis of the miRNA expression profiles of BAL samples from 21 NSCLC cases and sputum samples from 10 cancer-free controls yielded a diagnostic sensitivity of 85.7% and specificity of 100%. Cluster analysis of sputum samples from the same 21 NSCLC cases and 10 cancer-free controls yielded a diagnostic sensitivity of 67.8% and specificity of 90%. Cosine similarity analysis of matched pairs of concordant and discordant BAL and Sputum samples suggests that triplicate sputum sample collection could improve the overall sensitivity of this method for use as a safe, noninvasive screening test for NSCLC.

Hierarchical cluster analysis of expressed miRNAs from sputum and bronchoalveolar lavage samples is a highly specific and relatively sensitive method for the timely diagnosis of early stage NSCLC. Larger, population-based studies are necessary for further validation of this promising approach in both the diagnostic and screening setting.

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**Results of laryngotracheal resection and anastomosis with posterior cricoidotomy in 31 patients. F. Sadegh Beigee, S. Pojhan, A. Daneshvar Kakhaki, K. Sheikhy, S. Reza Saghebi, A. Abbasidezfouli. From Shahid Beheshti University of Medical Sciences, Tehran, Iran**

Surgical treatment of proximal tracheal or laryngotracheal stenosis even a short segment, could be difficult and may need to more interventions such autologous cartilage insertion. In this study we report results of laryngotracheal resection and anastomosis using autologous cartilage insertion. We reviewed retrospectively, record of 31 patients with postintubation laryngotracheal stenosis who underwent laryngotracheal resection and anastomosis in our centre with posterior cricoidotomy and insertion of autologous cartilage. Results of operation described as successful if we could decannulate the patient, and failed if we could not decannulate the patient. Twenty 3 male and 8 female, 14–78 years entered the study. The most common cause of intubation was multiple trauma ( $n = 25$ ). Length of stenosis was 12–60 mm and distance from vocal cord was 0–20 mm. All patients underwent resection of stenotic trachea and posterior cricoidotomy and insertion of an autologous cartilage graft, inserted within cricoidotomy. Also anterior arch of cricoid cartilage was resected in 28 patients. Temporary post operation insertion of T-tube, stent or tracheostomy was done in 22 patients. Follow up was 1–3 years. Result of operation was successful in 29 and failed in 2 patients. In all patients postoperative follow up bronchoscopy showed healed and epithelialized cartilage graft.

Surgical treatment of proximal tracheal and laryngotracheal stenosis is challenging. It seems in this form of stenosis, cricoidectomy and insertion of autologous cartilage is useful to increase lumen diameter and success of resection and anastomosis.

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**Preoperative computed tomography localization of pulmonary arterial branches for lobectomy. J. Poon, J. MacGregor, A. Graham, S. McFadden, G. Gelfand. From the University of Calgary, Calgary, Alta.**

A successful pulmonary lobectomy relies on precise, anatomic dissection of the pulmonary vasculature. Pulmonary artery (PA) branches are known to have anatomic variability and when mis-handled may lead to significant morbidity and mortality.

The objective of this study was to assess the accuracy of preoperative chest computed tomography (CT) scans in identifying PA branches in patients undergoing lobectomy.

From December 2013 to March 2014 all patients undergoing lobectomy at a single institution were enrolled. The number of PA branches was determined preoperatively by a single dedicated chest radiologist. When possible, high quality 3 dimensional reconstructions were used. Any abnormal anatomy in terms of location and number of PA branches was documented using predetermined definitions. Postoperatively, the anatomic information was then graded by the surgeons with respect to accuracy and utility, using a 5-point Likert scale.

A total of 40 patients were eligible, with 15 patients excluded because of poor CT resolution or a lack of contrast. A further 11 patients were excluded from analysis most commonly because a lobectomy was not performed. Preliminary analysis was performed on 14 patients.

Preoperative scans were able to localize 91.2% (31 of 34) of all PA branches but overcalled an additional 3 branches. Overall, preoperative localization was able to correctly identify all PA branches in 64.2% of patients (9 of 14). The sensitivity and specificity for detecting abnormal pulmonary arterial anatomy was 60% (95% CI 17.4%–92.7%) and specificity of 77.8% (95% CI 40.1%–96.0%). The perceived surgeon's utility of preoperative localization was 3.57 ( $\pm 0.49$ ) on the 50-point Likert scale.

When high quality 3-dimensional reconstructions were used, localization accuracy increased to 95.0% (19 of 20) without over-calling any additional branches. High quality reconstructions were able to correctly identify all the PA branches in 87.5% of patients (7 of 8). Furthermore, perceived utility of preoperative localization increased to 4.0 ( $\pm 0.77$ ), which was significant when compared with non-high quality reconstructions (1-tailed  $t$  test:  $p = 0.01$ ).

Overall, preoperative localization of PA branches with chest CT scanning is modestly accurate. When high quality 3 dimensional reconstructions are used, accuracy markedly increases with much more utility to the operating surgeon.

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**(CJS Editors' Choice Award) Is it safe to wait? The effect of surgical wait times on survival in non-small cell lung cancer. S. Coughlin, M. Plourde, K. Guidolin, D. Fortin, R. Malthaner, R. Incullet. From the Western University, London, Ont.**

Cancer Care Ontario guidelines propose that clinically resectable

non-small cell lung cancer (NSCLC) should be resected within 28 days of decision to treat. This is not evidence based. Our objective was to determine the effect of surgical wait time on survival and incidence of upstaging in patients with stage I and II NSCLC.

All patients with clinical stage I and II NSCLC who underwent surgical resection at our centre between January 2010 and December 2011 were reviewed. Data collected included preoperative clinical (cStage), postoperative pathological staging (pStage), wait time, and survival. Analysis was stratified based on preoperative clinical stage. The effect of wait time on survival was assessed using a Cox proportional hazard model, with wait time in months as a categorical variable. Incidence of upstaging at least one stage was assessed using logistic regression. For stage I, this was adjusted for histology and R0 resection. The sample size precluded any adjustments for stage II patients.

Two hundred and twenty-two patients were identified; 180 were cStage I and 42 were cStage II. In patients with cStage I, wait times up to 4 months had no significant effect on survival or incidence of upstaging. For those with cStage II, patients waiting between 1 and 2 months did not have significantly different survival (HR 0.925,  $p = 0.885$ ) or incidence of upstaging (OR 4.0,  $p = 0.23$ ) compared with those waiting 0 to 1 month. Patients waiting between 2 and 3 months, however, had significantly decreased survival (HR 3.6,  $p = 0.036$ ) as well as increased incidence of upstaging (OR 20,  $p = 0.02$ ) compared with those waiting 0 to 1 month.

Patients with surgically resectable cStage I NSCLC can wait up to 4 months from date of decision to treat for surgery, without significant change in survival or incidence of upstaging. Preoperative cStage II patients should undergo resection within 2 months.

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**Left upper lobe resection using VATS anterior approach with an eparterial tracheal bronchus: a case report.** *T. Esmail, P. McCarthy, M. Gonzalez, T. Krueger.* From the National University of Ireland, Galway, and the University of Lausanne, Switzerland (CHUV)

Tracheal bronchus has been described and assigned various nomenclatures in previous literature. We demonstrate in this case, the anatomic variance of an eparterial tracheal bronchus arising from the left main bronchus. In addition to discovering this rare anatomic variance, we show evidence that the anterior video-assisted thoracoscopic surgery (VATS) procedure described, is successfully applicable to dealing with this additional obstacle in a superior lobectomy situation. Intraoperative and CT images highlight the congenital anomaly. A 73-year-old patient with an irregular nodule found in the left superior lobe, subsequently diagnosed as an epidermal carcinoma, was successfully resected using the anterior VATS method and sectioning of the last "extra" bronchus.

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**What is the evidence in evidence based thoracic surgery? Validation of a review protocol and a snap shot of the distribution of publications in thoracic surgery at a global level.** *J. Masters, E. Berg, M. Forsyth, J. Ojah, P. Sytnik, J. Donaleshen, T. Gottschalk, S. Srinathan.*

From the University of Manitoba, Winnipeg, Man.

The body of knowledge that informs General Thoracic Surgical practice comes from 3 main sources: 1) direct interaction with colleagues, 2) synthesized literature such as text books and 3) published primary studies, "the literature." This study sets out to systematically identify and define the nature and quality of the world's thoracic surgery literature that ultimately informs clinical practice.

A search of all articles pertinent to adult thoracic surgery was done from Jan. 1, 2008, to Dec. 31, 2011, in 38 journals of interest to thoracic surgeons. Articles where surgery was not performed, case reports and consensus studies were excluded. Data extraction was independently completed by 2 trained reviewers and adjudicated by a third. Twenty-five articles were selected for full text categorization by 3 independent reviewers to determine agreement across 5 categories. The results were analyzed for interrater reliability.

A total of 2971 articles were selected for title and abstract review. Of the 1763 articles selected for full text review, 139 articles were randomly selected. The  $\kappa$  score for interrater reliability among 25 of those was 0.69 ( $> 0.60$  is considered good). From full text review, 20 of the selected articles were excluded. Among the 119 remaining articles there were 76 intervention studies (64%), 11 (9%) diagnostic studies, 26 (22%) prognostic studies and 6 (5%) prevalence studies. Ninety-eight (82%) were aimed at malignant disease. By anatomic site: 75 (63%) were lung, 21 (17%) esophagus, 20 (16%) mediastinum, and 5 (4%) chest wall. North America and Europe equally published 44 (37%) articles while 28 (26%) were from Asia.

This is the first study that attempts to understand the broad nature of the evidence guiding a specialty. We have validated our review protocol and will continue further evaluation of the included studies. The ultimate goal is to identify areas of strength and weakness in the body of evidence underpinning practice to help direct future research.

#### 150

**The effect of surgeon volume on procedure selection in non-small cell lung cancer.** *C. Finley, I. Camposilvan, L. Schneider, N. Akhtar-Danesh, W. Hanna, C. Schieman, Y. Shargall.* From McMaster University, Hamilton, Ont.

Procedure selection by the surgeon can greatly impact patients' operative and long-term survival. This selection potentially reflects comfort with technically challenging surgeries. This study aims to examine surgeon choices for non-small cell lung cancer (NSCLC) and if surgeon volume predicts the type of procedure chosen, controlling for patient demographics, comorbidity, year and institutional factors.

Data were abstracted from an Ontario population-based linked database from 2004 to 2011. Patient demographics, comorbidities, year, institutional and surgical factors were evaluated. Three-level random-effect multilevel regression analyses were performed to examine the role of factors influencing the operation patients received for NSCLC.

Of 8070 patients who underwent surgical resection, 842, 6212 and 1002 underwent pneumonectomy, lobectomy, and wedge resection respectively. The proportion of patients undergoing pneumonectomy fell from 14.8% in 2004 to 7.6%

in 2011. A total of 4070 (50.4%) were male and 124 unique physicians and 45 institutions performed resections. Ninety-day mortality was 12.6%, 3.9% and 5.7% for pneumonectomy, lobectomy and wedge resection, respectively. Multilevel regression analysis showed physician volume, age, year of procedure, sex and Charlson index were predictive of performing a pneumonectomy. Adjusting for these variables, the results indicated that for each 10 case increase in physician volume, the relative risk of performing a pneumonectomy decreased by 9.1% (95% CI 8.2–9.995,  $p = 0.04$ ).

While patient and temporal factors influence the type of resection a patient receives for NSCLC, surgeon volume is also a strong predictor. This study may be limited by minimal stage data, but the suggestion that a surgeon's total procedural volume for NSCLC significantly influences procedure selection has implications on how we deliver care to this patient population.

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**Thoracoscopic lobectomy: 5-year outcome and lessons learned from 381 consecutive patients. A. Ashrafi, M. Kearns, J. Bond, S. Ong, T. Bong, A. Hafizi. From the University of British Columbia, Vancouver, BC**

There are now several reports confirming acceptable short-term outcomes for thoracoscopic lobectomy. The usual advantages of thoracoscopic lobectomy, as compared with lobectomy by conventional thoracotomy, include reduced length of stay, decreased postoperative pain and decreased inflammatory response. A prospective database of patients undergoing video-assisted thoracoscopic lobectomy in a tertiary care hospital was queried. We analyzed operative and perioperative (30-d) mortality, complication rate, conversion rate and survival.

Data were prospectively collected on all patients who underwent thoracoscopic lobectomy between December 2008 and March 2014.

Thoracoscopic lobectomy was performed on 381 patients, 163 (42.8%) male, 218 (57.2%) female, with a median age of 69 years (range 18–89). The postoperative pathology confirmed non-small cell lung cancer (NSCLC) in 327 (85.5%) patients. Pathologic analysis demonstrated stage I in 242 (74.0%), stage II in 66 (20.2%), stage III in 16 (4.9%), and stage IV in 3 (0.9%) of NSCLC patients. Ninety-nine percent (377) of patients had complete resection with negative pathological margins. There were 62 conversions to open thoracotomy (conversion rate 16.3%) 12 of which (3.1%) were necessitated to control bleeding. The median chest-tube days is 4 (range 1–46). Median hospital length of stay was 5 days (range 2–46). The overall 5-year survival rate for this cohort is 82%. The operative and perioperative (30-d) mortality were 0% and 1.05%, respectively.

Thoracoscopic lobectomy is gradually replacing open lobectomy for early-stage lung cancer. There are only a handful of studies looking at the long-term outcome of this operation. We

have previously reported our short-term outcome at this conference. We now report our 5-year survival data, mortality rate, and complication rate on 381 consecutive patients. Our intraoperative and 30-day postoperative mortality rate of 0 and 1.05%, respectively, are comparable to other major series in the literature.

### 152

**Does the usage of a digital chest drainage system reduce pleural inflammation and volume of pleural effusion after major lung resections for cancer? A prospective, randomized study. M. De Waele, C. Schieman, C. Finley, L. Schneider, T. Schnurr, F. Farrokhyar, W. Hanna, P. Nair, Y. Shargall. From McMaster University, Hamilton, Ont.**

Excessive amounts of pleural effusion are a common cause for delay in chest tube removal following lung resection. Digital pleural drainage systems are increasingly used, with assumed superiority over traditional analog systems in the management of postoperative air leak. The effect of system type on pleural effusion and inflammation has not been studied. We hypothesized that digital systems, introducing intermittent, balanced suction would be associated with less pleural inflammation and effusion formation.

A total of 103 patients, enrolled in a prospective, randomized controlled study, received either analog ( $n = 50$ ) or digital ( $n = 53$ ) drainage systems following lung resection for malignancy. Chest tubes were removed according to an a priori defined protocol. Inflammatory mediators (Interleukin-6, 8, 10, 1Ra, TNF- $\alpha$ ) in pleural fluid and sputum were collected and analyzed. The primary outcome was to observe differences in pleural effusion volume. Secondary outcomes were duration of chest tube in situ, air-leak incidence, length of hospital stay and degree of pleural inflammation.

Mean age was 66.7 years, 50.5% male. A trend for shorter chest tube duration was found with the digital system ( $p = 0.055$ ). There was no difference in total amount of fluid drained or length of hospital stay. Incidence of prolonged postoperative air leak was significantly higher when using the analog system (9 v. 2;  $p = 0.025$ ). Video-assisted procedures were superior to open on all outcomes ( $p < 0.001$ ). Lobectomy was associated with longer chest tube duration ( $p = 0.001$ ) and increased fluid drainage when compared with sublobar resection ( $p < 0.001$ ), regardless of drainage system. Comparison of inflammatory mediator levels revealed no difference.

Digital drainage systems are superior in regards to incidence of postoperative air leak and chest tube duration. Inflammatory mediators and total pleural effusion volume are not correlated with type of drainage system used. Minimally invasive procedures and sublobar resections have less effusion formation and shorter duration of chest tube.

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