

ABSTRACTS

of presentations to the Annual
Meetings of the

Canadian Association
of General Surgeons

Canadian Association
of Thoracic Surgeons

Canadian Society
of Colon and Rectal
Surgeons

Canadian
Hepato-Pancreato-Biliary
Society

Canadian Society of
Surgical Oncology

RÉSUMÉS

des communications présentées
aux congrès annuels de

l'Association canadienne
des chirurgiens généraux

l'Association canadienne
des chirurgiens thoraciques

la Société canadienne
des chirurgiens du côlon
et du rectum

la *Canadian*
Hepato-Pancreato-Biliary
Society

la Société canadienne
d'oncologie chirurgicale

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Association canadienne des chirurgiens généraux

AUTOCRINE MOTILITY FACTOR RECEPTOR EXPRESSION PREDICTS RECTAL CANCER PATIENT OUTCOMES. *M.R.C. Dickeson, S.K. Chan, O.L. Griffith, P.T. Phang, H. Masoudi, S.J.M. Jones, I.R. Nabi, S.M. Wiseman.* Department of Surgery, St. Paul's Hospital, Departments of Medical Genetics, Cell Biology and Pathology, University of British Columbia, Genetic Pathology Evaluation Centre, Prostate Research Centre, Vancouver General Hospital, British Columbia Cancer Agency, Michael Smith Genome Sciences Centre, Vancouver, BC.

The identification of molecular markers that aid in predicting outcomes for individuals diagnosed with rectal adenocarcinoma could provide important prognostic information beyond that of clinical and pathological characteristics alone. The purpose of this study was to identify molecular markers that predict outcomes for individuals diagnosed with rectal cancer.

A retrospective analysis was carried out for 130 consecutive patients undergoing resection for rectal adenocarcinoma at a single institution over a 6-year period. Clinical characteristics evaluated were: age, sex, tumour location, pre- and postoperative chemo- and radiotherapy, and surgical procedure. Pathologic variables evaluated included: margin status, TNM stage and the presence of vascular and lymphatic invasion. Significant variables were identified by Kaplan–Meier survival analysis and log-rank test. The tumour specimens from these 130 patients were used to prepare a tissue microarray (TMA) that was stained for 10 molecular markers involved in tumourigenesis. The markers evaluated were: autocrine motility factor receptor (AMF-R), Aurora-A, Aurora-C, Cav-1, HER2, HER3, HER4, MDM2, MRAS and PGI. Statistical analysis was used to compare the expression of the markers and correlate their expression with the clinical and pathologic variables.

The clinicopathologic variables and virtually all molecular markers analyzed in the study did not significantly predict patient outcomes. However, increased expression of AMF-R did significantly predict decreased overall survival ($p < 0.001$), disease-free survival ($p = 0.036$) and disease-specific survival ($p = 0.005$).

The failure of clinical and pathologic variables to predict patient outcomes reemphasizes the need for better tools to predict rectal cancer prognosis. AMF-R warrants further study as a molecular prognosticator, and potential target for therapy, for rectal cancer.

2

SHORT-TERM BLOCKADE OF T CELL COSTIMULATORY AND ADHESION PATHWAYS PREVENTS NEONATAL PORCINE ISLET XENOGRAFT

REJECTION. *D.C.M. Mok, H. Arefanian, R.V. Rajotte, G.R. Rayat.* Alberta Diabetes Institute, Department of Surgery, University of Alberta, Edmonton, Alta.

The objective of this study was to determine if a combination of short-term blockade of the CD28/B7 costimulatory pathway using CTLA4-Ig in combination with short-term blockade of other costimulatory, or the LFA-1/ICAM-1 adhesion pathway using monoclonal antibody (mAb) therapy could lead to long-term neonatal porcine islet (NPI) xenograft survival.

Six- to 8-week-old, male streptozotocin-induced diabetic (≥ 17 mmol/L) C57BL/6J mice were transplanted with 2000 NPIs under the kidney capsule. Transplanted mice were treated with an intraperitoneal injection of CTLA4-Ig (50 μ g on days -1 to 15) either alone or in combination with anti-LFA-1 (200 μ g on days 0, 1, 7, 14), anti-ICOS (200 μ g on days 0–14) or anti-CD45RB (300 μ g on day -1 and 100 μ g on days 0–5) mAbs. Upon graft rejection or > 100 days post-transplantation in long-term functioning grafts, mice were euthanized and their graft examined by immunohistochemical staining. Flow cytometry was used to phenotype systemic immune cell populations.

Single therapy of CTLA4-Ig (0/6), anti-CD45RB (0/10) and anti-ICOS (0/6) mAbs did not prevent rejection of NPI xenografts in mice. Single therapy with anti-LFA-1 mAb, however, resulted in long-term graft function in 67% (4/6). Meanwhile, combination therapy of CTLA4-Ig with anti-LFA-1 mAb, anti-CD45RB mAb or anti-ICOS mAb prolonged graft survival in 67% (4/6), 33% (2/6) and 50% (3/6) of mice, respectively, but immune cell infiltration of the graft was still detected. Immune cell infiltration in functioning islet xenografts were predominantly CD4⁺ T cells. In contrast, systemic CD4⁺ T cell populations in combination therapy-treated islet xenograft recipients were reduced to levels found in naive nontransplanted B6 mice.

Simultaneously targeting the CD28-B7 costimulatory pathway and the LFA-1/ICAM-1 adhesion pathway was most effective in preventing NPI xenograft rejection and controlled systemic CD4⁺ T cell expansion. Combination therapy targeting T cell costimulatory and adhesion pathways may form a future component of antirejection therapy for islet xenotransplantation with the potential to induce xenograft tolerance.

3

THE ROLE OF SCREENING EVALUATIONS IN PATIENTS WITH GERMLINE MUTATIONS OF THE E-CADHERIN/CDH1 GENE (HEREDITARY DIFFUSE GASTRIC CANCER). *P. Hebbard, D. Fontaine, J. McCarthy, K. Laing, F. Bursery, N. Wadden,*

A. Macmillan, J. Green, A. Kwan, D.A. Wirtzfeld. Departments of Surgery, Pathology, Oncology, Medicine, Radiology and Genetics, Memorial University of Newfoundland, St. John's, NL.

Hereditary diffuse gastric cancer (HDGC) is an autosomal-dominant condition associated with germline mutations in the *e-cadherin/CDH1* gene. Currently, mutation carriers have an approximate 80% lifetime risk of developing gastric cancer and, in women, about a 40% lifetime risk of breast cancer.

We performed a retrospective chart review of 17 mutation-positive individuals who underwent prophylactic total gastrectomy and 17 mutation-positive women to evaluate the efficacy of standardized breast screening protocols.

Standardized screening oesophagogastroduodenoscopy (OGD) with random biopsies of normal-appearing mucosa was not effective in identifying early gastric malignancy. Forty percent of gastrectomy specimens had occult foci of signet-ring gastric cancer, only 1/7 (14%) being identified preoperatively. All patients were attributed a T1N0M0 stage, and no adjuvant treatment was offered.

Standardized screening with annual magnetic resonance imaging (MRI) and mammogram has been offered to all mutation-positive women. The role of prophylactic mastectomy and chemoprophylaxis is discussed. Prophylactic bilateral mastectomies with reconstruction have been offered to patients requesting surgery. Diagnoses of breast cancer have been treated according to recognized standards.

Prophylactic surgery is an essential consideration in families with *e-cadherin* mutations. To date, screening examinations have been ineffective for gastric cancer. Healthy patients should be offered prophylactic gastrectomy. With regards to breast cancer risk, high-risk screening regimens or prophylactic surgery are acceptable options.

4

ILEOCOLONIC ANASTOMOSIS RESULTS IN A COLONIC BACTERIAL PROFILE IN THE NEO-TERMINAL ILEUM AND AN ANTIGEN-DRIVEN IMMUNE RESPONSE. *A.M. Borowiec, R. Foshaug, L. Guan, S. MacFarlane, B.C. Sydora, J. Doyle, T.A. Churchill, R.N. Fedorak.* University of Alberta, Edmonton, Alta.

The cascade of luminal microflora and systemic immune changes following terminal ileum (TI) resection was investigated in interleukin 10 gene-deficient (IL-10KO) mice predisposed to develop Crohn disease.

A validated surgical model of TI resection and ileocolonic anastomosis was established in control wild type (WT) and in IL-10KO mice. Male WT and IL-10KO mice 7 weeks of age were divided into 2 groups: 1) a TI transection and ileocolonic anastomosis group and 2) a control group handled in the same way but with no operation. Mice were euthanized at 6 and 15 weeks postoperatively. Luminal microbial changes within the colon and ileum were analyzed using 16S rRNA amplification. Systemic immune changes, reflected by secreted IFN- γ and IL-17, were assessed by splenic lymphocytes stimulation with enteric bacterial antigens.

Eighteen WT and 18 IL-10KO mice underwent successful surgery. In nonoperated control mice there was 45% and 57% bacterial similarity between the colon and ileum in the WT

and IL-10KO mice, respectively. In contrast, following the ileocolonic anastomosis, this similarity increased to 80% in WT mice and 84% in IL10KO mice. In conjunction with the colon-like bacterial profile in the ileum, a significant increase in the systemic immune response occurred, as indicated by a rise in IFN- γ and IL-17 secretion in IL-10KO mice and IFN- γ in WT mice at 15 weeks after surgery.

The bacterial "colonization" of the neo-terminal ileum after ileocolonic anastomosis leads to stimulation of an immune response that may in fact be an essential step in the postoperative disease recurrence.

5 (CAGS BASIC SCIENCE AWARD)

TARGETING CXCR4 WITH A SMALL MOLECULE INHIBITOR IN A TRANSGENIC MOUSE MODEL INHIBITS PRIMARY TUMOUR GROWTH AND DISTANT METASTASIS IN BREAST CANCER. *S. Hassan, M. Buchanan, O. Salvucci, W.J. Muller, M. Basik.* Lady Davis Institute for Medical Research, Segal Cancer Centre, McGill University, Montréal, Que.

To improve patient survival, a better understanding of the metastatic process is required. One model that helps explain metastasis is the chemokine-receptor model: Stromal-cell derived factor-1 is overexpressed by those organs to which breast cancer metastasizes and serves as a chemoattractant to home in those cancer cells which overexpress its receptor, CXCR4. We hypothesized that the downregulation of CXCR4, using a small molecule inhibitor called CTCE-9908, would inhibit primary tumour growth and distant metastasis in a transgenic, HER2-expressing breast cancer mouse model: polyoma middle T oncoprotein.

Using 15–16 mice per treatment group, we investigated the effect of CTCE-9908 at 25 mg/kg and 50 mg/kg in comparison to its scrambled peptide administered after the onset of the primary tumour, for a 4.5-week duration. We also tested CTCE-9908 in combination with DC101, an anti-VEGFR2 monoclonal antibody, using 6–9 animals per group.

In the CTCE-9908 dosing cohort, a 45% reduction in the number of macroscopic lung nodules ($p < 0.05$) was identified, and a delay in growth of the primary tumour after 3 weeks of treatment ($p_{trend} < 0.05$) was also observed. In the combination cohort, a comparable effect of inhibition in lung metastasis was observed at 62% for CTCE-9908 50 mg/kg and 60% for DC101. When CTCE-9908 was administered together with DC101, a 72% decrease in lung metastasis was observed ($p = 0.02$).

Therefore, CTCE-9908 demonstrated efficacy in inhibition of the primary tumour growth and lung metastasis in vivo as a single agent, and also further enhanced the inhibition of metastasis in combination with an antiangiogenic agent.

6

VALIDATION OF THE OBESITY SURGERY MORTALITY RISK SCORE IN PATIENTS UNDERGOING OBESITY SURGERY IN CANADA. *E. Efthimiou, N.V. Christou.* Section of Bariatric Surgery, Division of General Surgery, McGill University, Montréal, Que.

The Obesity Surgery Mortality Risk Score (OS-MRS) has been suggested for risk stratification of patients undergoing bariatric surgery.

We aimed to assess the validity of the OS-MRS in predicting mortality in patients undergoing bariatric surgery (BS) in a Canadian bariatric surgery centre.

We identified patients who underwent BS from our prospectively collected database (since 1983) and assigned the designated points from the scoring system (DeMaria EJ et al. *Ann Surg* 2007;246:578-82), in each case based on the comorbidity and relevant demographics. We included in our analysis cases of both open and laparoscopic BS as well as revision cases. Our results can be seen in Table 1.

Table 1, abstract 6. Assessed risk and mortality of patients undergoing bariatric surgery, according to procedure

Bariatric procedure	Cases, no. (%)	OS-MRS, mean (range)	Deaths, no. (%)
Open gastric bypass	1272 (51.1)	1.1 (0-5)	13 (1)
Lap gastric bypass	867 (34.8)	1.3 (0-5)	4 (0.5)
Lap BPD/DS	25 (1.0)	1.6 (1-3)	0 (0)
Lap sleeve gastrectomy	43 (1.7)	1.9 (0-3)	0 (0)
Lap adjustable banding	162 (6.5)	1.0 (0-4)	0 (0)
Revisional surgery	121 (4.8)	1.1 (0-4)	0 (0)
Total	2490	1.2 (0-5)	17 (0.68)

BPD/DS = biliopancreatic diversion/duodenal switch; Lap = laparoscopic; OS-MRS = Obesity Surgery Mortality Risk Score.

Predicted and actual mortality can be seen in Table 2.

Table 2, abstract 6. Mortality of patients undergoing bariatric surgery, according to OS-MRS class

OS-MRS class	Group; no. (and %)		
	Cases	Predicted mortality	Actual mortality
A	1623 (65.2)	5 (0.3)	5 (0.3)
B	796 (32)	15 (1.9)	10 (1.2)
C	71 (2.9)	5 (7.5)	2 (2.8)
Total	2490	25 (1.0)	17 (0.68)

OS-MRS = Obesity Surgery Mortality Risk Score.

There was no difference between the OS-MRS predicted deaths rate and actual mortality in our series in the individual groups and overall (χ^2 test).

The OS-MRS accurately predicts operating mortality for patients undergoing a whole range of bariatric procedures in a Canadian centre. These observations need further validation from other centres.

7
EPIDEMIOLOGY OF TRAUMA-RELATED DEATH IN ONTARIO.
D. Gomez, W. Xiong, A.B. Nathens. St. Michael's Hospital, Toronto, Ont.

Trauma-related mortality is 4-fold higher in rural regions. The explanation for this might be multifactorial, ranging from increased risk of injury to differential access to trauma care. We set out to evaluate the epidemiology of trauma-related

death in Ontario to better understand the causal factors related to this higher mortality.

Deaths were identified through a population-based registry of all trauma-related deaths in the province (2002 and 2003). Deaths due to asphyxiation, burns, drowning, electrocution, intoxication and same-level falls were excluded. Municipality of death was categorized by the proportion of the population living in a rural environment to provide insights into associations of death and rurality. The rural population of each municipality was derived from 2001 census data.

There were 3486 trauma deaths over this time interval: a death rate of 14.6 per 100 000 population. The distribution of site of death differed by rurality (see Table 1). Patients were half as likely to die in the field in more urban environments. The relative risk of death in the emergency department (ED) among those surviving to reach hospital was 1.5-fold greater in the most rural municipalities compared with the most urban.

Table 1, abstract 7. Site of death according to rurality

Site	Proportion of the population living in a rural environment		
	50%-100%	1%-49%	< 1%
Municipalities, no.	35	97	38
Site of death, %			
Field	77.63	59.14	39.32
Operating room	1.34	2.13	6.31
Emergency department	12.75	20.58	23.89
Hospital	8.28	18.15	30.49

These data provide insights into where efforts should be directed. Delays in discovery time are likely causal in the high proportion of scene deaths. However, there might be opportunities for interventions in rural EDs to reduce the likelihood of early deaths.

8
ARE THERE ADVANTAGES TO ROBOT-ASSISTED SURGERY OVER LAPAROSCOPY FROM THE SURGEON'S PERSPECTIVE?
J.A.M. Van Koughnett, S. Jayaraman, R. Eagleson, D. Quan, C.M. Schlachta. Canadian Surgical Technologies and Advanced Robotics (CSTAR), Lawson Health Research Institute, University of Western Ontario, London, Ont.

Where a procedure can be performed laparoscopically, the advantages of a robotic approach are often difficult to quantify. Using a newly developed scale, this study aims to measure surgeon preferences for ease of use by comparing a complex operation performed robotically and laparoscopically.

As part of a larger study comparing outcomes of laparoscopic and robotic biliary-enteric anastomosis, a surgeon performing 20 choledochojejunal anastomoses in an ex vivo pig model completed a subjective assessment scale after each procedure. The surgeon had no previous experience performing choledochojejunal anastomoses laparoscopically or using robot assistance. Ten anastomoses were performed laparoscopically and 10 using da Vinci robot assistance. The scale, developed by a panel with expertise in laparoscopic and robotic surgery as well as human factors analysis, included 13 task-related

factors assessing operative challenges and ease of use. Overall difficulty was also assessed on a 10-cm visual analog scale.

Robotic surgery was associated with superior ease to laparoscopy in 8 of the 13 factors, including image quality ($p < 0.001$), depth perception ($p < 0.001$), comfort ($p < 0.001$), eye fatigue ($p < 0.001$), dexterity ($p < 0.001$), precision of motion ($p = 0.02$), speed of motion ($p < 0.001$) and range of motion ($p = 0.04$). The visual analog scale also showed a significant benefit in overall ease of the robotic over laparoscopic procedure (2.5 cm v. 7.5 cm, $p < 0.001$). Non-significant trends favouring robotics were seen with fluidity of motion ($p = 0.07$) and equipment set-up ($p = 0.33$).

This study suggests that surgeon ease of use may be quantified by using this assessment scale and that robot assistance may be advantageous over laparoscopy when performing complex surgical tasks in an ex vivo model from the surgeon's perspective. Further evaluation is planned.

9

LAPAROSCOPIC MANAGEMENT OF ACUTE SMALL BOWEL OBSTRUCTION. A REVIEW OF 177 CASES. *S. Drolet, G. Larochelle, R.C. Grégoire, J.P. Gagné.* Centre for Minimally Invasive Surgery, Centre hospitalier universitaire de Québec, Québec, Que.

The objective of this study was to review the outcomes of patients treated laparoscopically for small bowel obstruction (SBO) in an academic health sciences centre.

All patients who underwent an attempt at laparoscopic management of SBO between April 1998 and April 2007 were included. Data recorded included demographics, SBO etiology, operative findings, surgical management, complications and postoperative course.

One-hundred and seventy-seven charts were reviewed. The mean age of patients (63% female) was 57.3 (19.7–93.31) years. The etiology of SBO, sometimes multiple, was as follows: adhesions (82%), small bowel volvulus (14.5%), Crohn disease (4.4%), small bowel neoplasia (2.2%) and others (5.6%). In 3 patients, abdominal wall hernia was the cause of obstruction. One-hundred and sixteen patients were treated laparoscopically (LS), 50 received mini-laparotomy (ML) and 11 were converted to laparotomy (LP). Complications occurred in 27.1% of patients: enterotomy (11.3%), wound infection (4.5%), pneumonia (1.7%) and others (9.6%). Twenty-six patients (14.7%) had a prolonged postoperative ileus. All enterotomies were identified and repaired during the initial procedure (6 LS, 12 ML, 2 LP). Median hospital stay was 8 days (LS 8, ML 7, LP 10 d). There were no deaths.

Laparoscopic management of acute SBO is safe, feasible and avoids a laparotomy in a majority of patients. Enterotomy is a frequent complication with this technique and must be recognized during surgery. In some patients, this complication can be managed with laparoscopic repair; otherwise a conversion with mini-laparotomy can be used without increased morbidity.

10

FIVE-YEAR OUTCOMES OF LAPAROSCOPIC ADJUSTABLE GASTRIC BANDING (LAGB) AND LAPAROSCOPIC ROUX-EN-Y GASTRIC BYPASS (LRYGBP) IN A COMPREHENSIVE BARIATRIC SURGERY PROGRAM IN CANADA. *E. Efthimiou,*

N.V. Christou. Section of Bariatric Surgery, Division of General Surgery, McGill University, Montréal, Que.

Bariatric surgery remains the most effective modality to induce effective and sustainable weight loss in the morbidly obese.

This is a retrospective outcomes study of 958 laparoscopic bariatric procedures performed over 5 years since the introduction of minimally invasive bariatric surgery in our comprehensive weight loss surgery program.

Data were extracted from our prospectively collected electronic bariatric surgery registry from February 8, 2002 (the day of our first completed laparoscopic RYGBP), to December 2007. Patient demographics, weight loss, short- (within 30 days) and long-term complications and mortality by procedure type were evaluated (Table 1).

Table 1, abstract 10. Characteristics and outcomes of patients receiving LAGB and LRYGBP

Characteristics	LAGB	LRYGBP	All cases
No. of cases (%)	124 (12.9)	834 (87.1)	958
Mean BMI (range)	45.5 (32.8–63.9)	51.3 (36.7–107.2)	50.5 (32.8–107.2)
Mean age (range), y	43 (21–66)	39 (17–65)	40(17–66)
Mortality, no. (%)	0 (0)	3 (0.4)	3 (0.3)
STC, %	12	9.7	11.7
LTC, %	22.6	9	10.7
Excess weight loss, %			
at 1 y	41	73	68
at 2 y	44	84	78
at 3 y	37	76	71
at 4 y	49	84	75
at 5 y	47	83	70

BMI = body mass index; LAGB = laparoscopic adjustable gastric banding; LRYGBP = laparoscopic Roux-en-Y gastric bypass; LTC = long-term complications; STC = long-term complications.

Ten cases (8.1%) of LAGB needed conversion to LRYGBP for poor weight loss, and 5 cases (4%) necessitated removal for band erosion/slippage. The anastomotic leak rate for LRYGBP was 2.7%. Pouch outlet stenosis (3.6%) and anemia (10%) were the most frequent long-term complications.

Laparoscopic weight loss surgery can be performed safely with acceptable mortality. Our study tends to suggest superior weight loss for LRYGBP, making this a more durable procedure in inducing weight loss, particularly in a public-funded health system.

11

IS RIGHT LAPAROSCOPIC DONOR NEPHRECTOMY RIGHT? *M. Sawatzky, A. Altaf, J. Ellsmere, D. Klassen, M.J. Walsh, M. Molinari, B. Nashan, H.J. Bonjer.* Department of Surgery, Queen Elizabeth II Health Sciences Centre, Dalhousie University, Halifax, NS.

A retrospective review was performed to compare our experience of right and left laparoscopic donor nephrectomies. A total of 26 right and 24 left consecutive donor nephrectomies

and their recipients were reviewed during the study period. Patient demographics and preoperative, perioperative and postoperative data were recorded and compared.

Patient demographics were similar between groups. Multiple vessels were encountered more frequently on the right side, 10 versus 3 ($p = 0.04$), with multiple arteries accounting for 5 versus 3 ($p = 0.52$) and multiple veins accounting for 7 versus 0 ($p = 0.007$). The donated kidney had lesser preoperative function in the right group as determined by nuclear medicine imaging, 46.5% versus 49.4% ($p < 0.001$).

Donor operating times were less in the right group, 198 versus 226 minutes ($p = 0.016$). There was no difference in recipient implantation difficulty as demonstrated by similar total operating and warm ischemia times. Complication rates were similar between groups of both donors and recipients. Postoperative donor and recipient renal function was similar between groups.

Right laparoscopic donor nephrectomy requires less operating time and is associated with similar outcomes for donors and recipients as left laparoscopic donor nephrectomy. Right laparoscopic donor nephrectomy may be preferable in general and should be considered when multiple renal vessels are present on the left side and/or when preoperative function of the left kidney is greater than the right.

12

ABDOMINAL IMAGING IN THE DIAGNOSIS OF ACUTE APPENDICITIS. THE EXPERIENCE OF AN ACADEMIC HEALTH SCIENCES CENTRE IN CANADA. *J.F. Ouellet, V. Brisson, P. Langis, M.C. Dufresne, S. Cloutier, S. Morin, G. Bouchard, C. Mailloux, G. Dionne, E. Légaré, F. Côté, J.P. Gagné.* Centre hospitalier universitaire de Québec, Québec, Que.

The objective of this study was to prospectively assess the use of abdominal imaging (AI) — ultrasound (US) and computed tomography (CT) — for the diagnosis of acute appendicitis (AA) in an academic health sciences centre in Quebec.

Over a 3-month period, from September to December 2007, patients referred for AI for suspected AA were listed. Data included demographics, Alvarado Score (AS), specialties of ordering physicians, results of AI, surgical procedures, operative findings and pathology reports. Charts of all patients booked for an appendectomy during the study period were also reviewed.

Seventy-four patients (72% female) with a median age of 35 years underwent AI: 50 underwent US, 5 underwent CT and 18 had both. Median AS was 3. Emergency department physicians (EDPs) ordered 85% (58/68) of the US scans. CTs were ordered by EDPs (61%), radiologists (22%) and surgeons (17%). Five patients with a median AS of 7 were referred directly for a surgical consultation. The consultant ordered AI in 4 of these cases. In these 5 patients, AA was confirmed at surgery. Upon receiving AI results, EDPs discharged 40 patients (median AS of 3, mean length of stay 10 h), referring 20 patients for a surgical consultation and 6 to another specialty. AI was useless in 65% of discharged patients. Nineteen patients, with a median AS of 5, 18 with positive AI, were taken to surgery; 18 underwent a laparoscopic appendectomy and 1 a laparoscopic right hemicolectomy for unsuspected cecal mass. There was 1 negative appendectomy (1/19).

Although the diagnosis of AA was formerly made on clinical grounds, most patients now undergo AI ordered by EDPs. Precise criteria remain to be defined. Surgeons also seem reluctant to operate without AI. The issues of costs and radiation need to be addressed in parallel with the low rate of negative appendectomies. Surprisingly, the management of AA remains a complex issue.

13

SHORT-TERM OUTCOMES FOLLOWING COLORECTAL RESECTION FOR DIVERTICULAR DISEASE IN CANADA. *L. Dubois, P.J. Karanicolas, P.H.D. Colquhoun, G.H. Guyatt.* Department of Surgery, University of Western Ontario, London, Department of Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, Ont.

We examined the perioperative outcomes following colorectal resection for diverticular disease in Canada and explored factors predictive of mortality.

We extracted data from the Canadian Institute for Health Information (CIHI) Discharge Abstract Database on all adult patients undergoing colorectal resection for diverticular disease during 2005 in Canada (excluding Quebec). Logistic regression identified variables associated with a higher risk of mortality.

In total, 3407 patients underwent colorectal resection for diverticular disease with a mean age of 60.9 (standard deviation 14.5) years. We classified approximately half of cases as urgent or emergent (52.9%), with 11.5% completed laparoscopically. Among urgent or emergent procedures, surgeons performed segmental resection with primary anastomosis in 41.8% of cases and segmental resection with colostomy in 46.3%. The overall in-hospital mortality rate was 4.3%. Increasing age (odds ratio 1.1/y, $p < 0.001$), urgent versus elective cases (OR 2.5, $p = 0.003$) and end-colostomy versus primary anastomosis (OR 1.7, $p = 0.001$) were independently associated with a higher risk of death.

Patients undergoing elective colorectal resection for diverticular disease have a low risk of perioperative death, but the risk increases substantially in the urgent or emergent setting. Primary anastomosis appears to be a safe option for selected patients undergoing urgent colorectal resection, although inferences are weak due to potential unmeasured confounding variables. One or more randomized controlled trials are needed to provide stronger evidence of the risks and benefits of primary anastomosis in the urgent setting.

14

SSI PREVENTION IN COLORECTAL SURGERY: EVIDENCE V. PRACTICE. *D.S. Fenech, J. Chung, C. Eskicioglu, A.B. Nathens, A.R. Gagliardi, M. McKenzie, R.S. McLeod.* University of Toronto, Toronto, Ont.

Despite level I evidence for appropriate antibiotic prophylaxis, normothermia, supplemental oxygen and appropriate hair removal in preventing surgical site infections, compliance with these measures may be poor. This retrospective chart review was undertaken at 7 teaching hospitals at 1 university to determine how well the evidence is employed in practice. The chart review was conducted as part of a larger initiative to shorten

the gap between the time evidence is published and its use in practice across the University of Toronto.

A retrospective chart review was conducted at 7 teaching hospitals at the University of Toronto. A minimum of 50 consecutive elective colorectal procedures were identified at each of the hospitals before April 30, 2007. Emergency and outpatient procedures were excluded.

Approximately 50 charts were reviewed at each hospital (48–83): 52.2% percent of patients were male and 60% had a diagnosis of colorectal neoplasm. The ASA class was greater than III for 90.8% of patients and 91.4% had no unusual findings at the time of surgery. Preoperative oral antibiotics were administered in 20.5% of procedures, primarily at 2 hospitals (Table 1). Preoperative parenteral antibiotics were omitted in 21% of patients but when given were given before the incision 97% of the time. Metronidazole, cefazolin and gentamycin were the most common antibiotics. Postoperative antibiotics were administered 25.2% of the time, primarily at 2 hospitals and, of these, 83% received postoperative antibiotics for more than 24 hours. Hair removal was not documented at 5 hospitals (70%). Temperature was not documented in the perioperative record 18.9% of the time, and only 30.2% of patients' minimum temperatures were greater than 36°C. The FiO₂ was not documented in 57.9% of cases and only 7.2% had a FiO₂ > 80%.

Table 1, abstract 14. Infection prevention measures recorded at 7 teaching hospitals in the charts of patients undergoing elective surgery for colorectal cancer

Intervention	Overall, %	Range, %
Antibiotics		
Preoperative, oral	20.5	0–86.7
Preoperative, IV	79	35.4–96
Postoperative, IV	25.2	7.2–51
Perioperative temperature not recorded	19.4	2–49.3
Proportion of patients with min. temperature > 36°C	30.2	15–38.5
Hair removal documented	37.1	0–94
Razor use documented	0.9	0–3.6
FiO ₂ documented?	42.1	0–87.8
FiO ₂ > 80%	7.2	0–32.7
IV = intravenous.		

Level-1 evidence for preventing surgical site infections in elective colorectal procedures is not uniformly employed in practice. In addition, important information regarding these practices is often not documented in the charts. Work is underway to improve both documentation and compliance with the evidence, and a second chart audit has been planned following implementation.

15

IMPACT OF A SPECIALIZED MULTIDISCIPLINARY TRACHEOSTOMY TEAM ON TRACHEOSTOMY CARE OF CRITICALLY ILL PATIENTS. C. de Mestral, S. Iqbal, N. Fong, J. Leblanc, P. Fata, T. Razek, K. Khwaja. Department of Surgery, McGill University Health Centre, Montréal, Que.

A tracheostomy team (“Trach Team”) was created in 2005

to follow critically ill patients who had undergone a tracheostomy, until their discharge from hospital. Composed of a trauma surgeon, respiratory therapist, speech pathologist and clinical nurse specialist, this team meets twice a week to round on these patients as they transition from the intensive care unit (ICU) to the medical and surgical wards. A retrospective study was performed to assess the impact of this multidisciplinary team. Outcomes analyzed were time to first tube change, time to decannulation, incidence of speech valve placement and the incidence of tracheostomy-related complications on the ward. The outcomes of 89 patients who required tracheostomies in a 12-month period after the team was created were compared with 48 patients from a similar time frame before the establishment of the Trach Team. Under the new service, there was a significant decrease in tube blockage (5.5% v. 25%, *p* = 0.016) and calls for respiratory distress (16.7% v. 37.5%, *p* = 0.04) on the wards. A significantly larger proportion of patients also received speech valves (67.4% v. 19.4%, *p* < 0.0001) after creation of this team. Furthermore, there appears to be a decreased time to first tube change (9.3 v. 26.0 d) and decreased time to decannulation (28.4 v. 50.4 d), but this was statistically insignificant due to small sample size. While further data analysis is required to demonstrate significant differences in time to decannulation and readmission to the ICU, the closer follow-up and more standardized care provided by a specialized multidisciplinary Trach Team results in fewer tracheostomy-related complications and an increase in speech valve installations.

16

PERIOPERATIVE SUPPLEMENTAL OXYGEN IN COLORECTAL PATIENTS: A META-ANALYSIS. M.S. Brar, S.S. Brar, E. Dixon. Department of Surgery, University of Calgary, Calgary, Alta.

Perioperative supplemental oxygen has been proposed to decrease the incidence of surgical site infection in colorectal surgery. A number of randomized controlled trials have been reported with inconsistent results. Important clinical outcomes other than surgical site infections have been collected in these studies and have yet to be included in previous reviews. A meta-analysis of randomized controlled trials was performed to elucidate the effects of perioperative supplemental oxygen in colorectal surgery on surgical site infection incidence, mortality, rate of intensive care unit (ICU) admission and length of stay.

Two independent reviewers performed a literature search of MEDLINE, PubMed, EMBASE, the Cochrane Library and the Cochrane Clinical Trials Registry. In addition, bibliographic searches were performed, and experts were contacted for unpublished data. Randomized trials involving colorectal patients that included perioperative supplemental oxygen as a treatment arm and defined surgical site infection as an outcome measure were included. Non-English language publications were excluded.

Five studies met inclusion criteria, however, 1 trial reported only surgical site infection as an outcome. Using a fixed-effects model, perioperative supplemental oxygen significantly reduced surgical site infection (odds ratio [OR] = 0.66, 95% confidence interval [CI] 0.47–0.92, *p* = 0.01) and mortality (OR = 0.17, 95% CI 0.04–0.67, *p* = 0.01). There was no significant difference in the rate of ICU admission or length of stay. However,

with a random-effects model, there was no significant difference in surgical site infection, but the mortality benefit with perioperative supplemental oxygen was maintained. Tests of heterogeneity were performed, and significant heterogeneity was only present among the studies with respect to length of stay.

This meta-analysis of randomized control trials confirms that perioperative supplemental oxygen in colorectal surgery reduces the incidence of surgical site infection. Moreover, supplemental oxygen appears to confer a mortality benefit. Further randomized controlled trials are required to confirm and strengthen these conclusions.

17 (CAGS CLINICAL RESEARCH AWARD)

TIMELY ACCESS AND QUALITY OF CARE IN COLORECTAL CANCER: ARE THEY RELATED? *Y. McConnell, K. Inglis, G. Porter.* Division of General Surgery, Dalhousie University, Halifax, NS.

Colorectal cancer (CRC) patients want both timely access and high-quality care, but no published data examine the relationship between these 2 aspects of their care. This study aimed to explore the relationship between CRC-specific quality indicators (QI) and access time intervals (ATI) in CRC patients.

Between February 15, 2002, and February 15, 2004, all patients undergoing nonemergent surgery for primary CRC within a single health district were enrolled in a prospective consecutive cohort study. A standardized method was used to collect clinicodemographic and diagnostic/treatment event data. Associations between accepted CRC QI and benchmarked ATI for diagnosis, surgery and adjuvant therapy were examined using multivariate logistic regression, controlling for other clinicodemographic factors.

Table 1, abstract 17. Achievement of quality indicators (QI) and benchmarked access time intervals (ATI) among colorectal cancer patients (n = 392)

Measure	%
Quality indicators	
Diagnosis by screening	9.9
Preoperative liver imaging	53.1
Preoperative colonic endoscopy/imaging	74.7
Pathology report: margin status	98.5
Pathology report: number of lymph nodes	96.7
≥ 12 lymph nodes examined	45.4
In-hospital/30-day mortality	3.8
Access time intervals	
Presentation to definitive diagnosis (4-week benchmark)	36.0
Definitive diagnosis to surgery (4-week benchmark)	51.3
Surgery to start chemotherapy (8-week benchmark)	47.4

Table 1 summarizes the QI and ATI for the study cohort, which consisted of 392 patients. On multivariate logistic regression, asymptomatic patients presenting via screening were more likely to move from presentation to diagnosis within the 4-week benchmark for this ATI, compared with symptomatic patients (RR 8.1, $p < 0.001$). The absence of preoperative liver imaging (RR 2.9, $p < 0.001$) and the presence of complete preoperative colonic evaluation (RR 2.2,

$p = 0.006$) were associated with achievement of the 4-week benchmark for the ATI from diagnosis to surgery. Conversely, the absence of complete preoperative colonic evaluation was associated with achievement of the 8-week benchmark for the ATI from surgery to adjuvant therapy (RR 9.1, $p = 0.001$). Detailed results of the multivariate analysis are presented.

Although several associations between QI and benchmarked ATI for CRC patients were identified, the relationship between quality and access appears complex and far from universal. This suggests that timely access cannot be used as a surrogate measure for quality of CRC care.

18

GETTING STARTED WITH ROBOTICS IN GENERAL SURGERY: IS ROBOTIC CHOLECYSTECTOMY THE WAY TO SHARPEN YOUR TEETH? *S. Jayaraman, W. Davies, C.M. Schlachta.* Canadian Surgical Technologies & Advanced Robotics (CSTAR), Division of General Surgery, Schulich School of Medicine and Dentistry, University of Western Ontario, London, Ont.

The value of robotics in general surgery may be for advanced minimally invasive procedures. Unlike other specialties, formal fellowship training opportunities for robotic general surgery are few. As a result, most surgeons develop robotic skills in practice. Our goal was to determine if robotic-assisted cholecystectomy is a safe and effective bridge to advanced robotics in general surgery.

Before performing advanced robotic procedures, 2 surgeons completed the Intuitive Surgical robotic training course and agreed to work together on all cases. Clinical surgery began with da Vinci cholecystectomy with a plan to begin advanced procedures after at least 10 cholecystectomies. We performed a retrospective review of our pilot series of robotic-assisted cholecystectomies and compared them with contemporaneous laparoscopic controls. The primary outcome was safety. The secondary outcome was learning curve.

There were 16 cases in the robotics arm and 20 cases in the laparoscopic arm. Two complications occurred in the robotic arm, while only 1 laparoscopic patient experienced a complication. None were significant. The mean time required to perform robotic-assisted cholecystectomy was significantly longer than laparoscopic (91 v. 41 min, $p < 0.001$). The mean time to clear the operating room was significantly longer for robotic cases (14 v. 11 min, $p = 0.01$). A trend showing longer mean anesthetic time for robotic cases was observed (23 v. 15 min). Regarding learning curve, the mean operative time needed for the first 3 robotic cases was longer than the last 3 cases (101 v. 80 min); however, this was not statistically significant. Since this experience, the team has confidently gone on to robotic biliary, pancreatic, gastrophageal and colorectal operations.

Robotic cholecystectomy can be performed reliably; however, due to the significant increase in operating room resources, it cannot be justified for routine use. Our experience, however, demonstrates that robotic cholecystectomy is safe and can be used to gain confidence in advanced robotics.

19

DOES ROBOTIC ASSISTANCE IMPROVE EFFICIENCY IN PERFORMING COMPLEX MINIMALLY INVASIVE SURGICAL PROCEDURES?

S. Jayaraman, I. Al-Ghamdi, F.Z. El-Deen, D. Quan, C.M. Schlachta. Canadian Surgical Technologies & Advanced Robotics (CSTAR), Division of General Surgery, Schulich School of Medicine and Dentistry, University of Western Ontario, London, Ont.

We developed a model of biliary-enteric anastomosis to test whether assistance with the da Vinci surgical system, as compared with laparoscopy alone, improves performance on a complex minimally invasive surgical (MIS) procedure.

An ex vivo model for choledochojejunostomy was created using specimens of porcine liver with an intact extrahepatic biliary system and a contiguous loop of proximal intestine. Choledochojejunostomies were performed in 2 experimental arms: Group 1 (laparoscopic) 25 cases; Group 2 (da Vinci-assisted) 24 cases. All procedures were performed by 3 surgeons with graduated expertise in MIS: Surgeon A (MIS and robotic focus); Surgeon B (experienced MIS); Surgeon C (basic MIS). Each surgeon performed equal numbers of procedures in each group. The primary objective was comparison of time to complete anastomosis using da Vinci and laparoscopic approaches. Secondary objectives included anastomosis quality and integrity and impact of experience on performance.

Da Vinci assistance led to significantly faster times than laparoscopy for: anastomosis completion (28.6 v. 38 min, $p < 0.002$), knot tying (1.8 v. 3.4 s, $p < 0.001$) and a lower leak rate with methylene blue challenge ($p < 0.004$). One stenosis occurred (Surgeon C, laparoscopy). Surgeon A completed the da Vinci-assisted anastomosis more rapidly than surgeon B (22.3 v. 33.6 min, $p < 0.001$) and Surgeon C (33 min, $p < 0.000001$). Surgeon A was significantly faster at completing the laparoscopic anastomosis than either Surgeon B (23.7 v. 39.4 min, $p < 0.006$) or Surgeon C (43.8 min $p < 0.002$). Unlike Surgeon A, Surgeons B and C both significantly benefited from da Vinci assistance over laparoscopy. There was no significant difference between surgeons or techniques regarding the number of suture bites required to complete the anastomosis.

Da Vinci assistance improves time to completion and quality of choledochojejunostomy over laparoscopy alone in an ex vivo model. This advantage is more pronounced in the hands of surgeons with less experience in complex laparoscopy.

20

GENERAL SURGERY WAIT TIMES IN A UNIVERSAL HEALTH CARE SYSTEM. *Y. Dang, W.M. Hopman, D. Mercer, J.S. Lott, J. Kawakami.* Queen's University, Kingston General Hospital, Kingston, Ont.

The purpose of this study was to assess a real-time surgical software program to examine general surgery wait times, as decreasing wait times for cancer surgery is a governmental priority initiative.

The wait list management system, Axxess.Rx™ (AdapCS.Canada) has been used exclusively by the department of general surgery to book nonemergency surgery for 5 years. We reviewed the surgery wait times for patients in a general surgery practice. Variables thought to be potentially important in predicting wait time were also collected, including cancer diagnosis, surgeon's assessment of urgency, age, sex, inpatient/outpatient status and year of surgery.

There were 2834 operations for cancer and 6750 for benign conditions performed. The mean waiting time for cancer surgery reached a nadir in 2003 at 23.0 days; it subsequently increased every year and is now 32 days for 2007. In comparison, benign surgery was at a nadir waiting time of 82.4 days in 2002 and is currently 127.6 days at our institution. Multivariate analysis revealed that the cancer diagnosis, age, year of surgery, urgency score and inpatient status were predictive of waiting time.

Waiting time for cancer surgery has increased slightly, but it appears the delay is increasing significantly for patients with benign disease. Our surgery wait time tool has been vital in assessing resource allocation on wait times.

21

Withdrawn

22

THE DEVELOPMENT OF A VIRTUAL REFERENCE MANUAL FOR PERIOPERATIVE NURSES WORKING IN A MINIMALLY INVASIVE SURGICAL SUITE. *S. Yeung, J. Harnish, D.R. Urbach.* Department of Minimally Invasive and General Surgery, University Health Network, University of Toronto, Toronto, Ont.

Continuing education is necessary for perioperative nurses to maintain their skills within the dynamic environment of minimally invasive surgery (MIS). It is becoming more common for hospitals to provide training and orientation for nurses online. In December 2005, the Toronto Western Hospital asked the MIS nurse specialist to create a reference manual for laparoscopic procedures that could be made available 24/7 via the hospital's Intranet site.

A virtual reference manual was created using web-based publishing software. The manual contains information on 4 laparoscopic procedures: cholecystectomy, appendectomy, adrenalectomy and ventral herniorrhaphy.

For each of the above surgical procedures there are 8 sections encompassing anatomy/physiology, anesthesia, patient positioning and preparation, draping, procedure description, medication, surgeon preferences and postoperative care. Prior to publication, all sections were reviewed by experts in the field. The manual also contains synoptic videos of the procedure for nurses to review, along with images of equipment, room set-up and draping procedures. Special attention is paid to the set-up of instruments and the step-by-step use of laparoscopic equipment.

The creation of a virtual reference manual was a collaborative effort of operating room (OR) personnel, surgeons and administration. Having an online resource should reduce the uncertainty and "fear" nurses experience when working in an MIS suite with unfamiliar equipment. This will be particularly helpful for the novice OR nurse, or the nurse from another service who is asked to fill in. The virtual reference manual will be available online in fall 2006. Once the manual is formally launched, further research is planned to assess the impact online resources have on nursing.

23

COLO-URACHAL FISTULA AS A COMPLICATION OF DIVERICULAR DISEASE — CASE REPORT. *F. Tuma, S. Najfi, S.E. Tilley.*

James Paton Memorial Hospital, Gander, Memorial University of Newfoundland, St. John's, NL.

A case report of a 73-year-old, otherwise healthy, male patient who initially presented with moderate abdominal pain and constipation. Abdominal series and computed tomography (CT) confirmed the diagnosis of diverticulitis with phlegmon of small bowel, resulting in partial small bowel obstruction. There was no diverticular abscess. Conservative treatment was initiated, and both the small bowel obstruction and the diverticulitis resolved after few days. He was then discharged home asymptomatic.

An elective outpatient barium enema was done a few weeks after discharge and confirmed left-sided diverticular disease. Colonoscopy confirmed the same, with presence of small inflammatory sigmoid polyp.

Nine weeks after the diverticulitis episode, the patient presented with feculent umbilical discharge. He was well otherwise with no gastrointestinal or sepsis signs or symptoms. Sinogram was done from the umbilicus end and showed contrast flowing to the sigmoid colon with no intraperitoneal spillage. CT scan confirmed the diagnosis of colo-urachal fistula. Conservative treatment was started and continued for a few weeks, as the discharge from the fistula was decreasing gradually until it stopped completely.

Two months later, the patient had a recurrence of the same fistula. Again, conservative treatment was tried for a few weeks but with no signs of improvement. Operative treatment with explorative laparotomy was then undertaken and showed 1) patent urachus from the umbilicus end but blind from the bladder end; 2) large inflammatory mass of sigmoid colon, small bowel loops and the patent urachus; and 3) fistulous communication between the urachus and the sigmoid colon. Resection of the mass including the patent urachus was done with primary anastomosis of both the small bowel and the sigmoid colon. The patient had an uneventful postoperative recovery and was discharged home on postoperative day 8. The pathology report showed urachal, sigmoid and small bowel tissue with inflammatory tissue but no malignancy.

24

CONSERVATIVE MANAGEMENT VERSUS LAPAROTOMY FOR FREE AIR FOLLOWING BLUNT ABDOMINAL TRAUMA: A CASE REPORT. *M. Bawazeer, M. Aljiffrey, R. Saadia.* Department of Surgery, Trauma Service, Health Sciences Centre, University of Manitoba, Winnipeg, Man.

Hollow viscus injuries following blunt abdominal traumas are uncommon. Because of that, there is no widely accepted pre-operative method for diagnosis. Computed tomography (CT) is the most commonly used modality, but it has high false positive and false negative rates. The presence of free air on CT scan is highly suggestive but not diagnostic for hollow viscus injuries, and its reported sensitivity is only 50%–75%. We report a patient with pneumoperitoneum found on CT scan after blunt abdominal trauma who underwent a negative laparotomy. To the best of our knowledge, this is the second report suggesting that laparotomy is not always indicated for isolated free air found on abdominal CT scans.

25

HAND-ASSISTED SPLENECTOMY IS THE SUPERIOR APPROACH FOR SPLEENS OVER 20 CM IN LENGTH. *T.W. Swanson, S. Sampath, A.T. Meneghetti, J. Connors, O.N.M. Panton.* Department of Surgery, Vancouver General Hospital, University of British Columbia, Vancouver, BC.

The objective was to evaluate the complication rates, hospital stays and operative times in hand-assisted laparoscopic splenectomies (HALS) compared with standard open splenectomies (OS) and laparoscopic splenectomies (LS) in a variety of spleens sizes.

A retrospective chart review of 217 splenectomies, between 1988 and 2007, at 5 Vancouver hospitals was conducted.

Over the time period, 156 splenectomies were performed laparoscopically: 22 spleens > 20 cm were removed laparoscopically (20 HALS) and 18 spleens between 17 and 20 cm (7 HALS). Conversion rates using the HALS technique in spleens > 20 cm was no different than in LS < 17 cm (6% v. 5%, $p = 0.917$). Estimated blood loss (375 v. 935 cc, $p = 0.08$) and hospital stay (4.2 v. 8.9 d, $p = 0.001$) in spleens > 20 cm was less in HALS than in OS. Operative time for HALS > 20 cm was longer than for OS (162 v. 114 min, $p = 0.003$) and slightly greater than a 27-minute difference seen between LS and OS in < 17 cm spleens. Complication rates with spleens > 20 cm were equal between techniques (6/20 HALS v. 6/18 OS). In spleens 17–20 cm, HALS had more minor complications, compared with LS (4/7 v. 2/10 patients, $p = 0.035$), but had no significant difference in terms of major complications, length of operation, hospital stay or blood loss.

This study represents the highest volume of HALS in spleens > 17 cm described to date. HALS has equal complication rates and shorter hospital stay than OS in spleens > 20 cm. HALS can be performed with low open conversion rates and should be offered to suitable patients with spleens > 20 cm when available surgical expertise allows.

26

THE WEIGHT (WAIT) MUST END: WAIT TIMES FOR BARIATRIC SURGERY IN CANADA ARE UNACCEPTABLE. *N.V. Christou, S. Al-Sabah, E. Efthimiou.* Section of Bariatric Surgery, Division of General Surgery, McGill University, Montréal, Que.

Severe obesity is reaching epidemic proportions throughout the world, including Canada. The only permanent treatment of severe or morbid obesity (MO) is bariatric surgery (BS). Access to BS is very limited in Canada.

This study sought to collect accurate data on wait times for BS in Canada.

We carried out a survey of members of the Canadian Association of Bariatric Physicians and Surgeons and performed a more detailed analysis at one Canadian bariatric surgery centre (#7 below), where a prospectively collected BS registry has been maintained since 1983. The survey response rate was 82%. The data are summarized in Table 1.

The wait time from office contact to surgery varied from 3 to 9 years at the 9 centres. At centre #7 there were 670 patients who had contacted the office for consultation, 607 patients waiting to see the surgeon and 217 patients on the actual operating list. This centre performed 138 BS cases in

2007. The wait time from office contact to surgery calculates as 1639/138, ~11 years, assuming all patients wait their turn at this centre. By comparison, the Fraser Institute and the Wait Times Alliance benchmarks for reasonable surgical wait times vary from 8 weeks for cancer surgery to 1.5 years for cosmetic surgery. There were 7 documented deaths on the wait list of centre #7 over the past 10 years.

Table 1, abstract 26. Wait lists for bariatric surgery at 9 bariatric surgery centres across Canada

Centre	Wait list; no. patients			Total	No. surgeries in 2007
	Office contact	Office app't	Surgery-ready		
1	90	12	78	180	65
2	0	21	55	76	24
3	0	90	160	250	120
4	130	6	15	151	11
5	455	38	385	878	99
6	836	93	710	1639	329
7	670	607	217	1494	138
8	100	100	100	300	200
9	0	240	80	320	82
Total	2281	1207	1800	5288	1068

app't = appointment.

This study clearly demonstrates that wait times for BS are the longest of any surgically treated condition. Given the significant reduction in the relative risk of death with BS (40%–89%, depending on the study), the current wait times for BS in Canada are unacceptable.

27

A RETROSPECTIVE REVIEW OF GENERAL SURGERY TRAINING OUTCOMES AT THE UNIVERSITY OF TORONTO. *J. Tyrwhitt, L. Rotstein, Y. Shargall, C. Compeau.* St. Joseph's Health Centre, University Health Network, Toronto, Ont.

In Ontario, the adoption of the Professional Association of Interns and Residents of Ontario guidelines for resident work hour thresholds has effectively reduced the work week of general surgery residents. Furthermore, in 1997, the Royal College of Physicians and Surgeons of Canada changed the pre-existing fall certification examination to a spring exam, reducing the final several months of residency training to a period of exam preparation. We questioned what impact these reductions in clinical experience have had on general surgery graduates at the University of Toronto.

Final year In-Training Evaluation Reports (ITERs) of University of Toronto general surgery trainees from 1995 to 2006 were evaluated. Residents were subdivided into 4 groups according to year of graduation ('95–'97, '98–'00, '01–'03 and '04–'06). We evaluated postgraduate 'performance' by categorizing residents into 1 of 4 groups: residents who 1) entered directly into general surgery practice after graduation, 2) entered into a Royal College certification subspecialty program, 3) entered a noncertification Royal College program or 4) entered into a nonregulated "clinical fellowships."

One-hundred and eighteen surgical trainees were evaluated. The average scores for each of the 5 ITER parameters (technical

skills, professional attitudes, application of knowledge, teaching performance and overall performance) were not statistically different for each of the 4 graduating groups. At completion of residency there were statistically fewer general surgery graduates from 2004–2006 ($p < 0.05$) who entered directly into general surgery practice compared with the other years. The graduates from 2004–2006 who did not enter into general surgery practice appeared to choose nonregulated "clinical fellowships."

These observations may indicate that recent surgical graduates possess an acceptable skill set but may lack the clinical confidence to enter directly into general surgery practice. Evidence seems to indicate that nonregulated "clinical fellowship" has become an unregulated surrogate extension of the training program whereby surgeons can gain additional clinical experience and surgical expertise.

28

ENDOSCOPIC TREATMENT OF ZENKER'S DIVERTICULUM: RESULTS OF A 7-YEAR EXPERIENCE. *A. Maghrabi, A. Alkadi, D. Thomson, S. Dhalla.* Department of Surgery, Brandon Regional Health Centre, Brandon, University of Manitoba, Winnipeg, Man.

We are reporting our experience for treating Zenker's diverticulum (ZD) using the endoscopic needle knife papillotome.

A total of 18 patients with a mean age of 80 (68–91) years were included in our prospective cohort study, where they underwent endoscopic Zenker's diverticulectomy using a needle knife papillotome at Brandon Regional Health Centre over a 7-year period. The mean follow-up was 27.5 months. A dysphagia scoring system from 0 (no dysphagia) to 4 (total dysphagia) was used. All patients' baseline characteristics, pre- and postoperative symptoms, operative time, time to oral intake, length of hospital stay, recurrence of symptoms and complications were analyzed.

Dysphagia score improved significantly after the treatment ($p < 0.0001$), there was also significant improvement in the regurgitation symptoms in our patients ($p < 0.0027$) and no difference in weight loss before or after the procedure ($p < 0.058$). The mean operating room time was 28.4 minutes. Oral intake was resumed within 48 hours except for 1 patient. Hospital stay was 24–48 hours except for 2 patients. Only 1 patient had a microperforation treated conservatively, and 2 patients had re-do procedures due to persistent of symptoms.

Endoscopic Zenker's diverticulectomy using a needle knife papillotome is a safe and effective alternative approach to manage ZD for highly morbid patients. It is minimally invasive, provides decreased anesthetic time, decreased hospital stay and an acceptably low complication rate.

29

ABDOMINAL COMPARTMENT SYNDROME DUE TO CONSTIPATION: CASE REPORT. *F. Tuma, A. Felix, H. Mir.* St. Clare Mercy Hospital, Memorial University of Newfoundland, St. John's, NL.

A case report of a 69-year-old gentleman who presented with mild abdominal pain and constipation of 3 weeks duration. He was well otherwise. His history was positive for a complicated

right hip arthroplasty done 2 months earlier; this was followed by revision, which was again complicated by methicillin-resistant *Staphylococcus aureus* (MRSA) infection necessitating intravenous vancomycin and a prolonged period of narcotic pain medications with the side effect of significant constipation.

On initial assessment of his abdominal pain, he was found to have severe constipation with no signs and symptoms of acute abdomen; therefore, he was admitted for observation and further investigations. Tap water enema was tried to relieve his constipation; this was associated with unexplained sudden episode of unresponsiveness, vomiting and aspiration. He was promptly and successfully resuscitated, intubated and ventilated.

Urgent pulmonary and abdominal computed tomography (CT) scanning showed not pulmonary embolism, but a significantly dilated entire colon and rectum. Observation in the intensive care unit (ICU) revealed worsening abdominal distension with bladder pressure of 20 mm Hg, but no ventilatory or urinary consequences. Rectal disimpaction followed by rectal tube insertion failed to improve his abdominal distention and constipation over the following 8 hours. His bladder pressure increased to 41 mm Hg, associated with oliguria, tachycardia and hypotension. This constellation of findings confirmed the diagnosis of intra-abdominal compartment syndrome. An emergent exploratory laparotomy was then done.

Operatively, the entire colon, starting from the ileocecal valve to include the intraperitoneal rectum, was hugely distended and gangrenous but not perforated. The small bowel and the stomach were completely normal looking. Therefore, total colectomy with terminal ileostomy was done with easy and tension-free closure of the abdominal wall. The patient was returned back to the ICU for continuous monitoring. He then developed anuria requiring hemodialysis and hypotension requiring continuous vasopressors; he continued to be unresponsive for 4 days. An electroencephalograph and head CT scan were performed showing no cerebral cortical activity and a large cerebral infarct, respectively. After discussion with the patient's family, the treatment and care were discontinued, and he died shortly after, on postoperative day 4. Autopsy was offered but declined by the family.

30

SURGICAL SITE INFECTION (SSI) PREVENTION: THE GAP BETWEEN EVIDENCE AND PRACTICE IN ACADEMIC MEDICAL CENTRES. *C. Eskicioglu, J. Chung, D.S. Fenech, A.B. Nathens, A.R. Gagliardi, S.S. Forbes, M. McKenzie, R.S. McLeod.* University of Toronto, Toronto, Ont.

A significant gap exists between the best evidence and the actual practice of surgery. Awareness of evidence is the first step in knowledge translation. Our primary objective was to identify gaps in the knowledge and understanding of SSI prophylaxis strategies in general surgery residents and faculty at 7 teaching hospitals. A survey was distributed to 55 surgeons and 68 residents. Our questionnaire focused on identifying whether surgeons had knowledge of evidence supporting manoeuvres to prevent SSI. The question addressing this particular issue asked, "Do you believe that research evidence supports the following best practices in preventing SSI?" We received 76 survey responses for a response rate of 62% (65%

from residents and 59% from attending surgeons). Awareness of research evidence supporting antibiotic prophylaxis, peri-operative normothermia and strict glycemic control was reported by 89.5%, 68.4% and 65.8% of respondents, respectively. There was less awareness of the evidence supporting no hair removal, the omission of bowel preparation and hyperoxia as practices to prevent SSIs. Responses were similar for attending surgeons and residents. These data suggest that despite level I evidence supporting the value of these SSI prevention measures, between 11% and 53% of surgeons and residents are unaware that this evidence exists. Broad-reaching initiatives that increase awareness of best evidence may encourage attending surgeons to change their practice. As the residents appear to adopt the beliefs of their mentors, it is critical that they also be engaged through appropriate educational initiatives. The next step for translating this evidence into practice is the identification of multifaceted implementation strategies that will engage both residents and attending surgeons.

31

ATTRITION IN MEDICAL AND SURGICAL OBESITY CLINICS: A RETROSPECTIVE REVIEW. *G. Hadi, D.W. Birch, X. Shi, C. Stoklossa, K. Chalifoux.* Centre for the Advancement of Minimally Invasive Surgery, Edmonton, Alta.

Surgery for morbid obesity is the only proven treatment that achieves long-term (sustainable) weight loss and a statistically significant reduction in mortality. Our clinical experience, coupled with preliminary evidence from the literature, suggests that patient compliance (lifestyle change) may predict long-term success. Moreover, compliance can only be determined through long-term clinical follow-up.

Obesity is a chronic disease, and all patients should be managed in a multidisciplinary clinic regardless of the approach to treatment. In this study we examine the attrition rates of a medical and surgical clinic for obesity and investigate factors that predict failure to maintain long-term follow-up. Our hypothesis is that high rates of attrition are associated with certain demographic characteristics and certain comorbidities.

Retrospective review of a multidisciplinary clinic's records (Weight Wise, Capital Health) is being assessed. A total of 1208 morbidly obese patients, with records from October 2002 to April 2008, are being reviewed. Demography (age, sex, weight and height) and comorbidities (psychiatric, cardiac, pulmonary, renal, hypertension, diabetes) are being analyzed.

Attrition is defined as self-discharge, not interested, unable to commit time, loss of follow-up and discharge due to poor compliance. A multidisciplinary team makes decisions for discharging noncompliant patients. The team consists of surgeons, internists, dieticians, social workers, psychologists, psychiatrists, physiotherapists, registered nurses and coordinators.

The patients are divided in 2 groups. The first group includes patients who had surgery (laparoscopic gastric band insertion or gastric bypass) and the second group includes patients who are being treated medically.

The records of 318 patients who had surgery for obesity and the other 890 patients under medical intervention are being reviewed. Initial results revealed an attrition of 37 patients (9%) from the surgical group.

Further analysis of the demographic characteristics and

comorbidities of the groups are being done to determine factors that impact long-term follow-up.

Data from this study will be used to determine strategies for improving long-term follow-up for obesity.

32

LAPAROSCOPIC ACCESSORY SPLENECTOMY: THE IMPORTANCE OF PERIOPERATIVE LOCALIZATION STUDIES. *A. Altaf, M. Sawatzky, J. Ellsmere, H.J. Bonjer, D. Klassen.* Division of General Surgery, Dalhousie University, Halifax, NS.

We report our experience with laparoscopic accessory splenectomy (LAS) in patients with recurrent immune thrombocytopenic purpura (ITP) after previous splenectomy, and the use of perioperative localization methods to help with the intraoperative identification of accessory spleen in these patients.

Five consecutive patients who underwent LAS after initial splenectomy for ITP at a tertiary care centre were reviewed. Demographics, preoperative diagnostic and localization studies, technical success and the effect on thrombocytopenia were examined. The location of accessory spleen was also recorded.

Five patients with recurrent ITP underwent LAS during the study period. All had successful removal of the accessory spleen based on final pathological exam. One patient required a second exploration with perioperative localization after a failed attempt without. A novel method of localization of accessory spleen was used in 3 operations. This consisted of preoperative computed tomography-guided injection of methylene blue at the accessory spleen's site and/or preoperative intravenous injection of Technetium-99m-labelled damaged red blood cells. Intraoperatively, the dye is used for visual identification, and the gamma probe is used to aid in localization or to confirm the presence of the accessory spleen within the excised specimen. We found these methods helpful in the intraoperative identification of accessory spleen. The accessory spleens missed at initial splenectomy were found in unusual locations. Four of the 5 patients had sustained improvement in platelet counts after LAS. One patient had postoperative ileus that resolved on conservative management. No other complication or mortality was observed.

We conclude that LAS after previous splenectomy is feasible and safe. Perioperative localization methods aid in the intraoperative identification of accessory spleen. Accessory spleens missed at initial splenectomy are generally found in unusual locations. Treatment of recurrent or unresolved ITP with LAS can be effective in some patients.

33

THE ROLE OF INTERVAL APPENDECTOMY IN THE MANAGEMENT OF APPENDICEAL ABSCESS OR PHLEGMON: IS IT INDICATED? *T. Swidinsky, D. Hochman.* Department of General Surgery, University of Manitoba, Winnipeg, Man.

A retrospective chart review of 26 patients shows that an interval appendectomy after appendiceal abscess or phlegmon is not indicated after conservative management. Data were gathered from a retrospective chart review of patients admitted to St. Boniface General Hospital in Winnipeg from April 2004 until September 2007. Patients who had an admission diagnosis of appendiceal abscess or phlegmon were selected for the

study. Comparisons were made between patients managed conservatively and those who failed conservative management. Using a Student's *t* test, the groups were compared by demographics, white blood cell count (WBC) at admission, and type and duration of antibiotics. Pathology of the failed group was examined. Twenty-nine patients were identified as being admitted for appendiceal abscess/phlegmon. Three were excluded owing to other diagnosis, 2 underwent an immediate operation, and 2 had scheduled interval appendectomies. Twenty-two patients were managed conservatively for a mean follow-up time of 611.8 days. Seven (31.8%) failed conservative management. Average time to recurrence was 107.57 days. There was no statistical difference between the groups in terms of age ($p = 0.146$), sex ($p = 0.624$) and WBC on admission ($p = 0.704$). There was a significant difference in duration of antibiotics: 10.71 days versus 16.73 days ($p = 0.034$), with those who failed receiving a shorter duration. One patient had adenocarcinoma on pathological review. Routine interval appendectomy after conservative management of an appendiceal abscess/phlegmon is not indicated based on the low rate of recurrence. Recurrence of appendicitis may be dependent on the duration of antibiotics given during treatment. A colonoscopy may be considered in patients who are managed conservatively.

34

TELESONOGRAPHY FOR TRAUMA: USERS' PERCEPTIONS 6 MONTHS AFTER INITIATION OF A PILOT TERRESTRIAL EVALUATION OF A SPACE-INITIATED TECHNOLOGY. *L. Kmetz, D. Dyer, C. Turner, R. Hall, D. Lautner, S. Lan, C. Gautier, J. Cusden, A. Bigras, G. Bigras, J. Boyd, D.R. Hamilton, P.B. McBeth, A.W. Kirkpatrick.* Regional Trauma Services, Calgary, Banff Mineral Springs Hospital, Banff, Alta., Telesat, Ottawa, Ont., and Wyles Life Sciences, Houston, Tex.

We recently introduced a trial teleultrasound system (TUS) between a tertiary care trauma centre (FMC) and a rural referring hospital (BMSH), that featured bidirectional video and unidirectional ultrasound (US) communication to facilitate real-time telementoring or observation of US during acute trauma resuscitations. The clinical protocol used both the focused assessment with sonography for trauma (FAST) and the extended (EFAST) for pneumothoraces. We thus sought to explore users' perceptions of the system after the initial experience. All TUS users, both sending and receiving, were contacted by phone or email and asked 7 structured questions regarding their overall satisfaction and perceptions of the usefulness of the TUS. Out of 18 potential respondents, 13 completed the survey: 12 MDs (1 surgeon, 9 emergency MDs, 2 residents) and 1 nurse, for a 72% response rate. In terms of prior reported US experience, for the FAST 54% reported great, 38% limited and 8% no experience; for EFAST, 38% reported limited, 54% none and 8% great experience. In terms of overall satisfaction, 46% were strongly satisfied and 46% satisfied, with 1 abstention, generating the perception by 92% that this would benefit the Canadian North. Collegiality was strongly felt to be improved by 69% and improved by 23%. Forty-six percent strongly felt this technology improved their personal US skills and 23% agreed while 15% disagreed, all of whom reported great prior FAST experience. The majority

(62%) were neutral regarding whether TUS was a better teaching or clinical tool, while 31% strongly or simply disagreed, feeling it was more important clinically. Overall, the majority of providers were satisfied with and perceived there were both local and further potential benefits for remotely injured patients to benefit from a TUS. Further evaluation of this approach and technology is warranted in more remote settings with less experienced personnel.

35

DO PERFORMANCE MEASURES ON THE LAPMENTOR VR SIMULATOR PREDICT FLS PERFORMANCE? *E. Greco, J. Escallon, T. Grantcharov, A. Okrainec.* University Health Network, Department of Surgery, University of Toronto, Toronto, Ont.

The Fundamentals of Laparoscopic Surgery (FLS) simulator has been extensively studied, and its assessment of technical skill has been found to be reliable and valid. One of the disadvantages of this simulator is that it requires a trained proctor for scoring. The LapMentor (LM) is a high fidelity virtual reality simulator with haptic feedback. It allows a trainee to practice 9 basic laparoscopic tasks including laparoscopic suturing. The purpose of this study was to determine the predictive validity of performance on the LapMentor with FLS score.

Sixteen participants (9 novice, 3 intermediate and 4 experienced surgeons) were tested on 8 LapMentor basic laparoscopic tasks and the 5 FLS tasks. Total time (TT), number of instrument movements (NIM) and total path length (TPL) were measured for each task on the LapMentor, with lower values indicating a higher skill level. Pearson correlation was used to assess the association between TT, NIM and TPL on each LapMentor task and the overall FLS score (see Table 1).

Table 1, abstract 35. Pearson correlation between 8 LapMentor (LM) tasks and total FLS score

LapMentor task	Total time	No. of instrument movements	Total path length
Ball touching task	-0.575*	-0.592*	-0.715†
Duct clipping	-0.071	-0.143	-0.029
Duct retraction & clipping	-0.741†	-0.649†	-0.585†
Ball transfer	-0.553*	-0.796†	-0.564†
Circle cutting	-0.833†	-0.789†	-0.745†
Cautery of bands	-0.233	-0.789†	-0.745†
3D object manipulation	-0.643†	-0.711†	-0.751†
Intracorporeal suturing	-0.780†		

FLS = Fundamentals of Laparoscopic Surgery.
*Significant at the 0.05 level (2-tailed)
†Significant at the 0.01 level (2-tailed)

There was an excellent correlation between performance on almost all LapMentor tasks and FLS score. LapMentor number of instrument movements and total path length were slightly more robust predictors of FLS score compared with total time.

36

AN UNTAPPED RESOURCE: USING THE ICU ENVIRONMENT FOR THE TEACHING OF END-OF-LIFE SKILLS. *S. Minor, D. Heyland, C. Schroder.* Department of Surgery, Dalhousie

University, Halifax, NS, Critical Care Medicine and Palliative Care Medicine, Queen's University, Kingston, Ont.

Proficiency and confidence in palliative end-of-life (P/EOL) care is essential to the practising surgeon. However, most surgical training programs lack any formal P/EOL care training, and adding yet another competency to an already full curriculum presents difficulties for most programs. The approach our centre took to confronting this challenge was to utilize the intensive care unit (ICU) rotation as the venue for delivering a P/EOL curriculum. Although at face value the ICU would seem to be an ideal environment to teach P/EOL care skills and to develop the specialized communication skills required in P/EOL care discussions, this assumption has not been fully validated. The purpose of this study was to evaluate the effectiveness and perceived value of a formal P/EOL care curriculum for junior residents during an ICU rotation by measuring self-assessed changes in P/EOL care attitudes and competencies.

Residents rotating through the ICU over a 6-month period completed pre- and postcurriculum surveys evaluating their self-assessed efficacy in providing P/EOL care and attitudes toward P/EOL care. Scores were analyzed using a paired Student's *t* test.

Seventeen of 19 (90%) residents completed both the pre- and postcurriculum evaluations. The P/EOL curriculum increased self-assessed efficacy ratings in the domains of pain management ($p = 0.04$), psychosocial knowledge ($p = 0.001$), communicator knowledge ($p = 0.001$), professional knowledge ($p = 0.002$) and manager knowledge ($p < 0.001$). The rotation was rated as being valuable in preparing residents to care for patients near the end of life ($p < 0.05$), with surgery residents indicating it to be the most valuable rotation in their palliative care training.

An ICU P/EOL curriculum improves self-rated efficacy scores across multiple domains in P/EOL care and is seen as a valuable educational experience.

37

EVIDENCE-BASED GUIDELINES FOR THE PREVENTION OF UNPLANNED PERIOPERATIVE HYPOTHERMIA (PH) IN PATIENTS UNDERGOING ABDOMINAL SURGERY. *S.S. Forbes, C. Eskicioglu, A.B. Nathens, A.R. Gagliardi, D.S. Fenech, R.S. McLeod.* For the Best Practice in General Surgery Working Group, Department of Surgery, University of Toronto, Toronto, Ont.

The objective of this study was to appraise the available evidence for patient monitoring, perioperative active warming methods, outcomes supporting the prevention of perioperative hypothermia and implementation strategies for the prevention of PH.

Outcomes assessed included the precision and accuracy of thermometers, efficacy of warming devices readily available in Canadian operating rooms, including intravenous (IV) fluid warmers and forced-air devices, and surgical site infections and morbid cardiac events associated with PH.

MEDLINE, EMBASE and the Cochrane Database were searched to identify randomized controlled trials of efficacy and prospective studies of diagnostic accuracy. The methods of the Canadian Task Force on Preventive Health Care were employed to grade study quality, level of evidence and formulate the final recommendations.

All patients undergoing abdominal surgery must have their temperature monitored with an esophageal probe while under general anesthesia; awake patients and patients in recovery must have temperatures monitored using oral probes (2 studies, level II-2 evidence, grade B recommendation). Active warming with IV fluid warmers and forced-air devices must be employed for all patients whose procedure is expected to last longer than 30 minutes (8 studies, level I evidence, grade B recommendation) with a target temperature of $> 36^{\circ}\text{C}$. The prevention of PH with systemic warming measures is necessary to prevent surgical site infections in patients undergoing clean surgery (14% v. 6%, risk ratio [RR] 2.39, 95% confidence interval [CI] 1.08–5.28, $p = 0.03$ in a study of preoperative warming) and clean-contaminated surgery (19% v. 6%, RR 3.25, 95%CI 1.35–7.85, $p = 0.005$ in a study of intraoperative warming), (2 studies, level I evidence, grade A recommendations) and morbid cardiac events in the high-risk population (6% v. 1%, RR 4.49, 95%CI 1.00–20.2, $p = 0.02$), (1 study, level I evidence, grade A recommendation).

The data are current up to January 31, 2008.

38

MINIMALLY INVASIVE SURGERY IN THE PROVINCE OF QUÉBEC. A GLOBAL PORTRAIT. M. Chhiv, Y. Lévesque, O. Mailloux, R.C. Grégoire, J.P. Gagné. Québec Centre for Minimally Invasive Surgery, Centre hospitalier universitaire de Québec, Québec, Que.

The objective of this study was to assess the state of minimally invasive surgery (MIS) practice in the province of Quebec.

A questionnaire concerning the practice and learning of MIS was mailed to all 489 Quebec general surgeons in October 2006; a second mailing was done in May 2007. The survey addressed the surgeon's demographics, site and type of practice, performance of basic and advanced MIS procedures, abdominal access technique and the perception of the respondent toward skill acquisition.

Two-hundred and fifty (51.0%) surgeons responded. Twelve of them were retired and thus excluded from the analysis. Mean age of respondents (71% male) was 45.2 years. Ninety percent perform at least 1 basic MIS procedure and 82.4% perform endoappendectomies. Eighty-five percent perform at least 1 advanced procedure, whereas 58.0% perform 3 or more. Laparoscopic resections for benign and malignant colorectal conditions are performed by 66.0% and 43.7% of respondents, respectively. Seventy percent use an open technique for creation of pneumoperitoneum. Factors positively influencing the use of advanced MIS procedures are: a younger age ($p < 0.0001$), fewer years of experience ($p < 0.05$) and the performance of basic MIS procedures ($p < 0.0001$). Using the Likert scale, we found that surgeons acquired their MIS skills by residency training (median of 4), by themselves (median of 4) and from colleagues (median of 4). The main factor limiting the practice of MIS is the lack of operative time (median of 4). Respondents feel that academic surgical departments (median of 4), the Quebec Surgical Association (median of 4) and the Canadian Association of General Surgeons (median of 4) are responsible for providing continuing medical education in MIS.

Many factors influence the practice of MIS by surgeons in the province of Quebec.

39

SURGERY IN THE HOMELESS POPULATION: PATIENT CHARACTERISTICS AND IMPACT ON LENGTH OF STAY. M. Goodwin, C.J. Brown. Department of Surgery, St. Paul's Hospital, Division of General Surgery, Department of Surgery, University of British Columbia, Vancouver, BC.

In this study we analyze the demographic characteristics and length of stay among homeless persons undergoing surgery at an urban hospital in Vancouver and compare these with other lower-income and higher-income domiciled persons.

From 2002 to 2006, all patients admitted to a surgeon at St. Paul's Hospital (SPH) were identified in the SPH electronic medical record. Three groups were identified: homeless adults, adults living in the Downtown Eastside and patients living in Vancouver city centre. In this early analysis, basic descriptive statistics were used to analyze demographic characteristics, principal diagnoses, comorbidities and length of stay.

Of the admissions for homeless surgical patients ($n = 134$), 63% were for the treatment of trauma as compared with 24% of the housed population ($p < 0.001$). Of the homeless population, 56% were identified as substance abusers, as opposed to 11% in the domiciled population ($p < 0.001$). Homeless surgical patients were more than twice as likely to be HIV positive (13% v. 6%; $p < 0.0001$) than the domiciled. Homeless patients stayed 3.4 days, or 36% longer per admission on average than housed patients ($p = 0.01$).

In summary, patients admitted for surgery who are homeless tend to be victims of trauma or deep tissue infection. Furthermore, they remain in hospital longer than housed patients. Policy and program planners should consider the potential of supported housing to offset the cost of excess hospitalization in the homeless population recovering from illness. Further analysis of these data using a multivariate model for hospital length of stay is planned.

40

RELIABILITY AND VALIDITY OF THE GENERAL SURGERY RESIDENT EVALUATION REPORT FORM: AN ASSESSMENT OF THE 7 CANMEDS ROLES. H. Redwan, T. Donnon, L. Mudrick-Donnon. Departments of Surgery and Community Health Sciences, Postgraduate Medical Education, University of Calgary, Calgary, Alberta.

Each of the residency specialty programs at the University of Calgary have developed various Rotation-Resident Evaluation Report (R-RER) forms designed to assess the 7 CanMEDs core competencies identified by the Royal College of Physicians and Surgeons of Canada. The aim of this study was to report the reliability and validity of the General Surgery (15-item), online R-RER forms.

The General Surgery R-RER forms completed during the 2006–2008 academic years (July 1, 2006, to March 30, 2008) were reviewed for all PGY 1–5 residents. Three of the 15 items were found to be inconsistently completed and were removed from subsequent analyses. Internal consistency and exploratory factor analyses were used to investigate the reliability and construct validity of the forms in connection to the measurement of residents' 7 CanMEDs competencies.

Although the General Surgery forms were found to have

good internal reliability (Cronbach's $\alpha = 0.95$), inadequate construct validity was derived from the resulting 2-factor solution. Factor analysis shows that the General Surgery form accounts for 74% of the variance and that item loadings depict a model emphasizing the role and responsibilities of residents as defined by the 1) medical expert and 2) professional roles only.

The General Surgery R-RER form appears to have excellent reliability without the corresponding construct validity derived through exploratory factor analyses. Although an oblique-rotated factor analysis provides the best representation of the 2-factor model, the resulting 12-item R-RER form falls short of measuring all 7 of the CanMEDs roles. Further research into the design and development of in-training evaluation reports that look at measures that encompass all of the roles will be explored.

41

PREOPERATIVE STAGING IN CANCER OF THE PANCREATIC HEAD: IS THERE ROOM FOR IMPROVEMENT? *K. Croome, S. Jayaraman, C.M. Schlachta. Division of General Surgery, Schulich School of Medicine and Dentistry, University of Western Ontario, London, Ont.*

Despite advances in preoperative staging, cancer of the pancreatic head is frequently unresectable at laparotomy. We performed an institutional retrospective review of patients referred for resection of cancer of the pancreatic head over a 2-year period. Our objective was to identify potential areas of improvement in preoperative staging. The primary outcome was the rate of metastasis or unresectability found at laparotomy in patients who were booked for potentially curative resection. One-hundred and thirty-three patients were referred with suspected pancreatic cancer. All had preoperative computed tomography (CT) scanning. Twenty-four also had preoperative endoscopic ultrasound (EUS) and 23 had magnetic resonance imaging (MRI). Seventy-eight patients were deemed not to be candidates for surgery, leaving 55 potentially resectable patients who were scheduled for attempted pancreaticoduodenectomy. Thirty-two patients (58%) underwent resection with curative intent. Twenty-three patients (42%) were found to be unresectable at the time of surgery. Reasons for unresectability were: metastases, 9 (16%), or locally-advanced disease, 14 (26%), not appreciated by preoperative staging. Reasons for unresectability due to locally advanced disease were: involvement of vasculature, 12 (22%), or mesentery, 2 (4%). One patient had a diagnostic laparoscopy immediately before planned open exploration and was found to have peritoneal seeding precluding curative resection. Of patients having EUS, 14 were not surgical candidates due to locally-advanced tumour. Ten patients were offered surgery with curative intent, whereas 5 (50%) were found to be unresectable (4 metastatic, 1 locally advanced). Of the patients having MRI, 11 were offered surgery, whereas 5 (45%) were not resectable (2 metastatic, 3 locally advanced).

In our institution, preoperative staging for cancer of the pancreatic head misses a substantial amount of metastatic and unresectable disease. There is clearly room for improvement, and newer technologies should be evaluated to enhance detection of metastatic and locally advanced disease to prevent unnecessary laparotomy.

42

MEASUREMENT OF QUALITY INDICATORS FOR SENTINEL LYMPH NODE BIOPSY (SLNB) AT AN ACADEMIC INSTITUTION: A FEASIBILITY STUDY. *B.J. Wells, A.R. Gagliardi, F.C. Wright, N. Fraser, D. McCreedy, C.M.B. Holloway, M.L. Quan. Departments of Surgery, Sunnybrook Health Sciences Centre and Princess Margaret Hospital, Toronto, Ont.*

SLNB is becoming the preferred method for axillary staging in early breast cancer. Previously, there were no performance measures or "quality indicators" (QIs) from which SLNB could be evaluated. We recently developed 11 QIs using a Delphi consensus method (see table). The aim of this study was to determine the feasibility of measuring these QIs and to

Table 1, abstract 42. Quality indicators for sentinel node biopsy in breast cancer

No.	Quality indicator	Proportion of patients...	Feasible to measure?
1.	Axillary node positivity rate	...undergoing SLNB in whom was identified and found to be positive.	Yes: Chart-level positive.
2.	Proper identification of SLN	...in whom sentinel lymph node(s) (SLNs) were identified as "hot" and/or "blue" and/or "clinically suspicious" in the chart or dictated OR note.	Yes: Chart-level
3.	SLNB performance in eligible patients	...undergoing SLNB in the setting of breast conserving surgery for T1 tumours.	No
4.	No. of nodes removed (> 1)	...who underwent SLNB in whom the number of nodes removed is greater than 1.	Yes: Chart-level
5.	Pathologic evaluation protocol	...in whom the SLNs were examined using a recognized protocol involving serial-sectioning.	Yes: Institution-level
6.	Pathologic reporting using AJCC	...whose SLNB final pathology reports identify the category of metastases and present the patterns of tumour according to AJCC/UICC criteria.	Yes: Chart-level
7.	Concurrent SLNB with lumpectomy	...who underwent SLNB and lumpectomy concurrently.	Yes: Chart-level
8.	Axillary recurrence rate	...with a negative SLNB who develop an axillary recurrence.	No
9.	Completion ALND for positive SLNB	...with a positive SLNB (as defined by the presence of, at a minimum, micrometastases greater than 0.2 mm) who received a completion axillary lymph node dissection (ALND).	Yes: Chart-level
10.	SLNB performance in ineligible patients	...who undergo SLNB as a stand-alone axillary procedure who are "ineligible" based on preoperative disease characteristics (i.e., inflammatory breast cancer, etc.)	Yes: Chart-level
11.	Standard protocol for injection of radiocolloid	...having radiocolloid injected at an institution that has defined nuclear medicine protocol for SLNB for breast cancer.	Yes: Institution-level

AJCC = American Joint Committee on Cancer; ALND = axillary lymph node dissection; OR = operating room; SLN = sentinel lymph node; SLNB = sentinel lymph node biopsy; UICC = International Union Against Cancer.

use them to describe baseline performance measures of SLNB performed at a single institution.

All patients with breast cancer undergoing SLNB at a single tertiary institution were identified through a database of SLNB cases performed from January 1 to December 31, 2006. Patient charts were reviewed and the QIs abstracted.

Nine of the 11 QIs were measurable: 7 required chart-level abstraction whereas 2 were confirmed at the institutional level. Two QIs were not measurable (see Table 1). There were 119 patients identified having SLNB during the study period: 5 patients had no SLNs identified, resulting in 114 cases of completed SLNBs. The axillary positivity rate was 14% (16/114). Method of sentinel lymph node (SLN) identification was documented in 99% of cases, and for 91 (80%) patients, greater than 1 SLN was removed. All SLNs were examined according to protocol, however only 43 (38%) pathology reports specified stage by American Joint Committee on Cancer (AJCC) guidelines. SLNB was performed concurrently with lumpectomy in 67 (59%) cases, and with mastectomy in 42 (37%) cases. Five (4%) SLNB cases occurred at a second operation. Of the 16 patients with a positive SLNB, 14 (87.5%) underwent completion ALND; 1 refused further treatment. Of the 5 patients with no SLNs identified, 4 (80%) underwent immediate ALND. No "ineligible" patients underwent a SLNB.

Nine of 11 previously developed QIs for SLNB were feasible to abstract from patient charts. Use of these QIs can serve to provide baseline measures and ongoing assessment of quality for SLNB.

43

A 5-YEAR RETROSPECTIVE COHORT STUDY OF BLUNT AORTIC INJURY IN THE BRITISH COLUMBIA TRAUMA SYSTEM. *N. Robbins, N. Bell, P. Brasher, A. Williams, J. Cooper, D.C. Evans.* Department of Surgery, Vancouver General Hospital, University of British Columbia, Vancouver, BC.

Blunt aortic injury (BAI) is considered a time-critical injury mandating rapid transfer to definitive quaternary-level care. In British Columbia (BC), the Vancouver General Hospital (VGH) is the principal referral centre for BAI within a provincial trauma system serving 4.4 million people. We sought confirmation that BAI patients transported rapidly to definitive care would have improved survival.

This was a retrospective, observational cohort of all patients with a BAI diagnosis captured by the VGH Trauma Registry from January 1, 2001, to December 31, 2006. Data retrieved included patient demographics, transfer details, injury severity scores, treatment and outcomes (hospital mortality and length of stay). Prehospital data provided time and location of injury. Transfer times and distances to initial and definitive care were calculated and mapped using geographic information system (GIS) analysis.

Fifty-two BAI patients were treated between 2001 and 2006. Seventy-three percent were male with a mean age of 42 years. Fifty-two percent were direct transfers from the scene and 48% were treated first at another hospital. Overall mortality was 44%, and mortality for direct and indirect transfers was 72% and 18%, respectively. The mean transfer time and distance from scene to VGH was 9.8 hours/227.5 km for

survivors and 2.0 hours/42.8 km for nonsurvivors. Among nonsurvivors, 77% had no attempt at repair, 18% underwent endovascular aortic replacement (EVAR) and 4% had open repair. Of survivors, 52% were treated with EVAR, 31% had open repair and 7% were managed expectantly.

Although patients diagnosed with BAI but not transferred to VGH were not studied, we believe these to be few. Survival following BAI was not shown to correlate with distance or time to definitive care in a large provincial trauma system. BAI presenting directly to a quaternary centre offering definitive care still resulted in death in more than two-thirds of cases.

44

A SINGLE-CENTRE EXPERIENCE OF DIAGNOSTIC LAPAROSCOPY FOR INTRA-ABDOMINAL LYMPHADENOPATHY. *S. Wiebe, D. Klassen.* Queen Elizabeth II Health Sciences Centre, Halifax, NS.

Laparoscopic biopsy represents an alternative to open laparotomy in patients with significant neoplastic or infectious diseases presenting with intra-abdominal lymphadenopathy in the absence of peripheral lymphadenopathy. The goal of this study was to evaluate the safety and diagnostic effectiveness of laparoscopic lymph node biopsy.

A retrospective review of 15 consecutive laparoscopies between February 2004 and March 2008 for computed tomography (CT)-detected intra-abdominal lymphadenopathy was conducted.

There were no procedure-related mortalities and no major morbidities. Conversion to laparotomy was required in a single case for intolerance of pneumoperitoneum. A diagnosis was established in all cases: 1 Hodgkin lymphoma, 9 non-Hodgkin lymphomas, 2 adenocarcinomas, 1 benign lymphadenopathy, 1 case of *Bartonella* infection and 1 case of previously undiagnosed cirrhosis with regenerative liver nodules. The average operative time was 75 (range 30–180) minutes. Four cases were performed in patients with previous intra-abdominal surgeries with an average operative time of 61 minutes. The majority of cases were performed in an outpatient setting.

Laparoscopic lymph node biopsy is a safe and effective diagnostic procedure for investigation of intra-abdominal lymphadenopathy. In our series, there was no increase in morbidity or operative time in patients with prior abdominal surgeries.

45

THE GENERAL SURGERY ROTATION FOR FAMILY MEDICINE RESIDENTS IN ONTARIO — THE IMPACT, BARRIERS AND LESSONS LEARNED. *T.K. Asano, C.J. MacDonald, F. Balaa, R.P. Boushey, E.C. Poulin, J. Mamazza.* Department of Surgery, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.

The purpose of this study was to examine the status, perceived value and potential for improvement of the general surgery curriculum for family medicine residents in Ontario.

Both qualitative and quantitative methodologies were used to examine individual, interpersonal and organizational barriers and facilitators at 4 academic centres during the 2007–2008 academic year. Self-administered questionnaires

were distributed to current family medicine (FM) residents ($n = 396$) and recent FM graduates ($n = 167$). Semistructured interviews of general surgery and FM educators and residents were conducted ($n = 25$). Qualitative data were analyzed using a modification of the grounded theory. Quantitative data were reported as summary statistics and univariate analyses.

Sixty-one percent of the current FM residents believed that a general surgery rotation should be mandatory during their residency training. However, for those that had completed a general surgery rotation, only 24% agreed that the tasks undertaken during the rotation enabled them to meet their educational needs. The interviews revealed broad consensus that gaining general surgical knowledge and skills were important for family medicine residents. However, there was less agreement about the setting and structure for implementing an effective surgical training experience. This study explored the challenges that have arisen from competing priorities, cultural differences between the 2 clinical disciplines, lack of proactive educational planning and the belief in the merits of expert versus nonexpert preceptorship for the acquisition of surgical knowledge and skills.

Recommendations are made with a view to overcoming the current challenges and move toward implementing an effective general surgery curriculum for family medicine residents in Ontario.

46

ASSESSING THE IMPACT OF A 2-DAY LAPAROSCOPIC INTESTINAL WORKSHOP. *T.K. Asano, C. Soto, E.C. Poulin, J. Mamazza, R.P. Boushey.* Department of Surgery, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.

The purpose of this study was to determine the impact of a comprehensive laparoscopic intestinal workshop for the adoption of laparoscopic colonic surgery.

A 2-day laparoscopic intestinal surgery workshop included interactive discussions during a live laparoscopic colon resection, didactic teaching, video clips and supervised hands-on practice of numerous laparoscopic colon resections on a cadaveric model. Participants ($n = 45$) completed a pre-, post- and 6-months-postcourse questionnaire.

The participants had been in practice for a mean of 11.0 (standard deviation [SD] 9.0) years. Fifty percent had learned laparoscopy during residency and 56% were already performing laparoscopic colectomies as part of their practice. In contrast, 32% of the participants felt unprepared to attempt a laparoscopic colectomy, however, immediately after the workshop only 7% continued to feel unprepared. Six months after the intestinal workshop, 53% of the surgeons that were not performing laparoscopic colectomies before the workshop had subsequently performed at least 1. Of these surgeons, 62% had a surgical preceptor for their case(s). Reasons cited for not performing a laparoscopic colectomy since the workshop included the lack of a surgical preceptor, inadequate local instrumentation and a perceived inadequate surgical skill set.

A comprehensive laparoscopic intestinal workshop contributed to the perceived acquisition of advanced laparoscopic surgical skills. Local laparoscopic preceptorship was an important adjunct to the workshop for the incorporation of laparoscopic colorectal surgery into practice.

47

AN ECONOMIC EVALUATION OF ABDOMINAL COMPUTED TOMOGRAPHY IN THE ASSESSMENT OF PATIENTS WITH SUSPECTED APPENDICITIS. *S.S. Brar, S.J. Heitman, E. Dixon, B.J. Manns.* Departments of Surgery, Medicine and Community Health Sciences, University of Calgary, Calgary, Alta.

A decision analytic model was created to model the effectiveness and cost-effectiveness of computed tomography (CT) scanning in the assessment of suspected appendicitis. Three strategies were assessed in this evaluation: 1) "clinical assessment alone" without use of CT scans; 2) "selective CT" where scans were done for patients with equivocal clinical presentations; and 3) "mandatory CT strategy" where all patients with suspected appendicitis underwent a CT scan. Effect was defined in our analysis as the accuracy of diagnosis. The cost and rate of negative appendectomy were secondary outcomes. The perspective of this analysis was the publicly funded health care system.

Probability estimates for our model were derived from a systematic review of the literature. Costs were calculated from local administrative data when available. Given our perspective, only direct costs were included in our analysis. Model validity was assessed by comparison with a patient cohort from the Calgary Health Region using administrative data. Sensitivity analysis and scenario analysis were performed to test the robustness of our model.

In the base case analysis, clinical assessment alone was the least effective (accuracy 87.5%) and the most costly strategy. The mandatory and selective CT strategies had identical effectiveness (92.8% and 93%, respectively). Negative appendectomy rates showed a similar ranking, with a 13.4% rate for clinical assessment alone, a 5.6% rate for selective CT and a 3.8% rate for the mandatory CT strategy. The mean cost of managing patients with suspected appendicitis was \$3381.30, \$3114.30 and \$3368.50 for patients with clinical examination only, selective CT and mandatory CT strategies, respectively. Therefore, in the base-case analysis, the selective CT strategy appeared optimal. In sensitivity and scenario analysis, the model was sensitive to the prevalence of appendicitis and the proportion of patients with atypical presentations of appendicitis. The model was not sensitive to cost variables.

48

THE YIELD OF ENDOSCOPIC RETROGRADE CHOLANGIOGRAPHY AFTER CHOLECYSTECTOMY FOR GALLSTONE PANCREATITIS: A POPULATION BASED STUDY. *P.M. Johnson, M.J. Walsh.* Division of General Surgery, Dalhousie University, Halifax, NS.

Endoscopic retrograde cholangiography (ERCP) may be used in patients after cholecystectomy for gallstone pancreatitis based on intraoperative cholangiogram findings or recurrent symptoms. Previous data have suggested that many common bile duct stones pass spontaneously in this patient population. The purpose of this study was to determine the yield of ERCP after cholecystectomy for gallstone pancreatitis

All patients who were admitted to hospital from 1997 to 2001 in Nova Scotia with pancreatitis who underwent cholecystectomy during the same admission were identified from the physician billings and hospital discharge databases. Patients who

underwent postoperative ERCP were identified and the type of procedure (therapeutic v. nontherapeutic) was determined. Patients who had preoperative ERCP or common bile duct exploration at the time of surgery were excluded. All patients were followed for at least 1 year after cholecystectomy.

Three-hundred and sixteen patients underwent cholecystectomy for gallstone pancreatitis. During follow-up, 32 of 316 (10%) patients developed recurrent biliary complications including pancreatitis (97%) and cholangitis (3%). Thirty-nine patients (12.3%) underwent ERCP which involved sphincterotomy in 41%, basket extraction in 13%, stent placement in 8% and no therapeutic intervention in 38%.

More than one-third of patients who have ERCP after cholecystectomy for gallstone pancreatitis do not undergo therapeutic intervention. Given the risks associated with ERCP, further research is needed to accurately identify patients who will benefit most from this procedure.

49

PREDICTION OF LAPAROSCOPIC PERFORMANCE BASED ON SIMULATOR ASSESSMENT. *G. Sroka, L.S. Feldman, J. Cao, P. Kaneva, G.M. Fried.* Steinberg-Bernstein Centre for Minimally Invasive Surgery, McGill University Health Centre, Montréal, Que.

Laparoscopic simulators can be used for assessment with the goal of predicting performance in the operating room. We have previously shown that Fundamentals of Laparoscopic Surgery (FLS) simulator metrics are predictive of intraoperative performance, as measured by GOALS (a validated global rating scale). We investigated whether motion analysis metrics add to FLS simulator score in the prediction of GOALS scores. Seventeen surgeons (12 novice [PGY 1–3] and 5 experienced [PGY 4+]) performed the 5 FLS tasks plus a cannulation task in the Pro-MIS simulator. The FLS tasks were scored for time and precision, and ProMIS generated motion analysis metrics (instrument smoothness and path length). Each subject was also assessed intraoperatively using GOALS during dissection of the gallbladder from the liver bed as part of elective laparoscopic cholecystectomy. Multivariate regression analysis was used to assess the independent contributions of surgical experience, FLS scores and motion analysis metrics to the prediction of intraoperative GOALS score. Statistically significance was set at $p < 0.05$. Both FLS score ($p < 0.0001$) and surgical experience ($p < 0.0001$) were independent predictors of the GOALS score. When experience level is known, instrument path length ($p = 0.28$) and instrument smoothness ($p = 0.08$) are not independent predictors of the GOALS score. This study confirms that FLS simulator score and surgical experience independently predict performance of dissection of the gallbladder from the liver bed. Measurement of motion analysis is expensive and cumbersome and does not add further information to the prediction of intraoperative technical skill.

50

IMPACT OF HIGH DEFINITION IMAGING ON PERFORMANCE OF SIMULATED LAPAROSCOPIC TASKS. *G. Sroka, L.S. Feldman, R. Fayez, P. Kaneva, J. Cao, D. Stanbridge, G.M. Fried.* Steinberg-Bernstein Centre for Minimally Invasive

Surgery, McGill University Health Centre, Montréal, Que.

The availability of a high definition (HD) laparoscopic camera improves image quality, however, whether this translates into improved performance compared with a standard camera (SD) is not known. The aim of this study was to assess whether an HD system impacts performance in a laparoscopic simulator.

Part 1: Twenty-four medical students were randomly assigned to perform simulated laparoscopic tasks with either a standard camera (Karl Storz, 720 × 480 pixels, 4:3 screen) or an HD camera (Karl Storz, Image 1 full HD 1920 × 1080 pixels, 16:9 screen). Tasks included peg transfer, cannulation and needle positioning, and were scored for time and errors. Each task was repeated 10–13 times (mean 10.6) until no further improvement was recorded. The slope (for the first 5 trials) and plateau (potential) of the learning curves were estimated using linear regression. These values were compared between the HD and SD groups using unpaired t test. Part 2: Six experienced and 6 inexperienced surgeons performed 5 FLS tasks using HD and SD cameras in random order. Tasks were scored for time and precision. Results were compared by using paired t tests. Statistical significance was set at $p < 0.05$. Part 1: The learning curves were virtually identical with HD or SD imaging for all tasks. Part 2: Total FLS score was significantly higher with the HD versus the SD camera systems (79.6, standard deviation 14 v. 75.3, standard deviation 15; $p = 0.02$). Extracorporeal suturing (95, standard deviation 16 v. 86, standard deviation 20; $p = 0.005$) and cutting (68, standard deviation 13 v. 63, standard deviation 13; $p = 0.02$) were better using the HD camera. This study shows that imaging quality plays no significant role in the learning curve of naïve surgeons. In contrast, HD imaging results in small but significant improvements in performance for more experienced surgeons. Further study is justified to define the specific benefits of the system in different experience levels and in different complexities of laparoscopic tasks.

51

STAGED SURGICAL RECONSTRUCTION FOR ACUTE GASTRIC NECROSIS WITH PERFORATION — A CASE REPORT AND REVIEW. *H. Cheah, A. Kwan, C. Mann.* Department of Surgery, Memorial University of Newfoundland, St. John's, NL.

Acute gastric necrosis is a rare event with a reported mortality rate of 80% despite treatment. We present the case of a 43-year-old woman of normal weight with acute gastric distension following an episode of binge eating. Computed tomographic (CT) examination demonstrated a massively dilated stomach with gastric wall pneumatosis and free intra-abdominal air in keeping with the diagnosis of acute gastric necrosis and perforation.

A successful outcome was attained following a staged surgical procedure. Initial management was an emergent total gastrectomy without reconstruction due to extensive contamination and a tenuous blood supply. A pharyngostomy tube and J tube allowed her to be maintained on enteral tube feeds until a complex staged reconstruction could be performed following a 6-month interval. At that time a Roux-en-Y esophagojejunostomy through a thoracoabdominal approach was performed. The patient returned home following surgery with a return to her baseline function.

52

EARLY OXIDANT-INDUCED AKT PHOSPHORYLATION AND SRC KINASE ACTIVATION IN MACROPHAGES IS MEDIATED BY ACID SPHINGOMYELINASE. *P.S. Tawadros, M. Ailenberg, M. Cantos, K. Szaszi, A. Kapus, J.C. Marshall, O.D. Rotstein.* St. Michael's Hospital, University of Toronto, Toronto, Ont.

We have previously reported that oxidative stress contributes to priming of macrophages for increased lipopolysaccharide (LPS) responsiveness through Src-dependent activation of the PI3 kinase/Akt pathway (*J Biol Chem* 2003;278:47834-41). Recent studies have implicated the lipid ceramide, generated from sphingomyelin via acid sphingomyelinase (ASM), as an important upstream regulator of signaling in inflammation. Other recent reports have suggested that lipid mediators such as ceramide can activate Src kinases. Taken together, we hypothesized that lipid metabolites generated through the ASM pathway may play an important role in oxidant-induced activation of Akt and Src kinase in macrophages.

RAW 264.7 macrophages were transfected in vitro with an ASM siRNA from Santa Cruz using Lipofectamine. A scrambled negative siRNA from Ambion was used as control. After 24 hours of transfection, cells were treated with 300 μ M hydrogen peroxide (H_2O_2) for 0–15 minutes. Western blot analysis was performed with a phospho-Akt antibody (Ser 473) and a phospho-Src family antibody (Tyr 416). Changes were assessed by densitometry.

Molecular inhibition of ASM by siRNA was verified by polymerase chain reaction (PCR) analysis of ASM mRNA levels compared with control housekeeping gene mRNA levels. Optimal knockdown conditions were found to be 40 pmol of ASM siRNA for 24 hours. In the ASM knockdown group, H_2O_2 -induced phosphorylation of Akt was reduced by over 95% at 5 minutes and 75% at 15 minutes, compared with control. As well, H_2O_2 -induced activation of Src kinase was reduced by over 95% at 5 minutes compared with control. These results support a role for ASM in generating early lipid mediators of oxidant priming in macrophages.

Oxidant-induced activation of Akt and Src kinase is mediated in part by the ASM pathway. ASM and its lipid products may therefore represent upstream targets for modulating oxidant-induced cellular priming.

53

THE FEASIBILITY AND IMPACT OF A 3-DAY SURGICAL SIMULATION COURSE IN AFRICA. *A. Okrainec, L. Smith, G. Azzie.* Department of Surgery, University Health Network, University of Toronto, Toronto, Ont.

Although simulation is now considered important for learning technical skills, there is very little literature assessing the use of simulation in resource restricted countries. The purpose of this study was to determine the feasibility and impact of a 3-day Fundamentals of Laparoscopic Surgery (FLS) course in Botswana, Africa.

A total of 20 surgeons and trainees participated in a 3-day FLS course. A pretest FLS score was obtained for each subject, followed by 2 days of practice with feedback. A final FLS post-test score was then obtained. Participants also watched the FLS instructional CD-ROM and took the written test on day 3.

Mean post-test scores were significantly higher than pretest scores for each task (Table 1) and for the total FLS simulator score (26, standard deviation [SD] 19 v. 57, SD 19; $p < 0.001$). The mean score on the written test was 242 (SD 116). In total, only 2 surgeons had a combined simulator and written test score required to obtain FLS certification.

Table 1, abstract 53. Test scores before and after a 3-day FLS course in Botswana, Africa

Performance	Test: mean score (and SD)		<i>p</i> value
	Pre-test	Post-test	
Peg transfer	34 (29)	65 (25)	< 0.001
Pattern cutting	14 (17)	49 (20)	< 0.001
Endoloop	26 (22)	49 (32)	< 0.001
Extraorporeal	30 (33)	68 (26)	< 0.005
Intracorporeal	27 (29)	55 (28)	< 0.005

FLS = Fundamentals of Laparoscopic Surgery; SD = standard deviation.

To our knowledge, this is the first time the FLS program has been taught in Africa. We have shown that giving the FLS course in a resource restricted country is feasible and resulted in a dramatic improvement in FLS-simulator performance after 3 days. However, most surgeons still did not reach FLS passing scores, indicating that more than 3 days will be required in future courses to help surgeons obtain FLS certification.

54

TELESIMULATION: A NOVEL METHOD OF TEACHING SURGICAL SKILLS IN RESOURCE RESTRICTED COUNTRIES. *A. Okrainec, O. Henao, G. Azzie.* Department of Surgery, University of Toronto, Toronto, Ont.

Telesimulation (TS) is a novel concept that uses the internet to link simulators between instructors and trainees in different locations. The objective of this study was to determine if telesimulation could be used to teach the Fundamentals of Laparoscopic Surgery (FLS) course from Canada to Botswana, Africa.

Pretest FLS scores were obtained for each surgeon during a first visit to Botswana. For the TS, 1 FLS box was located in Toronto, Canada, and 1 in Gaborone, Botswana. The set-up was identical at each site: the FLS camera was connected to a television with an S-video cable and to a laptop with a USB cable, allowing the FLS camera to be used as a webcam. A second webcam was used to display an external image of each person on the FLS. Skype software was used to establish a video connection between both FLS cameras and the exterior webcams. The instructor and the trainee could speak to each other and see themselves and each other's FLS boxes in real time.

A total of 10 TS sessions were held between 9 surgeons in Botswana and 2 FLS instructors in Toronto. Instructors could teach, demonstrate and provide feedback on all 5 FLS tasks performed by surgeons in Botswana. Preliminary data suggest that all FLS tasks could be scored accurately from Canada and that trainees improved over the course of the study.

Telesimulation is a novel, practical and inexpensive method for teaching FLS in Africa which can be applied anywhere in the world with internet access. Final data with post-test FLS scores will be obtained on a future trip to Africa to determine

if telesimulation is an effective method for teaching and certification of FLS.

55

DOUBLE BALLOON ENTEROSCOPY FOR SMALL INTESTINAL DISEASES: A SYSTEMATIC REVIEW OF EVIDENCE PUBLISHED IN EARLY 2007. *F. Moustarah.* Edmonton, Alta.

Double balloon enteroscopy (DBE) is a novel technology for endoscopically assessing and treating suspected or confirmed small bowel pathology. Since its early introduction in Asia in 2001, DBE has been disseminated to Europe, but its adoption in North America has only been recent. Strong evidence for the efficacy of DBE in treating small bowel conditions is lacking.

A systematic review of the evidence published in the first quarter of 2007 was carried out to evaluate the role of DBE in diagnosing and treating small bowel abnormalities and to review its safety profile. A systematic search for evidence was conducted using a broad search strategy to survey the major electronic databases as well as the grey literature.

Studies meeting predetermined inclusion criteria were reviewed. Data were extracted and analyzed by the author. Studies were graded according to the Oxford criteria for medical evidence. There were no systematic reviews, randomized controlled trials or controlled observational studies identified for inclusion. Out of 392 unique titles resulting from the search, 34 were published in 2007, of which 22 (11 case series and 11 case reports) were included for the review. This represents a total sample of 1211 patients undergoing DBE with only 5% being in North America.

The indications for DBE varied, with the most common being obscure gastrointestinal bleeding (OGIB); patient age ranged from 12 to 89 years. The diagnostic yield ranged from 41% to 100%, with the calculated yield being 77.9% in patients with OGIB. The therapeutic impact of DBE ranged from 65% to 84% in reported series. Interventional endoscopic therapy was possible in up to 78% of patients. DBE associated severe adverse events were rare. There appears to be a role for DBE in managing patients with small bowel pathology and better selecting those who are candidates for laparotomy with intra-operative enteroscopy.

56

TOWARD OBJECTIVE EVALUATION OF COSMETIC OUTCOMES OF BREAST-CONSERVING SURGERY — VALIDATION OF A NEW SOFTWARE PROGRAM IN COMPARISON TO A PANEL SCORE. *F. Ali, S. Latosinsky, M. Cheang.* Department of Surgery, Health Sciences Centre, University of Manitoba, Winnipeg, Man.

Until recently, there has been no completely objective way to evaluate cosmesis post-breast-conserving surgery (BCS). This study aims to compare and validate a new software program that evaluates cosmesis based on calculation of breast asymmetry, scar visibility and colour difference versus a panel of 3 evaluators. A 3-panel score has recently been shown to be the most reliable method of cosmetic evaluation of BCS.

Using a cohort of 99 women > 2 years post-BCS with radiotherapy, photographs were taken under standard conditions in the anteroposterior view. Both the panel and software

employed the previously validated 4 point Danoff cosmetic scale for each patient, thus allowing for direct comparison. A weighted kappa statistic and Kendall coefficient was used to compare Danoff scores between the software and 3 randomly chosen evaluators (1 nurse and 2 surgeons) from the previous trial.

Ninety-five women were evaluated; 4 were rejected as they were incompatible with the software. The software had a weighted kappa of 0.47 (95% confidence interval 0.34–0.59) as compared with the randomly chosen panel of 3. This represents moderate correlation. The Kendall coefficient was 0.54 (0 = no agreement, 1 = complete agreement).

As per the kappa and Kendall values, the software correlated moderately to the panel score. This correlates well to a previous validation study of this software versus an international expert panel. The moderate correlation also compares favourably to interrater reliability from studies measuring subjective evaluations only; these studies have shown only fair to moderate reproducibility between evaluators. They also depend on experience of evaluators. The software shows promise in allowing surgeons to evaluate their cosmetic outcomes rapidly, reliably and objectively, and may perhaps render subjective methods unnecessary.

57

A NEW URGENT SURGERY SERVICE AT A TEACHING HOSPITAL — IMPACT ON WAITING TIMES AND PATIENT CARE. *M. Segedi, M. Hameed, A. Buczkowski, C.J. Brown, D.C. Evans, O.N.M. Panton.* Department of Surgery, University of British Columbia, Vancouver General Hospital, Health Sciences Centre, Vancouver, BC.

We studied the impact of a new Urgent Surgery Care (USC) service at a tertiary hospital on surgical waiting times and patient outcomes.

Adult patients admitted from the emergency department at Vancouver General Hospital under the care of one of the general surgeons from July 1, 2006, to December 31, 2007, were identified from the Quality Utilization Information Support Team (QUIST) database. A retrospective cohort study using univariate and multivariate analyses was performed to compare patient outcomes over 3 consecutive 6-month periods: Traditional (pre-USC), Interim (surgeon-centred model) and USC (team-based model). Exclusion criteria included a delay to surgery of greater than 48 hours and surgery related to trauma or genitourinary pathology.

Overall, 796 patients met study criteria. The groups were equivalent in size (Traditional $n = 262$; Interim $n = 275$; USC $n = 259$), sex distribution and age distribution (Traditional 53.6, standard deviation [SD] 20 y; Interim 52.9, SD 20 y; USC 53.6, SD 20 y). Length of stay was significantly lower in the USC group compared with the Traditional group (4.4, SD 5.5 d v. 6.5, SD 10.2 d; $p = 0.0075$). Regardless of the group, a small proportion of patients underwent surgery within the requested operating priority time (Traditional 19%; Interim 23%; USC 13%). Significantly fewer patients underwent surgery within the operating priority time in the USC cohort compared with other groups ($\chi^2 = 0.02$). Actual time to surgery did not differ between the groups (Traditional 16.8, SD 10.1 h; Interim 16.2, SD 10.2 h; USC 18.3, SD 10.8 h).

Patients cared for under the new USC model had similar

wait times for surgery but significantly shorter lengths of hospital stay. Timeliness of surgical intervention after surgical booking was low, with less than a quarter of patients undergoing surgery within the specified time priority.

This study describes our preliminary experience with an Urgent Surgery Care delivery model and potential impact on patient outcomes. Weaknesses identified will aid in creating a continuous surgical outcomes improvement system.

58

OPEN VERSUS STAPLED HEMORRHOIDECTOMY: A CASE CONTROL STUDY. *S.R. Cader, C. de Gara.* Department of Surgery, University of Alberta, Edmonton, Alta.

To compare outcomes of conventional open Milligan–Morgan hemorrhoidectomy with stapled hemorrhoidectomy for symptomatic hemorrhoids in 1 surgeon's practice, and to see if these outcomes agree with the literature, thus guiding future practice.

A list of all hemorrhoid surgical cases that Dr. de Gara performed between 1997 and 2006 was obtained. One-hundred and twelve cases were listed. Charts were excluded if the surgery was other than a hemorrhoidectomy, if the patient was on anticoagulation or if concomitant inflammatory bowel disease was present. Eighty-one charts met inclusion criteria and were analyzed for severity of hemorrhoids, preoperative symptoms, surgery performed and postoperative outcomes. As postoperative follow-up was generally not long enough to assess for long-term symptoms or recurrence, a random sample of patients in each of the conventional and stapled hemorrhoidectomy groups will be telephoned and interviewed to assess for long-term outcomes.

59

ESTIMATING THE INVASIVE PLACEBO EFFECT SIZE: THE ELEPHANT IN THE ROOM. *J. Boutros, M. Boutros, S.M. Hameed, A. Levy.* Division of General Surgery, Department of Surgery, Department of Healthcare and Epidemiology, University of British Columbia, Vancouver, BC, McGill University, Montréal, Que.

The choice of a control group in surgical trials is not simple, and the placebo control presents multiple issues. We aim to determine the circumstances in which a placebo control is methodologically appropriate in the assessment of surgical interventions and to estimate the placebo effect in this context.

The literature was surveyed, and studies fulfilling predetermined criteria were included. A pooled weighted average estimate of the placebo effect size was calculated, and a sensitivity analysis was performed.

Seven trials with an invasive placebo control were identified. The placebo effect size was extracted from each study, and the pooled weighted-average estimate of the placebo effect size of all the trials was 0.507. One trial, involving the invasive administration of medication, was overwhelmingly larger than the others, and the weighted-average estimate of the placebo effect size without this trial was 0.388. Advantages of including a placebo control included the ability to blind the patient and outcome assessors to treatment group allocation, and to estimate the placebo effect size, however, this in turn negatively affects generalizability. The placebo effect was

found to be most measurable when the primary outcome was a patient-reported continuous outcome.

Hence, the authors conclude that the use of an invasive placebo is most justifiable methodologically when the primary outcome is a patient-reported continuous outcome and when the expected treatment effect size is less than 40%.

60

THE DEVELOPMENT OF A TEMPLATE FOR HEALTH TECHNOLOGY ASSESSMENT OF SURGICAL PROCEDURES USING MIXED METHODS. *E. Dixon, I. You, G. Maddern, W. Ghali.* University of Calgary, Calgary, Alta.

To develop a template for health technology assessment (HTA) of surgical procedures.

Using a combination of investigative methods, we performed an HTA of hepatic resection for metastatic colorectal cancer (HRMCC). We used health services research methods and spatial epidemiology to describe 1) current rates of HRMCC and their change over the time period of interest, and 2) the outcomes following the application of the technology during the study period. We also used a consensus- and evidence-based methodology (Delphi process) to identify quality indicators of care for patients undergoing HRMCC. And finally we identified other gaps in knowledge regarding the optimal use of HRMCC and attempted to address them. Specifically, we wanted to know what effect surgeon training has on outcomes following HRMCC. The final component of this mixed method assessment is a health economics assessment of the technology (this has previously been studied and reported).

Using HRMCC as a case study of an existing surgical technology/technique, we used 4 linked studies to develop a template for HTA of surgical procedures. In the first 2 studies, we used administrative data from the Canadian Institute for Health Information (CIHI) to describe the rates, changes in these rates and regional variation over the past 10 years of HRMCC across Canada (Study A); in Study B, we looked at the outcomes (mortality) following HRMCC across the country over the same 10-year period while accounting for potential confounders and studying the effect of hospital volume. In study C, we used a Delphi process of international experts in different aspects of the care of patients with metastatic colorectal cancer to derive a list of 19 quality indicators for patients undergoing HRMCC. In Study D, we examined what effect surgeon training had on perioperative and long-term outcomes following HRMCC.

Using mixed methods, we have developed a template for the HTA of both new and existing surgical technologies.

61

BREAST CANCER SURGERY AND SAME-DAY DISCHARGE: A PROSPECTIVE QUALITY OF LIFE STUDY. *L. Bohacek, D. Pace.* Department of General Surgery, Memorial University, St. John's, NL.

Same-day discharge following breast cancer surgery has become a common practice. The goal of our study was to assess patients' qualitative experience and satisfaction with same-day discharge in St. John's, NL.

Fifty patients answered a quality of life questionnaire following breast surgery. This 2-part questionnaire was completed via telephone interview conducted at 2 and 6 weeks after discharge.

Of the 50 patients, 40 were discharged home the same day. Among the same-day discharge patients, the perceived Activities of Daily Living level (on a scale of 1–10) fell from 9.7 to 4.4 immediately following surgery, rising again to 7.6 after 2 weeks. The majority (80%) of these patients found their postoperative pain to be slightly bothersome at most, and 75.9% found their pain medications to be very effective. Seventy percent found the postoperative nausea was not bothersome, and 54.5% found the provided antiemetic medications were very effective. The majority of patients were able to think clearly and feel self-sufficient within the first 2 days of surgery. The average time to “full recovery” was 18.6 days, and the average time to return to work was 26 days. Twenty-five percent of same-day discharge patients did require a return visit to the emergency department following discharge (not significantly different from the patients who stayed overnight). Seventy-five percent of patients felt the same-day discharge either reduced or had no negative effect on their stress level. Seventy-two percent stated that if they were to have surgery again, they would prefer to be discharged home, and 68% stated that they were extremely satisfied with the surgery.

The majority of patients contacted provided positive feedback with respect to pain and nausea control, ability to return to normal function and overall satisfaction with the same-day discharge process.

166

THE STATUS OF MULTIDISCIPLINARY CANCER CONFERENCES IN ONTARIO. *F.C. Wright, R.S. McLeod, D. Urbach, D. Davis, N. Lookhong, A.R. Gagliardi.* Department of Surgery, University of Toronto, Toronto, Ont.

Cancer care is complex, and multimodal therapy is now considered standard of care. Multidisciplinary cancer conferences (MCC) offer a venue to regularly prospectively discuss patients with cancer, and there are strong indications that such discussion improves patient outcomes. In Ontario, before 2006, no guidelines or recommendations existed regarding MCCs, and little was known about their prevalence, form or function. This study represents the first description of MCCs in Ontario, Canada.

A survey was sent to 728 general surgeons in Ontario with 2 repeat mailings to explore the status of MCCs. In particular, surgeons were asked if their hospital had MCCs, how long they had been in existence, how often they were held, type of cases presented, regular participants, extent of organizational support and their perceived benefits. Significant differences among subgroups were examined statistically.

The response rate was 44.2% (170/385 eligible surgeons). Sixty-nine percent of respondents said their institution had MCCs (91% academic, 56% community). Seventy-eight percent of community hospitals had “general MCCs” where all types of cancer cases were discussed. MCCs at community hospitals occurred biweekly or monthly, but surgeons indicated they were most likely to attend monthly. MCCs at academic centres were most likely to be held weekly, and surgeons were most likely to attend weekly. Few MCCs had a designated coordinator. Surgeons perceived that MCCs helped them incorporate multidisciplinary opinions into their patient care plans, improved communication with colleagues and improved patient outcomes.

We have demonstrated that the majority of academic centres in Ontario have MCCs, that minimal administrative support exists and that they are perceived to improve communication between colleagues and patient outcomes. Further research is required to understand barriers and enablers to establishing and maintaining MCCs, especially in community practice.

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62

INHIBITION OF SELECTIN-SIALYL LEWIS X BINDING REDUCES INFLAMMATION FACILITATED LUNG CANCER CELL ADHERENCE TO HEPATIC SINUSOIDS. *J. Spicer, B. McDonald, J. Bernier, B. Giannias, P. Brodt, L.E. Ferri.* LD MacLean Surgical Research Laboratories, Division of Thoracic Surgery, McGill University, Montréal, Que.

Lung cancer is associated with poor long-term survival due to a high rate of metastases. There is emerging evidence that increased inflammation might increase the risk of cancer recurrence after resection. Given that selectins have been shown to impact cancer cell adhesion to endothelial cells (EC) in vitro, and that systemic inflammation is known to increase sinusoid EC E-selectin expression, we sought to investigate the influence of inflammation-mediated changes in selectin-sialyl Lewis X binding on the early stages of lung cancer metastasis.

C57BL/6 mice were prepared for hepatic intravital microscopy and injected with highly metastatic Lewis lung carcinoma cells (C10 + GFP) or nonmetastatic Lewis lung carcinoma (C36 + GFP) as a negative control. Both neutrophil (PMN) and cancer cell-EC interactions were quantified with direct in vivo visualization of hepatic microvasculature. In some mice, nonspecific selectin antagonist (fucoidin) or blocking mAb to E-selectin or its ligand sialyl Lewis X (sLex) was administered. To examine the impact of systemic inflammation on PMN and lung cancer cell migration, lipopolysaccharide (LPS) was injected intravenously with and without prior PMN depletion with antineutrophil serum (RB6-8C5). At least 5 mice/condition were prepared. Data are expressed as mean (and standard error of the mean [SEM]). The Mann-Whitney *U* test determined significance: **p* < 0.05, ***v.* C10 + LPS; ****v.* C10 + LPS + PMN depletion.

Compared with control C36, C10 had increased in vivo adherence to sinusoidal EC (mean cells/field of view: 1 [SEM 0.2] v. 13 [SEM 0.5]).* This increased adhesion (13 [SEM 0.5]) was attenuated by fucoidin (6.2 [SEM 0.4])* and blocking mAb to sLex (5.2 [SEM 0.2])* and E-selectin (8.4 [SEM 0.4]).* Systemic inflammation mediated by LPS IV increased neutrophil adherence in the hepatic sinusoidal capillaries 8-fold. This was associated with an increased C10 adherence to the liver, an effect that was limited by sLex blockade, fucoidin and neutrophil depletion (RB6-8C5) (see figure). Blockade of sLex in PMN-depleted mice further diminished C10 adhesion, implying a neutrophil-independent, selectin-mediated mode of cancer cell-EC adhesion.

Using a physiologically relevant in vivo model of the early steps of cancer metastasis, we have demonstrated that selectin-sLex-mediated binding increases the ability of lung cancer

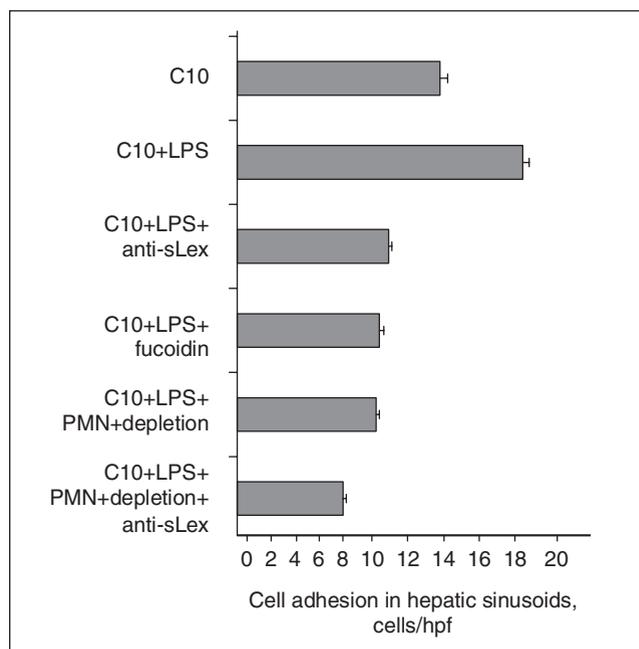


FIG. 1, abstract 62. Cell adhesion in sinusoids of mice administered metastatic Lewis lung carcinoma cells (C10), lipopolysaccharide (LPS), anti-sLex (sialyl Lewis X antibody), fucoidin and neutrophil (PMS), alone and in combination, with and without prior depletion.

cells to adhere to liver sinusoid endothelial cells and that systemic inflammation increases cancer cell adhesion by both neutrophil dependent and independent mechanisms. These data identify the cytokine inducible selectin-sLex axis as a potential target for the treatment of lung cancer.

63

SURGICAL MANAGEMENT OF PERICARDIAL EFFUSION: COMPARISON OF RESULTS IN PATIENTS WITH MALIGNANT AND NONMALIGNANT DISEASE. *O. Nguyen, D. Onellette.* Department of Surgery, Maisonneuve-Rosemont Hospital, University of Montreal, Montréal, Que.

The goal of this presentation is to compare the survival rates between patients with malignant and benign pericardial effusion treated surgically with a subxiphoid pericardial window.

We reviewed the chart of 65 patients between February 1994 and July 2007, all of them treated at a single institution with a subxiphoid pericardial window.

All 65 patients had a pericardial effusion confirmed by echocardiography. Forty-five of these patients had initial

drainage by pericardiocentesis. Among these 45 patients, a pericardial catheter was left in place in 35 patients. Among the patients who had cancer, the majority had lung cancer (69%). The overall complication rate was 26%. The overall 30-day mortality was 23%. It was, respectively, 27% and 7% for malignant pericardial effusion and benign pericardial effusion. The survival rates at 3 months, 6 months, 1 year and 2 years for patients with cancer were 47%, 29%, 20% and 10%, respectively. For noncancer patients, the survival rates at 3 months, 6 months, 1 year and 2 years were 93%, 93%, 86% and 86%, respectively. The median survival time for patients with cancer was 3 months and for patients without cancer was 84 months.

Patients with malignant disease had a worse survival rate than patients with nonmalignant disease. Among cancer patients, lung cancer patients fared worse. The subxiphoid pericardial window is a simple, safe and effective surgical procedure. However, the use of any surgical approach in patients with advanced malignant disease should be individualized, and the benefits and risks of surgery should be clearly explained to patients, their family and the referring physician.

64

MANAGEMENT AND OUTCOMES OF TRAUMATIC TRACHEAL INJURY. *W.C. Hanna, L.E. Ferri, T. Razek, D.S. Mulder.* Divisions of Thoracic Surgery and Trauma, McGill University Health Centre, Montréal, Que.

Traumatic tracheal injury (TTI) is a rare consequence of penetrating neck wounds and, as such, the optimal treatment is unclear. We sought to define the characteristics and management of this complicated condition.

A prospectively entered trauma registry from a busy level 1 centre was reviewed for all cases of TTI from 1993 and 2007. Data were collected on patient characteristics, patterns of injury, investigations, management and outcomes.

The incidence of TTI was 0.05%/year and resulted in 12 patients (all male). Stab wounds to the neck constituted 75% (9/12) of injuries. Associated injuries included esophagus (2/12), thyroid (3/12), carotid artery (2/12) and larynx (1/12). Presenting signs included subcutaneous emphysema (7/12), pneumothorax (4/12), air leak from wound (4/12) and pneumomediastinum (3/13). Ten patients underwent preoperative investigations: chest radiography (10/10), computed tomography (4/10) and bronchoscopy (2/10). All cases were managed operatively via cervical incision (10/12) or thoracotomy (2/12). The trachea was repaired primarily in 10 of 12 cases. Concomitant esophageal repair with a muscle flap was done in 2 cases. A muscle patch without primary repair was used in 1 case, and no repair was attempted in 1 of 12 cases. There were no mortalities, and median length of hospital stay was 8 (1–48) days.

This descriptive study demonstrates that for patients arriving alive to a level 1 trauma centre with a traumatic tracheal injury, proper and timely operative management provides excellent outcomes.

65

THE USE OF THORACOSCOPY TO IMPROVE MEDICAL STUDENTS' INTEREST AND UNDERSTANDING OF THORACIC ANATOMY: A PILOT STUDY. *S. Alnassar, J. Clifton, R.J. Finley, R. Sidhu.*

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The evolution of minimally invasive surgery (MIS) has a great potential for improving both health care and medical education. MIS thoracoscopy can be a useful teaching tool offering a link between clinical medicine and basic science. Our objective was to develop a video-based educational tool designed for learning thoracic anatomy and to examine whether this tool would increase students' stimulation and motivation for learning anatomy.

Our video-based tool was developed by recording different thoracoscopic procedures focusing on intraoperative live thoracic anatomy. The tool was then integrated into a pre-existing program for first year medical students ($n = 150$), and included cadaver dissection of the thorax and review of clinical problem scenarios of the respiratory system. Students were guided through a viewing of the videotape which demonstrated live anatomy of the thorax (15 min) and then asked to complete a 5-point Likert-type questionnaire assessing the video's usefulness.

Questionnaires were completed by 119 medical students. Most students were satisfied with the thoracoscopic video as a teaching tool (mean score 4.39, standard deviation [SD] 0.65) and thought that it increased their interest in learning (mean score 4.63, SD 0.58) and their understanding of thoracic anatomy (4.10, SD 0.89). The majority would like to see this new teaching tool implemented into the anatomy curriculum (mean score 4.60, SD 0.66). The video presentation also increased students' interest in surgery as a future career (mean score 4.19, SD 0.83).

Incorporating live surgery via thoracoscopic video presentation in the gross anatomy teaching curriculum had high acceptance and satisfaction scores from first year medical students. The video increased students' interest in learning, in clinically applying anatomic fact and in surgery as a future career. Future studies will include a randomized controlled trial to evaluate the objective gain in knowledge associated with this teaching tool.

66

THE EVALUATION OF THORACIC TRAUMA IN STABLE PATIENTS USING A ROBOTIC TELESURGICAL MODEL: A FEASIBILITY STUDY. *P.D. Bhatia, D. Bottoni, R.A. Malthaner.* Canadian Surgical Technologies & Advanced Robotics (CSTAR), Lawson Health Research Institute, Department of Surgery, Division of Thoracic Surgery, University of Western Ontario, London, Ont.

The feasibility of using a robotic telesurgical platform to manage thoracic trauma in stable patients was evaluated in an animal model.

Experiments were conducted on a total of 10 porcine hemithoraces (5 left and 5 right). Injuries (lung laceration, massive hemothorax, diaphragmatic laceration, aortic hematoma) were generated in a random, blinded fashion in the hemithorax using a minimally invasive technique. The da Vinci surgical telemanipulator (Intuitive Inc.) was used to evaluate and manage the injuries inflicted on each hemithorax. Primary outcomes were time to survey, number of injuries correctly identified and

time to successfully repair each injury. Secondary outcomes included number of iatrogenic injuries incurred, subjective evaluation of the process by the operating surgeon and mortality of the animal at the end of the experiment.

Ninety-five percent of injuries (19/20) were correctly identified. The median survey time was 20.5 (range 17–68) minutes. A significant learning curve was demonstrated with survey times. The mean time to repair lung lacerations was 19.8 (range 11.5–30.5) minutes. The mean evacuation time for hemothoraces was 5.25 (range 3–6.5) minutes. Diaphragmatic lacerations were initially difficult to access and repair and required repositioning of the ports and the robot. Only 2 out of 5 lacerations successfully repaired (mean time to repair 38.8, range 37–40.5 minutes). Aortic injuries were identified but not repaired. One subject (10%) died of respiratory failure due to a pre-existing pneumonia.

A robotic telesurgical approach to the evaluation of stable thoracic trauma patients is safe and feasible in a porcine model. Diaphragmatic injuries can be repaired but require repositioning of the robot. Further advances in flexible instruments and less bulky robotic platforms may make this concept applicable to human patients in the future.

67

ROLE OF INTRAPLEURAL TISSUE PLASMINOGEN ACTIVATOR AND STREPTOKINASE IN MANAGEMENT OF COMPLICATED PLEURAL EFFUSIONS. *S. Alghamdi, D. AlShehab, G.P. Giraldo, R.S. Sundaresan, D.E. Mazziak, F.M. Shamji, A.J.E. Seely.* Department of Thoracic Surgery, The Ottawa Hospital, Ottawa, Ont.

Intrapleural fibrinolysis remains a controversial therapy for complicated pleural effusions. Our aim was to evaluate safety and efficacy of intrapleural fibrinolysis in a single institution experience.

Over a 3-year period (2004–2007), 61 consecutive patients (age 18–88 years; 46 [75%] male, 15 [25%] female) received intrapleural fibrinolysis for complicated pleural effusions related to infection ($n = 44$ secondary to bacterial pneumonia: 37 tuberculosis, 1 postoperative, 5 post-trauma, 1 infection), malignancy ($n = 8$: 4 lung cancer, 4 other malignancies), hemothorax all related to blunt trauma ($n = 3$) and unknown etiology ($n = 6$). Indications for intrapleural fibrinolysis were persistent radiological evidence of loculations after failing drainage by tube thoracostomy, and included intrapleural tissue plasminogen activator (TPA; $n = 39$, 64%) or streptokinase ($n = 22$, 36%) as a daily dose of 16 mg and 250 000 units in 100 mL normal saline via pleural tube, respectively. Patients were treated for 1–6 days (mean 3, standard deviation [SD] 1.4); 13 patients (21%) received 2 cycles (6 d) of fibrinolytics. Once clinical and radiological reevaluation confirmed minimal drainage (< 150 mL/24 h), and resolving empyema and effusion, the chest tube or pigtail was removed. Failure of treatment (i.e., inadequate lung re-expansion) or clinical deterioration (i.e., sepsis syndrome) mandated surgical intervention.

Following intrapleural fibrinolysis, clinical improvement occurred in 47 patients (77%) and failure requiring surgery in 14 patients (23%): 12 (86%) thoracotomy, decortication and 2 (14%) thoracoscopic pleural drainage. The mean length of stay was 11 (SD 8) days. No significant differences were noted

between streptokinase and TPA regarding fluid drained or hospital length of stay. One patient on anticoagulants experienced a complication from bleeding. There was 1 mortality (1.6%) from multiple organ failure secondary to refractory pseudomonas pneumonia 4 months postintrapleural streptokinase.

Intrapleural administration of tissue plasminogen activator or streptokinase is an effective and safe mode of treatment for complicated pleural effusions and may decrease the need for operative intervention.

68

VATS LOBECTOMY IS ASSOCIATED WITH IMPROVED SHORT-TERM OUTCOMES COMPARED WITH THE OPEN APPROACH. *W. Saleh, C. Robineau, L.S. Feldman, C. Sirois, D.S. Mulder, L.E. Ferri.* Divisions of Thoracic and General Surgery, McGill University, Montréal, Que.

Barriers to widespread adoption of minimally invasive approaches to pulmonary lobectomy include a lack of data documenting superiority to the conventional open approach. We thus examined our early experience of video-assisted thoracoscopic surgical (VATS) lobectomy and compared the short-term outcomes of this procedure to open lobectomies performed during the same time period.

All patients undergoing lobectomy at a single institution from January 2006 to December 2007 were identified from a prospective database. In order to reduce selection bias, patients undergoing VATS lobectomy were compared with open lobectomy patients who were potentially VATS operable (e.g., $t < 4$ cm, noncentral). Patient characteristics, operative variables and postoperative outcomes were compared between the 2 study groups. Data are expressed as median (range) or mean (standard deviation [SD]). The Mann–Whitney U test and the Fisher exact test determined significance ($p < 0.05$). Multivariate analysis identified significant predictors of length of stay (LOS).

Of 124 patients undergoing lobectomy, 35 were excluded (reason = $t > 4$ cm, bilobectomy, sleeve/chest wall resection or hilar nodal disease) leaving in 69 open (O) and 20 VATS (V). There was no difference in age (V = 69 [35–82] y v. O = 66.5 [25–84] y), sex (V = 57% male v. O = 55% male), American Society of Anesthesiologists (ASA) grade > 2 (V = 3/20 v. O = 15/69), predicted FEV₁ (V = 87% [SD 15%] v. O = 88% [SD 17%]) or size of tumour (V = 2 [0.5–3.5] cm v. O = 2.3 [0.5–4] cm). Surgical time (V = 162 [SD 48] min v. O = 122 [SD 44] min),* but not total operating room time (V = 230 [SD 67] min v. O = 198 [SD 59] min), was higher in VATS. A trend for reduced prolonged air leak (V = 0/20 v. O = 9/69, $p = 0.08$), all pulmonary complications (V = 1/20 v. 14/69, $p = 0.09$) and all complications (V = 2/20 v. O = 20/69, $p = 0.06$) was seen with VATS. VATS was associated with shorter duration of chest tube drainage (V = 1.5 [1–6] d v. O = 6 [2–30] d)* and LOS (V = 2.5 [1–7] d v. O = 6 [3–50] d).* Linear regression identified tumour size ($p = 0.01$) and operative approach ($p = 0.04$) as independent predictors of LOS.

VATS lobectomy is safe for resection of early lung cancer and compares favourably to open lobectomy with respect to short-term postoperative outcomes. Prospective studies to compare the long-term outcome between the 2 approaches are needed.

69

TRACHEAL AND LARYNGOTRACHEAL RESECTIONS: A SINGLE INSTITUTIONAL 18-YEAR EXPERIENCE. *S. Al-Mutairy, H. Unruh, L. Tan, P. Kerr.* Departments of Surgery and Otolaryngology, University of Manitoba, Winnipeg, Man.

Tracheal resections are uncommon in most surgical practices. Our present understanding of the principles of tracheal surgery owes much to the efforts Dr. Hermes C. Grillo and colleagues from Harvard Medical School and Dr. F. Griffith Pearson and colleagues from the University of Toronto. Beginning in 1995, we undertook a joint effort with the Department of Otolaryngology whereby all patients were operated on by a team that included both a thoracic surgeon and an otolaryngologist. Our approach has been to establish a widely patent airway with a temporary tracheotomy. If required, this included intralaryngeal resection of the stenosis. Nineteen patients had tracheal resection, 8 with postintubation stenosis (PIS), 8 with idiopathic subglottic stenosis (ISS) and 3 with primary tracheal tumours. Two patients in the PIS group required standard laryngotracheal resection and tracheostomy, while the rest were managed with simple tracheal resection and apposition. Six patients in the ISS group required laryngotracheal resection of whom 5 had intralaryngeal resection of the stenosis. This latter procedure was accomplished by elevation of the mucosa from the posterior plate of the cricoid after the anterior aspect of the ring had been resected. A high-speed burr was used to thin the plate to a thickness of about 1 mm, taking care to not perforate the plate. The elevated mucosa was thinned of the abnormal submucosal tissue, and with anastomosis the thinned posterior cricoid was covered with laryngeal mucosa. All had a temporary tracheotomy placed below the repair. Only 2 suprahyoid release manoeuvres were required, 1 each in the PIS and ISS groups. All patients were successfully decannulated, usually at 1 month following surgery. One patient had a stricture which was managed successfully by simple dilatation. No other airway complications, including recurrent nerve palsy, were observed.

70

THE ROLE OF ENDOBRONCHIAL ULTRASOUND (EBUS-TBNA) IN LYMPH NODE STAGING OF NON-SMALL-CELL LUNG CANCER. *M.F. Humer, W. Senner, A. Luoma, B. Nelems.* Interior Health Authority Thoracic Surgery Programme, Kelowna, BC.

This study was designed to define the role of endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) in staging non-small-cell lung cancer (NSCLC), comparing EBUS to mediastinoscopy. Between January 15, 2007, and January 15, 2008, 307 patients underwent EBUS, 198 with NSCLC.

Of 198 NSCLC patients, 182 had concurrent EBUS and mediastinoscopy nodal biopsies, 16 patients had EBUS only because of comorbidity, complexity. Of the 182 patients, within the zone reachable by both mediastinoscopy and EBUS, 156 patients had direct correlation: 119 mediastinoscopy and EBUS biopsies were both negative; in 37 cases they were both positive. Of the 26 cases without direct correlation, 14 were within the combined reachable zone:

5 mediastinoscopy cases were negative, EBUS-positive 'mediastinoscopy miss' and 9 EBUS cases were negative and mediastinoscopy-positive 'EBUS miss' false negatives. Twelve cases without direct correlation were in the EBUS extended zone not reachable by mediastinoscopy. In this extended zone, 8 EBUS cases were positive in the posterior subcarinal 7 position, mediastinoscopy being negative. This posterior subcarinal 7 biopsy is mediastinoscopy's traditional 'blind spot.' In the extended zone, 4 EBUS cases were positive in the interlobar 11 position.

Combining mediastinoscopy and EBUS is more accurate than either procedure alone. EBUS provides additional information in the extended nonmediastinoscopy zone of posterior subcarina and interlobar positions. We recommend EBUS to precede mediastinoscopy with large mediastinal nodes, followed by mediastinoscopy if EBUS negative. In potentially resectable cases with small mediastinal nodes on computed tomography, we recommend concurrent EBUS and mediastinoscopy, a new gold standard.

71

TRANSLYMPHATIC CHEMOTHERAPY FOR THE TREATMENT OF LYMPHATIC METASTASIS IN LUNG CANCER. *J. Liu, X.Y. Wu, M.R. Johnston.* Institute of Medical Science, Faculty of Medicine, Department of Pharmaceutical Science, Faculty of Pharmacy, University of Toronto, Toronto, Ont., Division of Thoracic Surgery, Dalhousie University, Halifax, NS.

We developed an implantable drug delivery system for the treatment of lymphatic metastasis in lung cancer. Biodegradable poly(lactide-co-glycolide) microspheres containing paclitaxel (PLGA-PTX) with drug loading of 7% (w/w) were formulated and then incorporated into a gelatin sponge matrix. The device is designed to be placed into the pleural space in proximity to the mediastinal lymphatics during lung cancer surgery. The system was characterized *in vitro*. Pharmacokinetics were studied in rats and compared with a similar dose of paclitaxel (Taxol, 8 mg/kg) given intravenously (iv) and intrapleurally (ipl). PTX concentrations in lymph nodes and plasma were determined by liquid chromatography mass spectrometry. The area under the concentration-time curve (AUC) was calculated. Therapeutic efficacy was assessed in a nude rat orthotopic lung cancer model with lung tumour resection 14 days after tumour implantation. Animals were treated intraoperatively with either intrapleural placement of PLGA-PTX sponge (100 mg/kg), placebo sponge or no treatment. Tumour recurrences were examined 32 days after implantation. *In vitro*, the PLGA-PTX gelatin sponge system exhibited controlled release properties. The microspheres were selectively taken up by pleural lymphatics and delivered to regional lymph nodes as the gelatin matrix disintegrated in the pleural cavity. Pharmacokinetic studies revealed a significantly higher AUC in mediastinal lymph nodes with ipl placement of the PLGA-PTX sponge as compared with iv or ipl administration of paclitaxel. This represents a 100- to 400-fold increase in lymphatic drug exposure as compared with iv dosing. Peak plasma concentration with the PLGA-PTX sponge was significantly less than iv drug administration. In the tumour-bearing rats, there was an 80% reduction in lymph node metastasis as compared with controls. Translymphatic targeted drug delivery reduces lymph

node metastasis in this preclinical lung cancer model. This effect may be attributed to the improved pharmacokinetic distribution of PTX to the mediastinal lymphatic system.

72

ROBOT-ASSISTED PALPATION IMPROVES MINIMALLY INVASIVE TUMOUR LOCALIZATION. *A.L. Trejos, J. Jayender, M.T. Perri, M.D. Naish, R.V. Patel and R.A. Malthaner.* Canadian Surgical Technologies & Advanced Robotics (CSTAR), Lawson Health Research Institute, Departments of Electrical and Computer Engineering and Mechanical and Materials Engineering, Division of Thoracic Surgery, University of Western Ontario, London, Ont.

Localizing hidden tumours during minimally invasive surgery (MIS) such as video-assisted thoracoscopic surgery (VATS) can be challenging. A tactile sensing instrument (TSI) that uses a commercially available sensor to measure distributed pressure profiles along the contacting surface was developed to facilitate remote tissue palpation and tumour localization. The objective of this research was to compare the performance of the minimally invasive robot-assisted TSI to human palpation for reliably locating hidden soft-tissue tumours.

Five- and 10-mm thermoplastic phantom tumours were randomly embedded in *ex vivo* bovine liver. The TSI was used to locate the tumours, guided by either a Mistubishi PA10-7C robot or a human. Eighteen specimens containing between 0 and 2 phantom tumours were palpated with each of the methods. Performance was assessed by measuring accuracy (the proportion of tests that were correctly identified as having or not having a tumour), exerted force and completion time. An ANOVA test was performed to establish differences among the different methods, followed by a Dunnett test to determine significant differences between the individual groups (see Table 1).

Table 1, abstract 72. Performance of human versus robot-assisted palpation for minimally invasive tumour localization

Palpation	Max force (SD), N*	Mean time (SD), s*	Test, %				
			Acc.	Sens.	Spe.	PPV	NPV
Human	11.81 (3.2)	299.8 (125.1)	63	61	67	85	36
Robot-assisted	5.17 (0.63)	142.9 (31.5)	92	94	86	94	86

Acc. = Accuracy; NPV = negative predictive value; PPV = positive predictive value; SD = standard deviation; Sens. = sensitivity; Spe. = specificity.
* $p < 0.001$.

Robotic assistance realized a 55% decrease in the maximum forces applied on tissue, a 50% decrease in task completion time and a 29% increase in tumour detection accuracy. These results imply that the use of robotic assistance for tactile sensing during MIS is not only feasible, but results in reduced tissue trauma and increased tumour detection, compared with manual manipulation with the tactile sensing instrument. Furthermore, robot-assisted palpation with a tactile sensing instrument has the potential to more accurately locate hidden tumours during MIS.

73

JOINT VENTURE IN MINIMALLY INVASIVE THORACIC SURGERY. TACKLING THE LEARNING CURVE BY COMBINING THE EXPERTISE OF A THORACIC AND A LAPAROSCOPIC SURGEON. *E. Joos, R. Labbé, J.P. Gagné.* Québec Centre for Minimally Invasive Surgery, Centre hospitalier universitaire de Québec, Québec, Que.

The objective of this study was to evaluate the results of a thoracic surgeon with limited experience in minimally invasive surgery (MIS) undertaking, with the initial assistance of an MIS surgeon, resections of lung neoplasm by video-assisted thoracoscopic surgery (VATS).

Between May 2007 and February 2008, all candidates for a lobectomy for cancer were offered VATS, with the MIS surgeon assisting in the first 6 procedures. Charts were reviewed. Data included demographics, American Society of Anesthesiologists (ASA) classification, pulmonary functions tests, types of resections, staging, histology and perioperative outcome.

There were 19 patients with a mean age of 63.8 (45–76) years. ASA classification was I (0%), II (79%), III (21%). Mean forced vital capacity (FVC) and mean FEV₁ were 3.11 L and 2.09 L, respectively. Resections were right upper lobe 8, right middle lobe 1, right lower lobe 2, left upper lobe 5 and left lower lobe 3. Surgical stages were Ia (9), Ib (4), IIa (1) and IIb (1). Other diagnoses included metastases (3) and granuloma (1). Mean tumour size and mean number of lymph nodes were 2.69 (1–7) cm and 4.4 (1–9), respectively. Most lesions were adenocarcinomas (15). Five patients had postoperative complications. Median operative time was 148 (53–226) minutes, 120 for the first 6 cases and 150 for the last 13. There were 2 conversions (10.5%), no transfusions and no mortality. Median length of stay was 6 (3–49) days.

VATS can be undertaken safely by a thoracic surgeon with minimal expertise in MIS. Combining the expertise of such a surgeon and a fellowship-trained laparoscopic surgeon might be the best way to accomplish the transition from open to minimally invasive thoracic surgery.

74

RETROSPECTIVE ANALYSIS OF SURGICAL THORACIC OUTLET SYNDROME CASES. *B. Nelems, M.F. Humer, W. Senner.* Department of British Columbia Thoracic Surgery, Interior Health Authority, Kelowna General Hospital, Kelowna, BC.

The objective of this study is to assess surgical outcomes for thoracic outlet syndrome patients. A 10-year retrospective study which included chart reviews of 394 procedures was carried out using a predesigned data collection worksheet. Three surgical approaches were critically analyzed: transaxillary first rib resection, cervical rib resection and cervical sympathectomy when performed concurrently with rib resection. The results indicate that surgical intervention is beneficial, with improved symptomology, increased functional capacity and significant improvement in pain management. In conclusion, with proper assessment, diagnostic testing and consultation before surgical intervention outcomes for thoracic outlet syndrome, patients can be improved.

75

FUNCTIONAL AND SYMPTOMATIC ASSESSMENT FOLLOWING LAPAROSCOPIC HELLER MYOTOMY AND PARTIAL FUNDOPPLICATION FOR ACHALASIA - A 3-YEAR EXPERIENCE. *A. Abdurahman, G.P. Giraldo, R.S. Sundaresan, D.E. Mazziak, F.M. Shamji, A.J.E. Seely.* Division of Thoracic Surgery, The Ottawa Hospital, Ottawa, Ont.

Laparoscopic surgery is an established method of treatment for achalasia, yet no data exist regarding outcomes and surgeon experience. The aim of this retrospective study was to assess functional and subjective outcomes following laparoscopic Heller myotomy and partial fundoplication for achalasia over a 3-year initial experience.

Data were collected from consecutive patients undergoing laparoscopic treatment of achalasia after initiation of a program of minimally invasive surgery (MIS) of the gastroesophageal junction (GEJ) at a single thoracic surgical centre. Functional assessment (manometry) and symptom severity scores (questionnaires) were obtained pre- and postoperatively. Twenty-seven patients underwent laparoscopic modified Heller myotomy and partial (Dor) fundoplication from July 2004 to July 2007; 7 were performed in year 1 and 10 in both year 2 and 3. Length of stay (LOS) was a median of 2.0 and mean of 2.6 days. Perioperative complications occurred in 2 patients (7%) and included 1 conversion to open (bleeding) and 1 esophageal leak (radiologically diagnosed) which resolved without need for intervention. Preoperative manometry was performed in all patients; 11 (41%) agreed to undergo postoperative manometry and 14 (52%) completed pre- and postoperative symptom severity questions (LES). Average tone decreased from 44.5 ± 15.7 to 21.1 ± 5.5 mm Hg; percent relaxation increased from $43\% \pm 13\%$ to $71\% \pm 13\%$; LES residual pressure decreased from 19.8 ± 8.8 to 6.2 ± 2.5 mm Hg, all $p < 0.001$; no difference was noted in LES length: 3.8 (SD 0.5) pre- and 3.4 (SD 0.6) cm postoperative, NS. Following surgery, symptom scores for dysphagia, gastroesophageal reflux symptoms and odynophagia were all significantly improved ($p < 0.01$). There were no differences in LOS or postoperative manometry and/or symptom scores in patients performed in years 1, 2 and 3.

Laparoscopic Heller myotomy and partial fundoplication improve LES function and symptoms in patients with achalasia. We detected no change in LOS, postoperative LES function or symptoms within the first 3 years of introducing a program of MIS GEJ surgery.

76

THE EFFECT OF LAPAROSCOPIC PARAESOPHAGEAL HERNIA

REPAIR ON PULMONARY FUNCTION TEST. *S. Alnassar, J. Kon-dra, J. Clifton, R.J. Finley.* Division of Thoracic Surgery, University of British Columbia, Vancouver, BC.

A retrospective cohort study was conducted to examine the impact of laparoscopic paraesophageal hernia repair on pulmonary function (PFT) and quality of life (QOL).

Between 2001 to 2005, 43 patients were diagnosed with paraesophageal hernia. Patients were evaluated by history, physical examination, chest radiograph (CXR), barium swallow and upper endoscopy. PFT was done preoperatively within 3 months before surgery and postoperatively at least 1 month after surgery. Postoperative QOL was evaluated using the Gastrointestinal Quality of Life Index (GIQLI), Chronic Respiratory Questionnaire (CRQ) and Likert symptoms scale.

Thirty-eight patients (10 male, 28 female) were included in the study: mean age was 71 (standard deviation [SD] 11.4, range 36–87) years. Presenting symptoms included gastroesophageal reflux (47.0%), dysphagia (34.2%), anemia (18.0%), dyspnea (32.4%), chest pain (60%) and cough (5%). Six patients had type II hernia, 26 type III and 6 type IV. Mean ASA was 2.5 (SD 0.65). Mean FEV₁ (10.0%; preoperatively 2.17 [SD 0.78] L, postoperatively 2.38 [SD 0.92] L, $p = 0.002$); forced vital capacity (9.3%; preoperatively 3.01 [SD 1.05] L, postoperatively 3.27 [SD 1.22] L, $p = 0.001$) and total lung capacity (8.3%; preoperatively 5.95 [SD 1.59] L, postoperatively 6.43 [SD 1.49] L, $p = 0.002$) improved significantly. Improvements were also seen in FEV₁/FVC% (2.0%; preoperatively 71.57% [SD 8.5%], postoperatively 72.87% [SD 9.04%], $p = 0.166$) and residual volume (7.8%; preoperatively 2.34 [SD 0.68] L, postoperatively 2.51 [SD 0.45] L, $p = 0.123$), but they were not statistically significant. Improved symptom scores were shortness of breath 3.73 (SD 1.03), chest pain 4.43 (SD 1.0), heartburn 4.33 (SD 1.11), regurgitation 4.57 (SD 0.94) and dysphagia 4.1 (SD 1.1). Mean GIQLI (out of 100) was 70.95 (SD 12.73, range 49–90); mean CRQ was 3.56 (SD 1.2, range 2.2–5.8) for the dyspnea domain, 5.35 (SD 0.88, range 3.86–7.0) for the emotional domain, 5.50 (SD 1.37, range 3.25–7.00) for the mastery domain and 4.13 (SD 0.85, range 2.25–5.50) for the fatigue domain. Mean length of stay 2.6 (SD 1.9) days. Minor postoperative complications occurred in 5 patients (14.7%). No in-hospital or 30-day mortality occurred.

Laparoscopic repair of paraesophageal hernia results in a significant improvement of PFT and is well tolerated by elderly patients with other comorbid diseases. It improves symptoms of shortness of breath, chest pain, heartburn, regurgitation, dysphagia and improves quality of life.

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77

COMPARING THE ADEQUACY OF LYMPH NODE HARVEST IN LAPAROSCOPIC VERSUS OPEN COLORECTAL CANCER PROCEDURES. *J.D. Rivard, D. Hochman.* Department of Surgery, University of Manitoba, Winnipeg, Man.

Recently, a study was published outlining a model to more accurately determine the minimal number of lymph nodes that should be harvested during colorectal resections for cancer, based on several patient characteristics. Our study seeks to determine whether laparoscopic colorectal cancer surgery achieves appropriate number of lymph nodes for staging using this model.

This study is a retrospective analysis on a prospectively collected database of patients who have undergone surgical resection for their colorectal cancer. All operations were performed by a single, fellowship-trained colorectal surgeon. Patient characteristics, including age, American Society of Anesthesiologists (ASA) grade, Dukes staging, operative urgency, degree of differentiation, histological type of tumour, type of resection and preoperative radiotherapy, have been recorded, and appropriate statistical analysis will be performed.

We anticipate that the lymph node harvest in laparoscopic colorectal surgery will be equal to or superior to the lymph node harvest obtained in traditional open surgery for colorectal cancer. We also expect to corroborate the fact that appropriate surgical lymph node harvest is determined on numerous patient factors and characteristics, which should be taken into account when determining an adequate sample of lymph nodes expected for staging in colorectal surgery.

78

PREOPERATIVE PREDICTION OF CONVERSION IN PATIENTS UNDERGOING LAPAROSCOPIC RECTAL SURGERY FOR CANCER: A CT-SCAN BASED MODEL. *A. Bouchard, G. Martel, C. Walsh, N. Fasih, J. Mamazza, E.C. Poulin, R.P. Bousbey.* Minimally Invasive Surgery Research Group, Department of Radiology, The Ottawa Hospital, Ottawa, Ont.

Laparoscopic rectal resection can be technically challenging given the bony confines of the pelvis. Difficult angles and limitations with laparoscopic instruments often necessitate conversion. The aim of the present pilot study is to develop a computed tomography (CT)-based model, using simple metrics, to predict conversion accurately and reproducibly in straight laparoscopic rectal cancer surgery.

We undertook a retrospective review of 30 consecutive cases of laparoscopic proctectomy for rectal cancer located below 15 cm from the anal verge. Preoperative staging CT scans and reconstructed pelvic images were reviewed for each patient. Eight pelvic measurements (including pelvic volume) were obtained by 2 independent observers and analyzed. The charts of all patients were reviewed, and reasons for conversions were identified. Descriptive statistics were obtained, and Spearman correlation coefficients were calculated.

Five out of 30 patients (16.7%) were converted to open surgery, including 0 of 9 anterior resections, 4 of 10 low anterior resections and 1 of 11 abdominoperineal resections. The recorded reasons for conversion were "narrow pelvis" in all cases and difficulty in obtaining adequate margins in 2 cases. Two of 8 recorded metrics were independently associated with conversion: the "sacral deepest point" measuring greater than 35.6 mm and the "lumbar to coccyx" angle greater than 10.5°. These 2 variables were also significantly inversely correlated with one another (Spearman correlation = -0.574, $p = 0.0017$). Finally, a plot graph analysis demonstrated that the combination of both cut-off metrics was the strongest predictor of conversion.

Two simple CT scan metrics can be used to accurately and reliably predict conversion in patients undergoing straight laparoscopic resection for rectal cancer.

79

DIGITAL RECTAL EXAMINATION IN THE PREOPERATIVE EVALUATION OF DISTAL RECTAL CANCERS. *F. Haggag, Y. Al-Subaibani, G. Martel, H.S. Stern, R.P. Bousbey.* Department of General Surgery, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.

To assess the reliability of digital rectal examination (DRE) and to compare the reported clinical tumour stage (T-stage) with the results from pelvic MRI and pathological staging.

From May 2006 to June 2007, a DRE was performed on 44 sequential patients by at least 1 experienced colorectal surgeon and a fellow who were blinded to the radiologic stage. Preoperative decisions regarding the need for neoadjuvant therapy (NT) were based on clinical assessment and radiologic staging. Radiologic staging consisted of preoperative pelvic MRI. The interrater reliability was assessed, as well as the extent of agreement of the clinical stage with the radiologic and pathologic T-stages using kappa statistics.

Thirty-four patients with median age of 69 (interquartile range [IQR] 57-79) years had DRE and MRI performed

before receiving preoperative therapy. Of these, 10 patients did not undergo surgery and were excluded. Interrater reliability for determining the clinical T was fairly good (kappa value = 0.61). Surgeons' prediction of the need for NT, based on their clinical exam alone, compared well (78%) with the actual rates of neoadjuvant therapy received. Clinical assessment determined by the DRE correlated well with the actual pathologic stage. For the subset of early cancers that did not receive NT, DRE was better at correlating with the final pathological stage than MRI. When MRI staging indicated that NT was appropriate, 80% received NT, while 20% did not. However, when MRI staging predicted that NT was not necessary, 33% received NT, while 67% did not. MRI examination correctly identified 7 T1–T2 (69%), 10 T3 (63%) and 3 T4 (100%) lesions in patients who did not receive NT.

DRE is an essential tool in the preoperative assessment for NT for patients with distal rectal cancer and is more accurate than MRI in correctly staging T1/T2 rectal tumours.

80

THE USE OF PROSTHETIC MESH IN PARAESOPHAGEAL HERNIA REPAIR AMONG CANADIAN EXPERTS. *F. Hagggar, H. Moloo, R.P. Boushey, E.C. Poulin, J. Mamazza.* Department of General Surgery, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.

We undertook a survey to assess the incidence of recurrence among expert surgeons, assess their attitudes, practices regarding screening of recurrences and current approach for the use of prosthetic mesh.

Experts in paraesophageal hernias (PEH) from 16 university-affiliated centres were invited to participate in a 29-item questionnaire. Surgeons were provided with a list of other participants and asked to provide additional names of experts in PEH surgery.

Of the 23 identified surgeons, 91% responded to the questionnaire. Almost every respondent (95%) indicated laparoscopic PEH (LPEH) surgery as their preferred operative approach. The most commonly used techniques for LPEH were primary repair with pledgets (38.1%) or without pledgets (38.1%). Fewer respondents preferred primary repair with synthetic mesh (19.1%), biologic collagen matrix mesh (14.3%), composite mesh (4.8%), pledgets and synthetic mesh (4.8%) and pledgets and bioabsorbable mesh (4.8%). Respondents reported recurrence rates of < 10% (38.1%) and 11%–15% (23.8%), with a few (14.3%) reporting rates of > 21%. Recurrences were most commonly attributed to tension on repair (70%), poor connective tissue (55%), poor crural quality (10%) and surgeon-related factors (20%). Most respondents (76%) routinely performed postoperative upper gastrointestinal series to screen for recurrences. Of the discovered recurrences, < 10% were managed surgically. The majority (71%) of surgeons believe the current evidence on the effectiveness of prosthetic mesh to be lacking.

There remains considerable practice variation among expert surgeons performing PEH surgery. There is no clear consensus regarding the most effective method of repair, use of prosthetic mesh and screening regime for recurrences. While the majority of surgeons identified tension on the repair as the likely cause for recurrence, the majority of surgeons perform a

primary repair without a prosthesis. The majority of surgeons recognize the need for better evidence regarding the use of mesh in the primary repair of PEHs.

81

QUALITY OF LIFE, SEXUAL AND BLADDER FUNCTION FOLLOWING RECTAL CANCER SURGERY. *F. Hagggar, G. Martel, E.C. Poulin, J. Mamazza, R.P. Boushey.* Department of General Surgery, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.

To evaluate the studies on quality of life (QoL) and sexual and bladder function following rectal cancer surgery.

All papers assessing rectal cancer-specific QoL in the English language were identified in Medline, EMBASE and the Cochrane Library from January 1980 to September 2007.

Thirty papers on aspects of QoL in rectal cancer surgery were identified. Eleven studies were cross-sectional or retrospective and 19 were prospective. Among prospective studies, 11 were randomized controlled trials (RCT). Sample sizes ranged from 18 to 1891 patients; follow-up was from 1 month to a median of 6.8 years after surgery. Global QoL was not formally measured using validated questionnaires in 4 studies. The most commonly used tools were the European Organization for Research and Treatment of Cancer QoL questionnaire core 30 (EORTC QLQ-C30) (43%), which measures psychological, functional and social impact of disease and QLQ-CR38 (40%) (colorectum 38), which is validated for use in patients with colorectal cancer. These studies suggest that overall QoL is better after surgery. Only 2 studies reported quality of life in patients with rectal cancer following radiotherapy, while another 6 assessed quality of life during chemotherapy and radiotherapy. There were 11 studies that dealt with the effect of rectal surgery on function; the symptoms investigated pertained mainly to sexual, urological and defecatory functions. To date, only 2 RCTs have described QoL, bladder and/or sexual functions. Both studies compared outcomes between laparoscopic and open rectal surgery. These studies concluded that laparoscopic surgery does not adversely affect bladder function, but that there may be a trend toward worse sexual function, especially in males, in the laparoscopic group.

Recent prospective studies suggest that QoL measured by generic questionnaires is better after rectal surgery. However, there continues to be a paucity of quality prospective studies reporting on sexual and urinary functions.

82

PALLIATIVE INVASIVE PROCEDURES IN OUTPATIENT PALLIATIVE COLORECTAL PATIENTS. *A. Easson, A. Walsh, S. Chadi, T. Kandasamy, G. Rodin, C. Zimmermann.* Departments of Surgical Oncology and Psychosocial Oncology and Palliative Care, Princess Margaret Hospital, University Health Network, Toronto, Ont.

Palliative invasive procedures (PIPs) are used for symptom relief when curative treatment is not possible. The present study retrospectively assesses PIP treatment patterns in patients with metastatic colorectal cancer referred for specialized palliative care (PC).

The medical records of 276 colorectal patients ($n = 81$ ascending colon, $n = 59$ descending colon, $n = 136$ rectal) referred for PC were reviewed for PIPs. PIPs were examined by cancer site and treatment method, stratified as: open/laparoscopic, endoscopic, interventional radiology (IR) and bedside. The interval between PC and PIP was calculated and examined with a 2-way (cancer site \times PIP) analysis of variance (ANOVA).

Of the 276 patients reviewed, 137 (50%) received 315 PIPs; included, 107 open/laparoscopic, 32 endoscopic, 129 IR, 47 bedside. Median time from diagnosis to PC was 22.8 months, and median time from diagnosis to PIP was 15.7 months. Median time from PC to death was 2.6 months. Sixty percent of PIPs occurred before PC. Time interval between PC and PIP was significantly related to PIP ($p < 0.001$) but not cancer site. On average open/laparoscopic procedures occurred 7.9 months before PC, endoscopic occurred 1.6 months before PC, IR procedures occurred 1.6 months after PC, and bedside procedures occurred 1.8 months after PC.

Palliative invasive procedures in colorectal cancer patients are common, required by 50% of patients referred for specialized palliative care. IR and bedside PIPs were common after PC referral, although 60% of PIPs were performed before referral. With patient quality of life the primary focus of palliation, these findings suggest further prospective investigation is necessary to determine the extent to which PIPs contribute to relief of burden and distress at the end of life.

83

DO RIGHT-SIDED LAPAROSCOPIC COLECTOMIES TAKE LONGER TO RECOVER? AN ANALYSIS OF 649 CASES. *G. Martel, A. Bouchard, C.M. Schlachta, E.C. Poulin, J. Mamazza, R.P. Boushey.* Minimally Invasive Surgery Research Group, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.

The objective of this study was to test whether right- and left-sided laparoscopic colectomies differ in terms of postoperative recovery of bowel function.

Consecutive patients undergoing laparoscopic colorectal procedures from 1991 to 2007 were analyzed from a prospectively collected database. Cases were unselected, as all referred patients were offered laparoscopy. To standardize bowel function recovery, all conversions and defunctioning ostomies were excluded. Summary statistics and univariate analyses were performed. A multiple linear regression model was built to evaluate risk factors associated with prolonged return to normal diet.

A total of 649 colectomies were retrieved from the database, including 280 right- (RT) and 369 left-sided (LT) resections. Both groups were comparable in terms of basic demographics, although the RT group was more likely to be taking steroids (10.0% v. 1.9%, $p < 0.0001$), to have had previous abdominal operations (28.6% v. 19.2%, $p = 0.0053$) and to have a diagnosis of colon cancer (57.5% v. 47.4%, $p = 0.011$). Intraoperative complication rates were similar between the 2 groups, although median operative times were significantly shorter among right-sided colectomies (146 v. 175 min, $p < 0.0001$). Postoperatively, the rate of surgical complications, including ileus and anastomotic leak, was similar between the 2 groups. However, medical complications were significantly

more common within the RT group (17.9% v. 10.0%, $p = 0.0037$). The median times required to resume a normal diet (3 [interquartile range [IQR] 3–5] v. 3 [IQR 2–4] d, $p = 0.0368$) and to discharge from hospital (5 [IQR 4–7] v. 4 [IQR 4–6] d, $p = 0.0198$) were significantly longer among right-sided resections, although the absolute differences were small. A multivariate model identified anastomotic leak ($p < 0.0001$), ileus ($p < 0.0001$), medical complications ($p < 0.0001$) and right-sided resections ($p = 0.0094$) as predictive factors of longer time to return to a normal diet.

Return of bowel function following laparoscopic colectomy is a complex phenomenon. Patients undergoing right-sided laparoscopic colectomies appear to be slower to recover than patients undergoing left-sided resections.

84

AN ANALYSIS OF 1486 COLORECTAL RESECTIONS PERFORMED FOR INFLAMMATORY BOWEL DISEASE IN CANADA. *P.J. Karanicolas, P.H.D. Colquhoun, L. Dubois, C.J. Swallow, G.H. Guyatt.* Department of Surgery, University of Western Ontario, London, Department of Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, Department of Surgery, University of Toronto, Toronto, Ont.

Inflammatory bowel disease (IBD) is a common indication for colorectal resection. Patients and surgeons need accurate estimates of expected outcomes following resection in order to make informed management decisions.

We obtained data from the Canadian Institute for Health Information (CIHI) Discharge Abstract Database on all adult patients who underwent colorectal resection for IBD in Canada (excluding Quebec) between January and December 2005. We performed logistic regression to identify variables associated with a higher likelihood of in-hospital death.

Surgeons performed 1486 colorectal resections in patients with IBD, the majority (59.4%) in patients with Crohn disease. There were a similar proportion of men and women (48.1% v. 51.9%), with a median age of 43 (interquartile range 32–55) years. We classified 53.6% of procedures as elective and 46.4% as urgent or emergent (hospital admission through an emergency department or with a primary diagnosis other than IBD). Increasing age (odds ratio [OR] 1.1/y, $p < 0.001$) and urgency of surgery (OR 9.2 for urgent or emergent, $p = 0.004$) were independently associated with a higher likelihood of death. The overall mortality was 1.8%, significantly higher in urgent cases than in elective cases (3.6% v. 0.3%, $p < 0.001$).

Colorectal surgery for IBD is common, with an overall low mortality rate. Older patients undergoing urgent operations are at higher risk of perioperative death. Management that avoids urgent surgery would substantially reduce mortality.

85

OUTCOMES FOLLOWING LAPAROSCOPIC COLECTOMY FOR CANCER: NOT ALL SIDES ARE CREATED EQUAL. *G. Martel, A. Bouchard, C.M. Schlachta, E.C. Poulin, J. Mamazza, R.P. Boushey.* Minimally Invasive Surgery Research Group, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.

The objective of this study was to compare the outcomes of

right- and left-sided laparoscopic colectomies for cancer.

Consecutive patients undergoing laparoscopic colorectal procedures from 1991 to 2007 were analyzed from a prospectively collected database. Cases were unselected, as all referred patients were offered laparoscopy. Inclusion criteria from the Clinical Outcomes of Surgical Therapy (COST) trial were applied, limiting the analysis to right- and left-sided colectomies for cancer. To standardize bowel function recovery, all conversions and defunctioning ostomies were excluded. Summary statistics and univariate analyses were performed.

A total of 336 cases of laparoscopic colectomy for cancer were identified, including 161 right- (RT) and 175 left-sided (LT) resections. Both groups were well matched for sex, weight, comorbidities, previous abdominal surgery and perioperative steroid use. The RT cohort was slightly older (69.9 v. 66.2 y, $p = 0.016$). There was no significant difference between the 2 groups in the distribution of American Joint Committee on Cancer (AJCC) stages, with stage 2 disease being the most frequent (37.3% v. 32.0%, $p = 0.31$). The median operative time was significantly shorter within the RT group (147 v. 180 min, $p < 0.0001$), although both cohorts had comparable rates of intraabdominal adhesions (11.8% v. 13.7%, $p = 0.6$) and intraoperative complications (5.0% v. 5.7%, $p = 0.76$). Postoperatively, the RT cohort had more frequent medical complications (21.7% v. 12.0%, $p = 0.017$) and demonstrated a trend toward greater overall complication rates (35.4% v. 25.7%, $p = 0.054$). Median times to resumption of a normal diet and to discharge were not significantly different between the 2 groups. Surprisingly, the RT group showed an excess postoperative mortality rate (8/161, 5.0% v. 1/175, 0.6%, $p = 0.016$). Among mortalities, only 1 case was attributable to a surgical complication, whereas others were medical complications (6/9) or unknown (2/9).

Stage for stage, right-sided laparoscopic colectomy for cancer may be associated with a greater rate of morbidity and mortality compared with left-sided resections. The observed difference in postoperative outcomes does not appear related to surgical complications.

86

ACCURACY OF ENDORECTAL ULTRASOUND IN THE EVALUATION OF RECTAL CANCER IN ST. JOHN'S, NEWFOUNDLAND. *S.L. Wong, M. Savoie, D.A. Wirtzfeld, W.G. Pollett.* Department of Surgery, Health Science Centre, St. John's, NL.

Endorectal ultrasound (ERUS) is reported as an accurate method for the staging of rectal cancer. However, ultrasonographic evaluation is known to be operator dependent. This study aims to evaluate the accuracy of ERUS in the evaluation of rectal cancer in St. John's, Newfoundland.

A retrospective chart review of 80 rectal cancer patients who underwent ERUS between April 2001 and March 2005 was undertaken to compare the accuracy of ERUS against the final pathology report in the determination of depth of invasion (T-stage) and nodal status (N-stage).

The overall accuracy for detection of the level of invasion was 44%. The overall sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) in uT3 and uT4 staging were 57%, 59%, 59%, and 57% respectively. The rotating probe appeared to be less accurate in comparison to

the nonrotating probe with recorded values of 52% and 71%, respectively. The overall accuracy for nodal status was 57%. The sensitivity, specificity, PPV and NPV for nodal status were 5%, 93%, 33% and 59%, respectively. The overall sensitivity, specificity, PPV and NPV for radiologists in determining uT3 and uT4 staging were 60%, 57%, 54% and 63%, respectively.

ERUS is a valuable tool used in the staging of rectal cancer and upon which important treatment decisions are based. We have shown that the accuracy, especially for depth of invasion, is low in a group of radiologists who employ this technique in our centre. Recommendations for the enhanced preoperative staging of rectal adenocarcinoma are made.

87

MOST ELDERLY PATIENTS RETURN HOME AFTER SURGERY FOR COLORECTAL CANCER—BUT WHICH ONES AND AT WHAT COST? *K.M. Devon, D.R. Urbach, R.S. McLeod.* Department of Surgery, Mount Sinai Hospital, University Health Network, University of Toronto, Institute for Clinical Evaluative Sciences, Toronto, Ont.

The elderly population is growing. The objective of this study is to describe the disposition and resource utilization of Ontario's elderly who undergo colorectal cancer surgery.

A cohort of 33 238 patients aged 50 years and over with a diagnosis of colorectal cancer was identified using the International Classification of Diseases (ICD)-9 and -10 codes in the Ontario Cancer Registry linked to procedure codes in the Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD) representing colorectal operations within 6 months of diagnosis from 1997 to 2004. Data were collected from the Chronic-Care Reporting System (CCRS), the Registered Persons Database (RPDB) and the Ontario Home Care Administrative System (OHCAS).

On multivariate analysis (Table 1), patients aged 75–79 and over 80 were more likely to be readmitted (OR 1.31; confidence

Table 1, abstract 87. Resource utilization of elderly patients after surgery for colorectal cancer

Resource utilization	Age, y			
	50–64	65–74	75–79	80+
Mean LOS (SD), d	10.2 (8.25)	11.8 (10.4)	13.8 (13.3)	16.9 (15.6)
Disposition postsurgery, %				
Readmitted within 30 d	11.1	13.0	14.9	18.2
Home*	98.4	96.4	89.2	78.6
Chronic care	0.41	0.83	2.22	4.59
Home care	43.5	47.5	51.8	55.6
Mean no. visits				
In 1st mo	19.7	20.0	19.4	17.7
In 1 y	59.2	65.4	70.4	73.7
HC service type, %				
Nursing	93.2	89.0	81.2	67.92
Home making	2.38	6.70	14.04	24.32
Stoma care	3.75	2.95	2.23	2.10
Other	0.67	1.35	2.52	5.66
HC = home care; LOS = length of hospital stay; SD = standard deviation. *since 2002.				

interval [CI] 1.19–1.45 and OR 1.59; CI 1.44–1.75), receive home care (OR 1.44; CI 1.34–1.55 and OR 1.71; CI 1.59–1.83), not return home (OR 5.62; CI 3.99–7.98 and OR 11.59; CI 8.32–16.13) and stay 2.78 (standard error [SE] 0.219) and 5.16 (SE 0.19) days longer, respectively. Factors predisposing patients over 75 years to all outcomes were urgent admission, stoma and Charlson score.

Elderly patients can return home following colorectal cancer surgery but may have increased supportive needs.

88

LAPAROSCOPIC COLECTOMY FOR COMPLEX DIVERTICULAR DISEASE: PUSHING THE ENVELOPE. *G. Martel, A. Bouchard, C.M. Schlachta, E.C. Poulin, J. Mamazza, R.P. Boushey.* Minimally Invasive Surgery Research Group, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.

The objective of this study was to evaluate the safety and feasibility of laparoscopic colectomy for complex diverticular disease.

Consecutive patients undergoing laparoscopic colorectal procedures from 1991 to 2007 were analyzed from a prospectively collected database. Patients with diagnoses of acute diverticulitis, chronic diverticulitis and diverticulosis were included. Complex cases (CX) were defined as having abscesses, perforations, fistulae or strictures, and were compared with uncomplicated cases (UN), which served as controls. Patients with acute diverticulitis were operated on urgently or for failure of conservative therapy. All patients underwent straight laparoscopy; there were no hand-assisted cases. Summary statistics and univariate analyses were performed.

A total of 183 patients were analyzed, of which 39 had CX and 144 had UN. Within the CX cohort, there were 15 (38.5%) abscesses/perforations, 17 (43.6%) fistulae and 10 (25.6%) strictures. CX patients were older (63.7 v. 53.3 y, $p < 0.0001$) and were more likely to have had previous abdominal surgery (30.8% v. 10.4%, $p = 0.0015$). The vast majority of patients underwent left-sided colectomies (100% v. 92.4%, $p = 0.12$). Nevertheless, median operative times were longer (289 v. 170 min, $p = 0.058$), and ostomies were fashioned more frequently (18.0% v. 4.9%, $p = 0.013$) in CX patients. Intraoperative complications were comparable between the 2 groups (7.7% v. 9.7%, $p = 1.00$), although CX cases were converted much more frequently (23.1% v. 4.2%, $p = 0.0007$). Postoperatively, rates of surgical complications were not significantly different for anastomotic leak, ileus and wound infection, although medical complications were significantly more frequent in the CX group (33.3% v. 4.9%, $p < 0.0001$). There were no mortalities. Finally, the median time required to resume a normal diet (4 v. 3 d, $p = 0.036$) and to discharge from hospital (6 v. 4 d, $p = 0.0009$) were both significantly longer in the CX group.

Laparoscopic surgery for complex diverticular disease is safe and feasible. Despite a high rate of conversion to open surgery, laparoscopy is applicable to complex diverticular disease in the great majority of patients.

89

TRANSANAL EXCISION IS A VIABLE TREATMENT OPTION FOR T1 RECTAL CANCER. *A. Karimuddin, C. Victor, H. M. MacRae, Z. Cohen, C.J. Swallow, R.S. McLeod.* Dr. Zane Cohen

Digestive Diseases Research Unit, Samuel Lunenfeld Research Institute, Department of Surgery, Mount Sinai Hospital, University of Toronto, Toronto, Ont.

Transanal excision (TAE) remains an attractive and controversial treatment modality for early rectal cancer. The recent literature has raised concerns regarding an increased local recurrence rate with TAE, with a questionable impact on overall survival in comparison with radical, transabdominal surgery (TAS). The objective of our study was to compare the outcomes of patients with T1 rectal cancer who underwent TAE or TAS in relation to local recurrence, disease-free survival and overall survival (OS).

All patients who had surgery for T1 rectal cancer between 1997 and 2007 were identified through the Mount Sinai Hospital Colorectal Cancer database. Sixty-three patients were identified, with 32 undergoing TAE and 31 TAS. There were no significant differences in patient sex or age (Table 1).

Table 1, abstract 89. Characteristics and outcomes of patients undergoing transanal excision versus transabdominal surgery for T1 rectal cancer

Characteristics	Transanal excision (n = 32)	Transabdominal surgery (n = 31)
Media age (IQR), y	61.5 (50.5–71.0)	62.0 (55.0–73.0)
Sex, no. (%)		
Male	19 (59.4)	15 (48.4)
Female	13 (40.6)	16 (51.6)
Median length of follow-up (IQR), mo	83.0 (58.0–103.0)	63.5 (22.0–99.0)
Local recurrences, %	3 (9.4)	0 (0.0)
Deaths	2 (6.3)	1 (3.2)
Cancer-related deaths	0 (0.0)	0 (0.0)
5-year survival (95% CI)		
Disease-free	0.91 (0.73–0.97)	1.00 (1.00–1.00)
Overall	0.94 (0.77–0.98)	0.95 (0.72–0.99)

CI = confidence interval; IQR = interquartile range.

There were 3 recurrences in the TAE group, but all were treated successfully on diagnosis with surgical intervention. There appears to be no significant difference in disease-free survival and/or overall survival.

The main concern with TAE for early rectal cancer has remained local recurrence. Our study shows that in well selected and well informed patients, T1 rectal cancer can be treated effectively with TAE. This approach appears to have a minimal impact on overall survival, and while local recurrence is higher than with TAS, careful and judicious surveillance allows for prompt diagnosis and treatment of recurrences, with negligible impact on overall survival.

90

TRANSANAL ENDOSCOPIC MICROSURGERY (TEM) FOR RECTAL LESIONS: SHORT-TERM OUTCOMES. *C.J. Brown, P.T. Phang, M.J. Raval.* Department of Surgery, St. Paul's Hospital, University of British Columbia, Vancouver, BC.

Transanal excision of rectal polyps and early rectal cancers is an alternative to radical surgery. However, recent data suggest

that local recurrence in patients with early rectal cancer (T1 lesions) is unacceptably high, ranging from 15% to 18%. Transanal endoscopic microsurgery (TEM) uses an operating anoscope and laparoscopic instruments to facilitate local excision of rectal lesions. Current literature suggests that TEM results in better oncologic outcomes than convention transanal excision. St. Paul's Hospital (SPH) is one of the first centres in Canada to use this technique, and we present early outcomes of our initial cohort after 18 months of implementation.

Three colorectal surgeons at St. Paul's Hospital have collected data for the SPH TEM database as a means of quality assurance for this new technology. Demographics, surgical, pathological and outcomes data are maintained as part of this ongoing project.

Between July 2006 and December 2007, 18 patients with rectal lesions were treated by TEM at St. Paul's Hospital. Patients were treated for adenocarcinoma (8), adenoma (6), carcinoid (3) and squamous cell cancer (1). Median patient age was 67 (range 42–81) years, and 67% (12/18) were men. Median size of the lesions was 2.6 (range 0.6–6) cm, and median height was 6 (range 2–12) cm. Of the patients with adenocarcinoma, depth of invasion was T1 (4), T2 (3) and T3 (1). Seven patients (39%) had the rectal defect closed, with the remainder left open. Two patients required conversion to conventional transanal excision. There were no significant postoperative complications, and 16 of 18 patients were discharged in less than 24 hours postoperatively.

Early experience with TEM at St. Paul's Hospital has shown it to be a technically feasible and safe method of performing transanal resection of rectal lesions. Further follow-up and critical analysis of accumulating data are necessary in determining its value in treating these patients.

91

OUTCOMES IMPROVED AFTER TOTAL MESORECTAL EXCISION (TME) WORKSHOPS IN BRITISH COLUMBIA (BC). *P.T. Phang, C.E. McGahan, G. McGregor, J.K. MacFarlane, C.J. Brown, M.J. Raval, R. Cheifetz, H. Kennecke, J. Hay.* Department of Surgery, University of British Columbia, Surgical Oncology Network, British Columbia Cancer Agency, Vancouver, BC.

In a province-wide audit in BC in 1996, local recurrence for rectal cancer management was 16% overall and 27% for stage 3 cancers using nonstandardized rectal cancer surgery techniques and postoperative adjuvant chemoradiation. To improve these outcomes, TME education workshops were held in BC in 2002 and 2003 with promotion of change to adjuvant short-course preoperative radiation and surgical technique standardized to TME. To assess whether pelvic recurrence was changed, a province-wide audit was repeated for patients treated in the year after the workshops.

A provincial audit was performed for 2003–2004. In total, 396 patients had radical resection of rectal cancers with curative intent. Preoperative adjuvant radiation was given to 49% of patients. Thirty-three percent of patients received adjuvant chemotherapy. Permanent colostomy was performed in 33% of patients. Median follow-up was 34.5 months, with 91% of patients followed for at least 2 years.

Overall, survival was 84%, disease-specific survival was 89%,

pelvic recurrence was 7% and distant recurrence was 14%. Pelvic recurrence was 4.7% (95% confidence interval [CI] 1.9–8.5) for patients receiving preoperative radiation and 10.3% (95% CI 4.7–13.4) for surgery alone. For stage 3 rectal cancers, pelvic recurrence was 9.2% and was significantly lower than in 1996 ($p = 0.03$, Kaplan–Meier). Overall recurrence risk was 0.57 (95% CI 0.25–0.94, hazard ratio) compared with 1996.

We conclude that pelvic recurrence was improved after TME education workshops and increased use of preoperative radiation in a province-wide cohort. Knowledge translation with integrated strategy by surgeons and radiation and medical oncologists has been successful in improving outcomes for rectal cancer management in a population setting.

92

A POPULATION-BASED STUDY OF SURGICAL TREATMENT OF COLON CANCER IN ONTARIO, CANADA. *R. Nenshi, M. Simunovic, N.N. Baxter, N. Gunraj, E.D. Kennedy, S. Schultz, D. Wilton, D.R. Urbach.* Institute for Clinical Evaluative Sciences, Toronto, Ont.

Population-based patterns of treatment were determined in Ontario, Canada.

Data from administrative health databases (Canadian Institute for Health Information [CIHI] and the Ontario Health Insurance Plan [OHIP]) were linked to a population-based cancer registry (the Ontario Cancer Registry [OCR]) to measure hospitalizations and surgical treatment received by all patients with a new diagnosis of colon cancer in Ontario from March 1, 2003, to April 30, 2004.

In total, 5265 residents of Ontario were newly diagnosed with colon cancer. Over half (50.9%) were men and 20.3% were < 60 years old. Of all patients, 4801 (91.2%) had a surgical procedure. Among persons aged < 60 years, 1.3% (95% confidence interval [CI] 0.5–1.9) had a resection with a permanent stoma, 11.9% (95% CI 9.9–14) had a resection with creation of a reversible stoma, 69.1% (95% CI 66.2–71.9) had a resection with primary anastomosis and 17.8% (95% CI 15.4–20.1) had an “other” surgical procedure (intestinal bypass, local excision or other abdominal procedure). Among persons > 60 years, 1.1% (95% CI 0.8–1.4) had a resection with a permanent stoma, 11.5% (95% CI 10.5–12.6) had a resection with creation of a reversible stoma, 70.7% (95% CI 69.3–72.1) had a resection with primary anastomosis and 16.7% (95% CI 15.5–17) had an “other” surgical procedure. Of all cases, 354 (7.4%) were done laparoscopically. Among persons aged < 60 years, 8.8% (95% CI 7.1–10.6) had laparoscopic surgery compared with 7% (95% CI 6.2–7.8) in the older group (p for difference = 0.047). There was no difference in the rate of laparoscopic procedures between men and women.

The majority of patients newly diagnosed with colon cancer in Ontario undergo resection without creation of a stoma. There was no significant difference in rates of the different types of surgery received according to age. Less than 10% of operations were done laparoscopically, and younger patients were more likely to undergo laparoscopic procedures.

93

STAPLED HEMORRHOIDOPEXY RESULTS IN RECURRENT

SYMPTOMATIC HEMORRHOIDS: 2008 UPDATE. *K.J. Lumb, P.H.D. Colquhoun, R.A. Malthaner, S. Jayaraman.* Department of Surgery, Schulich School of Medicine and Dentistry, University of Western Ontario, London, Ont.

In a recently published meta-analysis of 12 randomized trials comparing stapled hemorrhoidopexy (SH) to conventional excisional hemorrhoidectomy (CH), we demonstrated that SH was associated with a greater risk of hemorrhoid recurrence. The purpose of this study was to update the analysis with more trials.

A systematic review of randomized controlled trials (RCTs) comparing SH and CH with long-term results was performed using the Cochrane methodology. Included studies had a minimum follow-up of 6 months and compared circular SH to CH. Studies were analyzed for clinical and statistical heterogeneity. Primary outcomes were hemorrhoid recurrence, symptom recurrence, complications and pain. A random effects model was used in the pooling of the trials summary statistics.

Nine additional RCTs were identified for a total of 21 included studies. Nine RCTs did not meet the inclusion criteria. SH patients were more likely to have recurrent internal hemorrhoids in long-term follow-up (odds ratio [OR] 3.22, 95% confidence interval [CI] 1.59–6.51, $p = 0.001$). SH patients were also more likely to complain of prolapse (OR 3.10, 95% CI 1.43–6.72, $p = 0.004$). When all symptoms were considered, patients undergoing CH surgery were more likely to be asymptomatic (OR 0.55, 95% CI 0.35–0.84, $p = 0.006$). Patients that received SH were more likely to have external anal skin tags (OR 1.47, 95% CI 1.00–2.16, $p = 0.05$) and to require subsequent operations (OR 1.89, 95% CI 0.99–3.61, $p = 0.05$). A nonsignificant reduction in postoperative bleeding was found with CH. SH was only found to nonsignificantly reduce pain and anal obstruction/stenosis.

In conclusion, conventional excisional hemorrhoidectomy continues to be superior to stapled hemorrhoidopexy for hemorrhoid symptoms and recurrence and continues to be the gold standard.

94

THE EFFECTS OF GLUCAGON-LIKE PEPTIDE 2 AND GLP-2 MIMETIBODY ON COLONIC ANASTOMOTIC HEALING IN A HYPOXIC RAT MODEL. *H.A. Redstone, W.D. Buie, S.L. Sague, P.J. Hornsby, D. Sigalet.* Department of Surgery, University of Calgary, Calgary, Alta., Immunobiology Department, Centocor, Radnor, Pa.

Glucagon-like peptide 2 (GLP-2) is a peptide hormone with intestine-specific trophic effects. It has been shown to improve intestinal adaptation in short bowel syndrome and have mucosal healing properties in animal models of inflammation, however, the native peptide has a very short circulating half-life. Given the potential utility activating the GLP-2 receptor in patients with compromised gastrointestinal function, we assessed whether the native peptide or a long-lasting variant would alter several indicators of anastomotic healing, using a previously validated hypoxic rat model of impaired colonic healing.

Fifty-six male rats underwent surgery with transection and anastomosis of the colon and were randomly allocated into 1 of 6 treatment groups. Animals were housed in either

normoxic or hypoxic conditions and received either GLP-2 30 µg subcutaneously twice daily, GLP-2 MIMETIBODY construct 2 mg/kg/dose given subcutaneously on days 0 and 3 and saline on other days or normal saline. At 5 days postoperatively, animals were euthanized, and anastomotic bursting pressures were obtained. Crypt cell proliferation was assessed by 5-Bromo-2'-deoxyuridine (BrdU) labelling. Anastomotic tissue was also obtained for analysis of cytokines (IL-1β, TNFα, IFNγ, IL-10, TGFβ and IL-13) by ELISA, and collagen types I and III and MMP-13 expression by reverse-transcription polymerase chain reaction (RT-PCR).

Anastomotic bursting pressure was not significantly different with either GLP-2 or GLP-2 MIMETIBODY treatment in either normoxic or hypoxic animals at day 5. Both GLP-2 and GLP-2 MMB treatment resulted in significantly higher numbers of positively-stained cells per crypt. Cytokine analysis showed increased levels of the proinflammatory cytokines IL-1β and IFNγ with GLP-2 treatment. Levels of the anti-inflammatory cytokines IL-10 and TGFβ were decreased by both GLP-2 treatments in both normoxic and hypoxic animals. There was no difference in the levels of TNFα and IL-13. Collagen analysis showed decreased expression of both type 1 and type 3 collagen with GLP-2 treatment.

GLP-2 treatment results in changes in the cytokine profile and collagen expression at the healing colonic anastomosis but does not affect bursting pressures. The effects on inflammatory cytokines were opposite to those seen in inflammation models, suggesting a distinct activity profile in this setting. These results suggest that clinically, if indicated, GLP-2 treatment could be continued throughout the perioperative period, but we do not see a direct benefit of GLP-2 therapy on anastomotic healing. The biological effect (crypt cell proliferation) was similar for native and GLP-2 MIMETIBODY construct treatment indicating the less frequent administration of the later was effective.

95

LAPAROSCOPIC INTESTINAL RESECTION FOR CROHN DISEASE: THE TOUGH STUFF. *A. Bouchard, G. Martel, E. Sabri, C.M. Schlachta, E.C. Poulin, J. Mamazza, R.P. Boushey.* Minimally Invasive Surgery Research Group, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.

To examine perioperative outcomes in patients undergoing intestinal resection for complicated Crohn disease including abdominal abscess and complex fistula disease.

Consecutive patients from 1991 to 2005 who underwent laparoscopic colorectal resections for Crohn disease were included. Cases were unselected, as all patients referred underwent a laparoscopic approach. Patients undergoing laparoscopic resection for uncomplicated Crohn disease were used as a control group for comparison. Data were obtained from a prospectively collected database. Summary statistics and univariate analyses were performed.

Eighty-four patients were studied, including 19 patients with disease complicated by abscess and fistula (group A) and 65 patients with uncomplicated Crohn disease (group B). A right-sided colectomy was performed in 89% of patients in group A and 62% of patients in group B. Other procedures included laparoscopic proctocolectomy ($n = 9$), proctectomy

($n = 8$) and total colectomy ($n = 7$). Patients in group A were more likely to be on preoperative steroids (47 v. 25%, $p = 0.056$). The rate of previous intra-abdominal surgery was identical in the 2 groups (17%). There were no intraoperative complications in group A; however, 4 patients (5%) in group B experienced an intraoperative complication, including cauterly injury, significant mesenteric hemorrhage and a ureteric injury. Conversion rates were similar in groups A and B (11 v. 6%, NS). Median operative time for patients undergoing laparoscopic right colectomy in group A was 175 minutes (interquartile range [IQR] 130–195) and was not significantly different than patients in group B (140, IQR 120–210 min). The overall postoperative complication rate was 21% ($n = 18$). Interestingly, postoperative complications were more common in group B (28 v. 5%, $p = 0.06$). The 30-day mortality rate was 0 for the cohort. Median postoperative length of stay was 4 (IQR 4–7) days in group A and 5 (IQR 4–7) days in group B (NS).

Laparoscopic intestinal resection for patients with fistulizing Crohn disease and/or abdominal abscess is feasible and as safe when compared with patients undergoing laparoscopic surgical resection for medically refractory uncomplicated Crohn disease.

96

PREOPERATIVE RADIATION WITH CONCURRENT CHEMOTHERAPY FOR RESECTABLE RECTAL CANCER: LONG-TERM FOLLOW-UP RESULTS OF A DOSE ESCALATION STUDY. *M. Teo, P.F. Ridgway, K.L. Wiltshire, I.G. Ward, C.J. Swallow, A.M. Oza, B. Cummings, G.R. Pond, P. Catton, J. Kim, J. Ringash, C.S. Wong, R. Wong, L.L. Siu, M. Moore, J. Brierley.* Departments of Radiation

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Neoadjuvant chemoradiation is now standard of care for locally advanced rectal cancer. Optimal dosage regimens remain disputed. The authors present the long-term follow-up of a dose escalation phase II study of neoadjuvant radiotherapy and standardized infusional 5-fluorouracil (5FU).

Primary outcomes were local recurrence-free survival (LRFS), disease-free survival (DFS) and overall survival (OS). Subgroup analysis was conducted to elucidate possible confounders such as stage, time to surgery, toxicity and comorbidity.

A total of 134 patients with adenocarcinoma of the rectum (T3/T4 or N1/N2) were treated. The initial cohort received 40 Gy in 20 fractions, the second, 46 Gy in 23 fractions, and the third, 50 Gy in 25 fractions. The 5FU was given in a synchronous fashion at (225 mg/m²/day). Statistical analysis was performed on an intention-to-treat basis, according to the Kaplan–Meier method, and comparisons were made with log-rank calculations.

A total of 121 patients underwent surgical resection. The 5-year LRFS was 91% in all 3 cohorts; 5-year DFS was 56%, 67% and 76% ($p = 0.072$) respectively. Subgroup analysis showed a trend toward increased OS with higher doses of radiation.

All treatment schedules were well tolerated. While at 2 years there was a significant difference in LRFS, the 5-year LRFS did not reveal a significant difference between the 3 cohorts. There was a trend toward increased DFS with higher doses of radiation.

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97

INTERPRETING 3-DIMENSIONAL STRUCTURES FROM 2-DIMENSIONAL IMAGES: A WEB-BASED INTERACTIVE 3D MODEL OF THE LIVER TO ENHANCE SURGICAL RESIDENTS' SPATIAL UNDERSTANDING OF STRUCTURAL INTER-RELATIONSHIPS. *J.L. Crossingham, J. Jenkinson, N. Woolridge, S. Gallinger, C.A.E. Moulton, G. Tait.* Biomedical Communications, Institute of Medical Science, Faculty of Medicine, University of Toronto; Department of Surgery, Division of General Surgery, Toronto General Hospital, Toronto, Ont.

Learning intrahepatic anatomy and developing an understanding of the relationships that exist between the key structures is a difficult process that is required of surgical residents. They need to mentally reconstruct 3D images from available computed tomography (CT) scans, and this may not be an effective way of understanding the liver. A web-based interactive 3D model of the liver was created to facilitate understanding of the complex spatial anatomy of the liver and to help visualize this anatomy in 3D when viewing CT scans. By importing CT scans into Osirix, 3D surface renderings of the liver were obtained. Using these images as reference, anatomic structures were modelled in Cinema4D. This included the liver surface and the intrahepatic structures: portal veins, hepatic veins, hepatic arteries and the biliary system. Users can view common liver anatomy and common variations online in interactive the 3D rotational model to observe the complex interactions of the vascular and biliary systems. This model will be useful for surgical trainees learning the difficult and complicated intrahepatic anatomy and will optimize learning opportunities for all trainees requiring knowledge of liver structures.

98

PERIOPERATIVE ANALYSIS OF LAPAROSCOPIC VERSUS OPEN LIVER RESECTIONS. *A.J. Rowe, P.A. Schumacher, A. Buczkowski, A.T. Meneghetti, O.N.M. Panton, C.H. Scudamore, S.W. Chung.* Department of Surgery, University of British Columbia, Vancouver, BC.

A prospective series of 18 laparoscopic liver resections performed from 2005 to 2007 was evaluated to determine whether a minimally invasive approach is superior to traditional open liver resection in terms of perioperative clinical outcomes and resource utilization.

These were compared with an equivalent group of 12 consecutive open liver resections undertaken immediately before the introduction of laparoscopic liver resection. The outcomes were evaluated for differences in perioperative morbidity, hospital length of stay and operative costs.

All patients had 1 or more lesions confined to the same side of the liver, including both benign and malignant pathology. There were no perioperative deaths in either group, but patients undergoing open resection had significantly more intraoperative blood loss (473 mL v. 287 mL, $p < 0.03$) and more postoperative complications (42% v. 6%, $p < 0.03$), compared with the laparoscopic group. There was a trend toward reduced hospital length of stay in patients undergoing laparoscopic resection (4.3 d v. 5.8 d, $p < 0.07$). There was no significant difference in skin-to-skin operating time or total time in the operating theatre (138 min for open resection v. 135 min for laparoscopic resection, and 224 min v. 214 min, respectively). The analysis of instrumentation comparing the Echelon stapler and Xcel trocar used for laparoscopic resection and the GIA and TX staplers used for open resection demonstrated that the 2 approaches were equivalent in terms of cost.

Our data suggest that laparoscopic liver resection is associated with less perioperative morbidity than open liver resection and that the 2 approaches are equivalent in terms of resource utilization. For segmental resections, a laparoscopic approach appears to be a superior technique. Further studies are needed to determine whether these results can be generalized to more complex liver resections.

99

TIME TO COMPLICATIONS IN PATIENTS AWAITING LAPAROSCOPIC CHOLECYSTECTOMY. *A. Barnes, C.D. Mercer, W.M. Hopman, M. Mercer, D. Jalink.* Department of Surgery, Queen's University, Kingston, Ont.

An acceptable wait time has yet to be established for elective laparoscopic cholecystectomy. This prospective analysis examines the relationship between time spent on the waiting list and risk of an adverse event, defined as a complication of untreated biliary disease leading to an emergency department visit.

Data were collected prospectively from 337 patients awaiting elective cholecystectomy. Rate of adverse events was analyzed in relation to duration on the waiting list by applying previously used time intervals, as well as intervals devised by the Ontario Wait Time Strategy for general surgery cases.

Fifty-four patients (16.0%) experienced at least 1 adverse event while awaiting surgery. Using waiting time intervals developed by the Ontario Wait Time Strategy, the highest risk of events occurred between 4 and 12 weeks on the waiting list (odds ratio = 1.2, as compared with the reference category [weeks 0-4]). Patients who experienced events waited an average of 104.7 days for surgery, compared with 118.4 days for the remaining patients ($p = 0.452$).

Patients appear to be at greatest risk of events after spending

4 weeks on the waiting list, but this risk falls notably after 12 weeks. This evidence supports the Ontario Wait Time Strategy guidelines, which indicate that patients with symptomatic biliary disease should undergo surgery within 12 weeks of presentation. It may also point toward a more indolent course of illness with minimal chance of future complications among patients who do not experience an adverse event within 12 weeks. Time to surgery is similar regardless of whether or not an event is experienced while on the waiting list.

100

HEPATIC INJURY: 10-YEAR REVIEW FROM A PROVINCIAL TRAUMA CENTRE. *M.E. Goecke, C.H. Scudamore, A. Buczkowski, R. Simons.* Trauma Services, Hepatobiliary Surgery, Vancouver General Hospital, Vancouver, BC.

The majority of patients with liver injury can be managed successfully nonoperatively; others require damage-control surgery (packing), and a few need heroic surgical interventions unfamiliar to many surgeons. Over the last decade, several new approaches to complex hepatic trauma have emerged including damage-control concepts, veno-venous bypass and stapled nonanatomic resection. The purpose of this study is to report on evolving trends in hepatic trauma management, the utility of new surgical technologies and their impact on overall survival.

The trauma registry and discharge abstract database of a level-1 provincial trauma centre were reviewed to identify all patients who suffered traumatic liver injury between January 1, 1997, and August 31, 2007. A retrospective chart review of these patients was completed to determine trends in management strategy (operative or nonoperative, operative approach), predictors of failure of nonoperative management and patient outcomes with subgroup analysis of higher-grade injuries and operative approach.

In total, 605 patients with liver trauma were identified, which accounted for 3% of the total trauma volume; 66% were male with an average age of 37 years and 54% had an abbreviated injury score ≥ 3 . Blunt trauma accounted for 83% of cases, of which 81% were motor vehicle collisions. Nonoperative management was attempted in 61%. Mortality from all causes was 19% with a trend toward improved survival over time for higher-grade injuries.

Nonoperative management is successful in the majority of patients with liver trauma. Those requiring operative intervention can usually be stabilized using damage-control techniques, notably packing. New operative approaches appear to offer survival benefit to those few patients requiring more definitive intervention.

101

CLINICAL EPIDEMIOLOGICAL ANALYSIS OF 309 ERCPs PERFORMED IN NOVA SCOTIA IN 2006 FOR CHOLEDOCHOLITHIASIS AND GALLSTONE PANCREATITIS. *M. Molinari.* Dalhousie University, Halifax, NS.

The ideal management of choledocholithiasis and gallstone pancreatitis is controversial. With the improvement of diagnostic imaging studies of the biliopancreatic duct, retrograde cholangiopancreatography (ERCP) should ideally be performed only as a therapeutic modality. Referral patterns for

ERCP and patient management are influenced by resources and location. Limited information is currently available for clinical use and results of ERCP in Atlantic Canada. The aim of this study was to assess the diagnostic, therapeutic and success rates of ERCP performed in a high-volume tertiary medical centre in Nova Scotia.

A retrospective observational study was performed over a 1-year period (January 1 to December 31, 2006) at the Queen Elizabeth II Hospital. ERCP data of 565 procedures were reviewed by 2 independent investigators and entered into computerized databases. All data discrepancies were analyzed and resolved. Demographic characteristics, indications for ERCP, interventions, diagnosis and outcomes were captured. Procedures were then divided into 2 groups: therapeutic or diagnostic. Therapeutic ERCPs were defined when successful stone extraction or sphincterotomy for sphincter dysfunction were obtained.

Within the 12-month period, 309 ERCPs were carried out for presumed choledocholithiasis (273, 88.3%) or gallstone pancreatitis (36, 21.7%) on a population with mean age of 62 (standard deviation 17.9) years. Therapeutic ERCP was performed in 175 (64.1%) patients with choledocholithiasis and in 12 (33.4%) individuals with a pre-ERCP diagnosis of pancreatitis. Inability to cannulate the papilla was observed in 8 (2.9%) patients with choledocholithiasis and 4 (11.1%) individuals with a pre-ERCP diagnosis of pancreatitis.

Because ERCP is an invasive procedure, ideally it should be indicated only as therapeutic modality. Our findings suggest that in Atlantic Canada, diagnostic ERCPs are still performed in 35.9% of cases of choledocholithiasis and 66.6% of gallstone pancreatitis. Implementing better referral patterns and patient selection would optimize resources and decrease complication rates for ERCP in the Maritimes.

102

IS BIOPSY NECESSARY IN THE MANAGEMENT OF LIVER LESIONS? *P. Renfrew, M. Smith, T. Hamilton, M. Molinari, M.J. Walsh.* Department of Surgery, Queen Elizabeth II Health Sciences Centre, Dalhousie University, Halifax, NS.

Our aim was to investigate whether biopsy of liver lesions is necessary in their management. The majority of liver lesions found either incidentally on imaging or with screening follow-up for a history of malignancy are a common occurrence. The management of these lesions can be a challenging clinical problem. This usually involves further imaging, blood work and the formulation of a treatment plan.

We conducted a retrospective chart review of 201 patients presenting with liver lesions or biliary strictures from July 2004 to June 2007. For each patient we assessed whether imaging modalities (ultrasound [U/S], computed tomography [CT], magnetic resonance [MR]), tumour markers (CA 19-9, CEA, AFP) or liver biopsies were conducted. We then examined whether these investigations had significant impact on the treatment for these patients.

Of the 201 patients, 104 (52%) had U/S, 181 (90%) had CT and 55 (27%) had MR imaging. A total of 128 (64%) had blood work for tumour markers, and 29 (14%) patients had liver biopsies. After the initial clinical assessment, 72 (36%) patients required further imaging to facilitate diagnosis and characterization of the lesion before treatment. However, with

further imaging, only 2 patients required liver biopsies for diagnosis. There were 109 (54%) patients that received treatment either in the form of a surgical intervention, referral to medical oncology, transarterial chemoembolization (TACE) or radio frequency ablation (RFA). For those receiving treatment, the majority (85 patients) did not have a liver biopsy. Additionally, there was a disparity between the biopsy result and the final pathologic diagnosis in 4 of 29 (14%) cases; in comparison, 16 of 201 (8%) cases were misdiagnosed radiologically.

Radiological modalities and tumour markers are sufficient for diagnosing and managing the vast majority of liver lesions. A hepatobiliary surgeon should be involved in the triage of these lesions, including the need for biopsy. It is a rare occurrence that biopsy of liver lesions is ever necessary.

103

SOCIETAL REINTEGRATION AND ECONOMIC IMPLICATIONS FOLLOWING ORTHOTOPIC LIVER TRANSPLANT. *M. Molinari.* Dalhousie University. Halifax, NS.

Data on the impact of orthotopic liver transplant (OLT) on patients' integration in their communities and its financial consequences at a personal and familial level are lacking. Primary aims of this study were to assess the employment rate, productivity and activity index of patients after OLT in Atlantic Canada. From September 2006 to January 2007, a cross-sectional study was performed using validated Work Productivity and Societal Reintegration questionnaires. Participants were interviewed by phone or during follow-up visits and were adults at least 3 years post-OLT, without communication impairments. All data were prospectively collected. Categorical data were analyzed by χ^2 and Student's *t* test for continuous variables; *p* values less than 0.05 with 2-tail distribution were considered significant. Among the eligible 158 patients, 47 were randomly selected. Forty-five (95%) participated and 2 declined for personal reasons. Fifteen patients (33%) were employed full time and 12 (52%) were employed in the same position as before OLT. Thirteen individuals (28%) were on disability while the remaining were students or housekeepers. Eleven patients (24%) had retired. After OLT, 19 patients (42%) experienced financial restrictions preventing access to care or necessary medications due to significant reduction in their annual personal (\$28300 v. \$26500, *p* < 0.005) and household income (\$44000 v. \$43700, *p* < 0.05). Overall, 77% of patients reported that OLT had a negative impact on their financial status in comparison with their pre-OLT status (*p* < 0.005). However, the productivity and activity index showed overall acceptance of their current societal role, and sequelae of OLT had little impact on activities of daily life at this time. In Atlantic Canada, patients undergoing OLT for end-stage liver disease have an employment rate of 33%, consistent with the available literature. Socially, 84% of patients are satisfied with their current role in society and are able to perform most daily activities without difficulty.

104

EARLY SURROGATE END POINTS PREDICT LONG-TERM OUTCOMES IN ORTHOTOPIC LIVER TRANSPLANTATION. *M. Boutros, M. Cantarovich, S. Paraskevas, M. Deschenes,*

P. Ghali, P. Wong, M. Fernandez, P. Chaudhury, P. Metrakos, J. Tchervenkov, J. Barkun. Division of General Surgery, Department of Surgery, Multi-Organ Transplant Program, Division of Gastroenterology, Department of Medicine, McGill University Health Centre, Montréal, Que.

As graft and patient survival continue to improve, there is an increasing need for early end points that are predictive of long-term outcomes in orthotopic liver transplantation (OLT). We propose dynamic changes in renal function as well as the use of clinical benefit states (CBS), a composite measure combining outcomes as "syndromes" rather than isolated complications, to predict long-term outcomes in OLT.

Using the MUHC-Transplant database, we identified all OLT recipients, excluding retransplants. We assessed the association between early changes in renal function and rejection with long-term outcomes. In addition, we created CBS defined as combinations of renal dysfunction (dichotomized creatinine-clearance [CrCl]) and rejection (liver biopsies) post-OLT. All relationships were assessed using Student's *t* test and χ^2 analyses.

Four-hundred and ninety-six OLT recipients, over a 17-year period (1990–2007), had a mean age of 55 years, a mean MELD of 23.2 and 69% were male. Long-term renal function: At 1 month, the best predictor of CrCl at 1 year was a decline in CrCl \leq 30% (66.1 v. 58.2 mL/min/1.73 m², *p* < 0.01). At 6 months, however, the best predictor of CrCl until 4 years was a CBS defined by a decline in CrCl \leq 20% and mild rejection (69.1 v. 62.3 mL/min/1.73 m², *p* < 0.023). Graft survival (GS): At 1 month, the best predictor of GS was a decline in CrCl \leq 30% (OR 1.91, CI 1.13–3.22). However at 3 months, the best predictor of GS was a CBS defined by a decline in CrCl \leq 50% and moderate rejection (OR 2.67, CI 1.29–5.56). Similarly, the best predictor of patient survival at 1 month is a CBS defined by a decline in CrCl \leq 40% and moderate rejection (OR 2.02, CI 1.20–3.40). Finally, hepatitis-C recurrence was most strongly predicted by a CBS at 3 months post-OLT defined by a decline in CrCl \leq 50% and mild rejection (OR 2.04, CI 1.02–4.25).

Certain key declines in early renal dysfunction are associated with long-term graft and patient survival. However, short-term combined end points defined as CBS are most strongly associated with traditional long-term clinical outcomes.

105

QOL EVALUATION OF PATIENTS UNDERGOING TACE FOR HCC. *M. Molinari.* Dalhousie University, Halifax, NS.

Two randomized controlled studies have shown that for patients who are not candidates for hepatic resection or liver transplantation for hepatocellular carcinoma (HCC), significant survival benefit is obtained by the use of transcatheter arterial chemoembolisation (TACE). Still, studies on the quality of life (QOL) of these patients are scarce.

The aim of this study was to assess QOL of a prospective cohort of patients treated by TACE for HCC in North America.

From January 2006 until September 2007, a consecutive cohort of 26 patients was diagnosed with nonresectable HCC. TACE was performed by selective chemoembolisation of the tumour(s) with doxorubicin and polyvinyl alcohol (PVA)

particles every 3 months. The World Health Organization Quality of Life (WHOQOL)-BREF questionnaire was used to collect data on the QOL of all patients before undergoing TACE and every 3 months after treatment. Patients' demographic characteristics, etiology of underlying cirrhosis, tumour size and location were collected prospectively.

The average population age was 60.4 (standard deviation [SD] 7.5) years old; 23 were males and 2 females. Average serum α -feto protein was 137 μ g/L (SD 43 378), tumour size was 7.1 cm (SD 3.9) and the average number of TACE sessions was 1.2 (range 1–3). Overall QOL score before TACE was 89 (SD 13.7), at 3 months was 96 (SD 8.1), at 6 months was 91 (SD 15.7) and at 9 months was 107 (SD 17.6). Before TACE, the average physical health scores was 20 (SD 4.5), at 3 months was 21 (SD 4.1), at 6 months was 22 (SD 3.7) and was 25 (SD 2.8) at 9 months ($p = NS$). The interval psychological health, social relationships and environment scores are reported in Table 1 ($p = NS$).

Table 1, abstract 105. QOL health scores of patients undergoing TACE for HCC

Health	Testing period; mean score (SD)			
	Before TACE	3 mo	6 mo	9 mo
Psychological	20.2 (2.7)	20.7 (2.9)	20.6 (2.8)	19 (3.4)
Relationships	10.4 (1.8)	10.4 (2.9)	10.8 (2.1)	10.3 (2.8)
Environment	29.8 (4.4)	30.7 (5.8)	31.8 (3.8)	32.6 (3.0)

SD = standard deviation; HCC = hepatocellular carcinoma; QOL = quality of life; TACE = transcatheter arterial chemoembolization.

In this study, the overall QOL of patients undergoing TACE for HCC remained stable over time and appears not to be affected by the number of embolic sessions performed. These findings confirm results from previous studies from Asian centres.

106

BILE DUCT INJURIES ASSOCIATED WITH LAPAROSCOPIC CHOLECYSTECTOMY: TIMING OF REPAIR DETERMINES LONG-TERM OUTCOMES. *S.C. Chow, A.K. Sahajpal, E. Dixon, P.D. Greig, S. Gallinger, A.C. Wei.* Hepatobiliary and Pancreatic Surgical Group, Division of General Surgery, Toronto General Hospital, Mount Sinai Hospital, University of Toronto, Toronto, Ont.

Bile duct injury is a serious complication following laparoscopic cholecystectomy (LC). The objective of this study is to report a large institutional experience with laparoscopic cholecystectomy-associated bile duct injury (LC-BDI).

Patients who underwent a surgical repair of a LC-BDI between 1992 and 2007 were identified by retrospective chart review at 2 university-affiliated hospitals. Risk factors for postoperative complications were analyzed by univariate analysis.

Sixty-nine patients were identified, 24 men and 45 women, with a median age of 49 years. Thirteen immediate (within 72 hours of LC), 34 intermediate (between 72 hours and 6 weeks) and 22 late (after 6 weeks) LC-BDI repairs were performed. The LC-BDIs were Strasberg type: A in 1 (1%), D in 2 (3%), E1 in 22 (32%), E2 in 16 (23%), E3 in 22 patients (32%), E4 in 4 (6%) and E5 in 2 patients (3%). Forty-one

hepaticojejunostomies (59%), 24 choledochojejunostomies (35%), 3 right hepatic lobectomies with biliary reconstruction (4%) and 1 primary common bile duct repair (1%) were performed. The overall morbidity and perioperative mortality rates were 30% (21 patients) and 1% (1 patient), respectively. Twelve patients (17%) developed short-term complications; the most common was cholangitis, which occurred in 7 patients (10%). There was no significant relationship between timing of LC-BDI repair and perioperative morbidity ($p = 0.95$). The most frequent long-term complication was biliary stricture, which occurred in 10 patients (14%). Patients repaired in the intermediate period were more likely to develop biliary stricture than patients repaired in the immediate or late periods ($p = 0.03$).

The timing of LC-BDI repair was identified as an important determinant of long-term outcome. Intermediate period (between 72 hours and 6 weeks) LC-BDI repairs were associated with the development of postoperative biliary stricture. Thus LC-BDI repairs should be undertaken either in the immediate (within 0–72 hours) or late (> 6 weeks) period after cholecystectomy.

107

A RETROSPECTIVE ANALYSIS OF HEPATOCELLULAR CARCINOMA PATIENTS: TREATMENT MODALITIES AND SURVIVAL. *P.A. Schumacher, J. Powell, A.J. Rowe, A. Buczkowski, S. Ho, C.H. Scudamore, A. Weiss, S.W. Chung.* Vancouver General Hospital, University of British Columbia, Vancouver, BC.

Existing treatment modalities for hepatocellular carcinoma (HCC) include resection, radiofrequency ablation (RFA), ethanol injection (EI), chemotherapy (CTx) and transarterial chemoembolization (TACE). This study was performed to evaluate the survival benefit of these modalities as primary or salvage therapy.

A retrospective review was conducted on 251 consecutive patients treated for HCC between 1996 and 2006 at Vancouver General Hospital (VGH) and the BC Cancer Agency (BCCA). Data on 247 patients for whom there was a complete data set were analyzed. Data were retrieved from clinical charts and information systems from VGH and BCCA. All patients underwent primary treatment by resection, RFA, EI, CTx, TACE or observation. A subset with persistent or recurrent disease underwent salvage therapy by 1 of these modalities. Survival analysis was performed using standard statistical methods.

Mean overall survival was 76.8 months. Factors associated with poorer survival were presence of symptoms at diagnosis, chronic HCV versus HBV infection, lack of antiviral therapy in early TNM stage HBV/HCV patients, portal venous thrombosis (PVT), poorer Child–Pugh status and higher

Table 1, abstract 107. Survival of patients undergoing treatment for hepatocellular carcinoma

Survival	Symp		PVT		Child-Pugh		TNM Stage		Primary treatment					
	No	Yes	No	Yes	A	B+C	I+II	III+IV	Res	RFA	EI	CTx	TACE	Obs
Mo	92.1	30.7	80.6	20.3	82.8	25.5	76.2	35.4	93.2	66.2	80.1	24.9	47.4	31.4

CTx = chemotherapy; EI = ethanol injection; Obs = observation; PVT = portal venous thrombosis; Res = resect; RFA = radiofrequency ablation; Symp = symptoms; TACE = transarterial chemoembolization

TNM stage (all $p < 0.001$). Among primary treatment modalities, survival was comparable for resection, RFA and EI and significantly poorer for CTx, TACE or observation. Among salvage treatment modalities, RFA of dominant lesions was associated with improved survival (Table 1).

These results underscore the value of early detection of HCC in at-risk patients. The data suggest that patients may be stratified based on tumour stage and underlying liver function to curative intent or disease control strategies to optimize survival and minimize operative risk.

108

HEPATIC RESECTION IN CANADA FROM 1995 TO 2004: RATE, GEOGRAPHIC VARIATION AND HOSPITAL VOLUMES.
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Liver resection is the only curative therapy for hepatic malignancy, both primary and secondary. Despite this, the rates of hepatic resection across Canada are unknown. This study sought to describe patient characteristics and crude outcomes along with the rate and regional variation of hepatic resection in Canada, its provinces and census divisions from 1995 to 2004.

Discharge data from all hospitals across Canada except

Quebec were obtained from the Canadian Institute for Health Information for 1995–2004. All patients undergoing a hepatic resection were identified using ICD 9 and 10 codes. Rates and regional variations in rates of hepatic resection were calculated and reported by province and census division using the postal code conversion file. Baseline demographics, patient characteristics and outcomes are reported.

The national age- and sex-adjusted hepatic resection rate per 100 000 people aged ≥ 18 years increased from 3.22 in 1995 to 5.86 in 2004. Provincial rates in 2004 varied from a low of 2.88 in Prince Edward Island to a high of 8.91 in the Territories. For census divisions, rates varied even more from a low of 0 in 76 divisions to a high of 94.85. There were 247 hospitals performing hepatic resections across Canada, with a range of 1–1185 cases per hospital. Eighty-nine percent of cases took place at high-volume centres (defined as those hospitals with case volumes in the 4th quartile). There was a progressive decline in the in-hospital mortality rate over the study period.

There is significant regional and geographic variation in the rates of hepatic resection across Canada. Disparity in access to centres performing hepatic resection may partially explain these results. Our study also demonstrates a pattern of regionalization which may be due to growing evidence that high-volume centres have superior outcomes for complex procedures.

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109

PHASE II STUDY OF REGIONAL TREATMENT FOR PERITONEAL CARCINOMATOSIS. *K. Lamuke, L. Mack, W. Temple.* Departments of Surgery and Oncology, University of Calgary, Calgary, Alta.

The objective of the current study was to assess the outcomes of cytoreductive surgery (CS) combined with hyperthermic intraperitoneal chemotherapy (HIPEC) and early postoperative intraperitoneal chemotherapy (EPIP) performed at our centre.

Between February 2000 and January 2008, 101 consecutive patients with gastrointestinal carcinomatosis, without distant metastases and good functional status, were treated with the intent to perform CS + HIPEC and EPIP. Outcomes including patient and tumour characteristics, operative details, complications and disease-free (DFS) and overall survival (OS) were recorded in a prospective database.

Eighty-two of 101 patients (82%), median age 49 (18–77) years, had a completeness of cytoreduction (CCR) score of 0 (no residual macroscopic tumour), 7 had a CCR-1 (disease < 2.5 mm) and 12 had a CCR-2 (disease ≥ 2.5mm). Pathologic diagnoses included tumours of the appendix (55), colon/rectum (31), mesothelioma (5), primary peritoneum (4), small bowel (3), ovary (2) and stomach (1). Seventy-two (71%) patients had a peritoneal carcinoma index (PCI) of > 13 at the time of surgery. Eighty-five (84%) patients received HIPEC and 84 (83%) received HIPEC and EPIP. Median estimated blood loss was 1200 (0–4800) mL and mean red blood cells transfused was 1 (0–17) unit. Median operating time was 390 (63–690) minutes, 44 (44%) patients required intensive care unit care and median length of stay in hospital was 21 (7–54) Days. There were 4 deaths (4%) out of 101 patients. Thirty-nine (39%) patients experienced a major complication (grade III, IV or V). The rate of reoperation was 12%; anastomotic leak rate was 5%. Group median OS was 18 (1–86) Months. Median DFS and OS was 14 (2–86) months and 18 (1–86) months for appendix tumours, respectively; 8.5 (5–31) months and 12.5 (1–46) months for colonic tumours, respectively.

CS + HIPEC and EPIP for gastrointestinal carcinomatosis is feasible. Morbidity and mortality rates at our centre appear comparable to those in the literature.

110

LAPAROSCOPY FOR THE MANAGEMENT OF GASTRIC CANCER: A SYSTEMATIC REVIEW AND META-ANALYSIS. *T.K. Asano, A. Bouchard, R.P. Boushey, E.C. Poulin, J. Mamazza.* Department of Surgery, The Ottawa Hospital, University of Ottawa, Ottawa, Ont.

The purpose of this study was to conduct a systematic review

to explore the role of laparoscopy for the management of gastric cancer.

Controlled clinical trials (CCTs) up to February 2008 were identified, when laparoscopic gastrectomy for adenocarcinoma was compared with open and when staging laparoscopy was compared with a predefined gold standard (pathologic/operative staging) in addition to conventional staging modalities. Primary outcomes included oncologic factors, 5-year overall survival, 30-day survival and major perioperative complication rates when laparoscopy was used as an intervention, and sensitivity and specificity when used for staging. Secondary outcomes assessed additional perioperative outcomes. Two reviewers independently extracted data and assessed trial quality. The data were statistically combined if clinically and statistically reasonable.

Four randomized controlled trials with 162 subjects met the inclusion criteria and compared laparoscopic versus open subtotal gastrectomy for cancer. One trial reported that the 5-year overall survival (relative risk [RR] 0.97, 95% confidence interval [CI] 0.70–1.34) and recurrence rate (RR 1.06, 95% CI 0.53–2.12) did not differ significantly between the 2 operative approaches. The combined 30-day survival from 3 trials did not demonstrate a statistically significant difference (RR 1.04, 95% CI 0.92–1.17). The combined results from 4 trials noted a nonstatistically significant reduction in the number of major complications for laparoscopic subtotal gastrectomies compared with open (RR 0.41, 95% CI 0.12–1.36). Three CCTs with 429 subjects met the inclusion criteria for assessing staging laparoscopy for gastric cancer. Overall, staging laparoscopy identified distant metastases that were not identified in preoperative staging computed tomography for 18%–30% of the subjects.

There is some level I evidence for gastric cancer that a laparoscopic approach compared with open can achieve similar long-term oncologic outcomes. There is some level II evidence that laparoscopy provides additional information to that gained from conventional staging modalities for advanced gastric cancers.

111

PROCESSES OF CARE AFTER COLORECTAL CANCER SURGERY IN ONTARIO. *J.C.C. Tan, N.N. Baxter, S. Gallinger, A. Kiss, D. Hodgson, C.H.L. Law.* University of Toronto, Institute for Clinical Evaluative Sciences, Toronto, Ont.

There is a lack of knowledge about factors associated with surveillance processes of care following curative colorectal cancer (CRC) resection. We sought to explore potential factors in a large population.

All patients diagnosed with CRC in Ontario from 1996 to 2001, aged 18–80 years were identified from the Ontario Cancer Registry. Patients who did not undergo a primary colon resection, who had synchronous metastases or who died within 1 year of resection were excluded. Linked hospital discharge abstracts and physician billings were used to examine general surgeon and medical oncologist visits, endoscopy (colonoscopy, sigmoidoscopy) and body imaging (computed tomography [CT], ultrasound) among patients who were alive with no evidence of relapse at follow-up year 5. Logistic regression was used to explore factors associated with endoscopy and body imaging, including patient demographics, Charlson comorbidity, mean neighbourhood income quintile, urban or rural residence and time period of diagnosis.

Among 12 804 potentially cured CRC patients eligible for follow-up, 8804 patients were alive and had no evidence of relapse after 5 years of follow-up. In follow-up years 2–5, 1643 (18.7%) had no general surgery visits, while more than half (4464, 50.7%) had no medical oncology visits. Nearly one-third (2760, 31.3%) did not receive any body imaging in years 2–5, while only 588 (6.7%) did not receive colon endoscopy in the entire follow-up period. On multivariable analysis, receipt of at least 1 endoscopic examination was associated with higher income quintile (odds ratio [OR] 1.5, 95% confidence interval [CI] 1.2–2.0) and diagnosis between 1999 and 2001 (OR 1.4, 95% CI 1.2–1.6). Receipt of endoscopy was negatively associated with high Charlson comorbidity score (OR 0.7, 95% CI 0.5–0.9). Receipt of body imaging was associated with general surgery (OR 1.8, 95% CI 1.5–2.3) and medical oncology (OR 1.9, 95% CI 1.5–2.3) follow-up, and diagnosis from 1999 to 2001 (OR 1.3, 95% CI 1.1–1.6). Body imaging was negatively associated with increasing age (OR 0.98, 95% CI 0.97–0.99).

Many CRC patients did not receive any postresectional body imaging, while it appeared most patients received at least 1 follow-up endoscopy. Further examination of patient and provider factors may identify addressable gaps in CRC follow-up care.

112

PHYSICIANS' AWARENESS AND ATTITUDES TOWARD DECISION AIDS FOR CANCER PATIENTS. *C. Brace, S. Schmocker, H. Huang, C. Victor, R.S. McLeod, E.D. Kennedy.* Departments of Surgery, Toronto General Hospital, Mount Sinai Hospital, University of Toronto, Toronto, Ont.

Patient decision aids are evidence-based tools that facilitate shared decision-making and significantly improve patient knowledge and satisfaction and reduce patient anxiety and decisional conflict. While considered optimal, decision aids are not widely used in clinical practice for treatment decisions for cancer.

To determine: (1) physician awareness of and use of decision aids, (2) the factors that physicians perceive as the major barriers toward the use of decision aids and (3) which physician factors are predictive of the use of decision aids in clinical practice.

The design of this study was a mailed, cross-sectional survey of general surgeons, medical oncologists and radiation oncologists in Ontario. The survey consisted of 14 items evaluated on a 5-point, categorical scale.

The overall response rate was 65.5% (477/728). The

majority of the participants were male and working in community hospitals for over 10 years. Overall, 68.6% (326/475) of the respondents were aware of what decision aids were and 45.8% (216/472) were aware of decision aids relevant to their practice. However, only 24.0% (113/471) were currently using decision aids. The main barriers to the use of decision aids reported by the respondents were: lack of awareness (65.8%), lack of resources (27.0%) and lack of time (24.7%). Multivariate analysis showed specialty to be the only physician factor influencing the use of decision aids (medical oncology; odds ratio 2.71, 95% confidence interval 1.33–5.54, $p = 0.006$).

Approximately one-third of physicians treating cancer patients are not aware what decision aids are and only 24.0% are currently using decision aids in clinical practice. Future studies assessing the decisional support needs of cancer care physicians and patients are required. Furthermore, strategies to increase physician awareness and knowledge about decision aids may facilitate shared decision-making and improve patient outcomes with respect to decision-making for cancer treatment.

113

LONG-TERM FOLLOW-UP OF A PROSPECTIVE TRIAL OF PREOPERATIVE EXTERNAL-BEAM RADIATION AND POSTOPERATIVE BRACHYTHERAPY FOR RETROPERITONEAL SARCOMA. *L.A. Mikula, P.F. Ridgway, C.N. Catton, J.J. Jones, B. O'Sullivan, M.A. Ko, C.J. Swallow.* University of Toronto Sarcoma Group, Princess Margaret Hospital, Mount Sinai Hospital, Toronto, Ont.

This prospective trial examines the long-term impact of preoperative external-beam radiation (XRT) and postoperative brachytherapy (BT) on survival in retroperitoneal sarcoma (RPS).

Historically, 5-year survival rates following resection alone are 50% or less, and most deaths are due to local failure. Radiation is of proven benefit in extremity sarcoma but its use in RPS remains controversial. Preoperative XRT offers several potential advantages over postoperative XRT for RPS.

Patients with RPS who presented to Princess Margaret Hospital in Toronto, Ontario, between June 1996 and October 2000 were entered into a prospective trial of combined preoperative XRT and postoperative BT. Survival curves were calculated according to the Kaplan–Meier method. Outcome measures included overall (OS) and recurrence-free survival (RFS) and treatment-related toxicity. Median follow-up is 89 months. Statistical significance was set at $p < 0.05$, 2-tailed.

Fifty-five patients were enrolled in the study, of whom 40 completed preoperative XRT and underwent complete gross resection. These 40 patients are reported on here. Twenty-two had high-grade sarcomas, and 11 had recurrent disease at presentation to our centre. Nineteen patients received postoperative BT and 21 did not. Five- and 10-year OS were 75% and 63%, respectively. Five- and 10-year RFS were 69% and 52%, respectively. There was no difference in OS or RFS between patients who received BT and those who did not. XRT was well tolerated, with RTOG scores ≤ 2 in all patients. In the group of 19 patients who received BT, 5 (25%) developed life-threatening acute treatment-related toxicity and 6 (30%) developed chronic toxicity (v. 1 and none, respectively, of 21 in the no BT group).

The survival rates achieved with combined management of RPS in this trial compare favourably to historical reports for resection alone. Preoperative XRT was well tolerated, while BT was associated with significant toxicity and did not confer any survival advantage. Neoadjuvant XRT followed by complete surgical resection may improve local control and survival in RPS, without increasing acute or chronic toxicity.

114

TRAINING GENERAL SURGERY RESIDENTS IN BREAST ONCOLOGY: RESULTS OF A CANADIAN RESIDENCY PROGRAM SURVEY. *T.D. Cil, F.C. Wright, C.M.B. Holloway.* Department of Surgery, University of Toronto, Toronto, Ont.

Improved 5-year survival in breast cancer is linked to increased surgical experience and higher volumes of breast surgery. The purpose of this study is to evaluate the clinic exposure and operative experience that surgical residents receive in Canadian general surgery programs.

All Canadian general surgery residents (excluding Quebec, $n = 367$) were sent a 20-item questionnaire to characterize their experience with different breast surgical procedures and clinics. A total of 162 residents from 12 programs responded (44%) with an even distribution from all postgraduate years (PGY). Residents had the most breast surgery experience in PGY-2 and -3. Almost 40% of residents performed ≤ 1 breast procedure per month in their most recent year of training. Only 34% attended more than 1 breast clinic/month. Lumpectomies were the most commonly performed operation (mean 20.7/y) with very few (1/y) duct excisions. Ninety-three percent of all residents were exposed to sentinel lymph node biopsy (SLNB), with senior residents performing a total average of 21 SLNB. Sixty-seven percent felt adequately trained in this procedure. Half of the residents cited the 2 biggest barriers to obtaining more breast surgical and clinical experience as "not enough time" and "lower priority cases." Eighty-two percent planned to treat breast disease in their future practice.

Exposure to breast oncology is a key requirement for all general surgical trainees. Although residents receive varied experience in many surgical aspects of treatment, their role in clinical decision-making is an important area that needs to be explored. Since the treatment of breast disease is an integral part of most general surgeons' practices, educators must ensure that the quality and quantity of residency training in this area is sufficient to provide optimal care.

115

CHARACTERIZATION OF COLON CANCER STEM CELLS AND THE ROLE OF THE BMP PATHWAY. *C.A. O'Brien, A. Kreso, S. Gallinger, J.E. Dick.* Institute of Medical Science and Department of Medical Genetics, University of Toronto, Toronto, Ont.

A central question in cancer biology is whether every cell has equal potential to sustain the tumour or whether tumours are organized as hierarchies sustained by a subset of cancer stem cells (CSC). We previously found that colon cancers possess a subset of CSC, providing evidence that colon cancer adheres to the CSC model: fractionation of colon cancer cells based on CD133 expression enriched for cell subset where 1 in 262 CD133⁺ cells represented a CSC. In contrast, even large numbers of CD133⁻ cells did not generate tumours.

Previous studies have examined molecular perturbations in the context of bulk tumour cells, however, we now have the ability to study pathways in the context of CSC. BMP-4 expression is known to be increased in colonic adenocarcinomas, as compared with normal mucosa, and expression can be inversely correlated with tumour differentiation status. To study the effect of BMP4 on colon cancer we injected 2×10^5 human colon cancer cells subcutaneously into NOD/SCID mice divided into 4 groups ($n = 5$ per group): 1) no treatment, 2) heparin-coated acrylic beads, 3) BMP4 100 ng and 4) Noggin 100 ng (BMP4 inhibitor), both conjugated to heparin-coated acrylic beads. The experiment was repeated a total of 3 times. Once tumour volume reached 0.5 cm³, weekly intratumoural injections were carried out until xenografts reached 1 cm³, at which time mice were sacrificed. The administration of Noggin resulted in tumour regression in 10 of 15 mice. In contrast, the growth rates of the BMP4-treated xenografts did not differ significantly from the 2 control groups. The CD133 fraction in the BMP4-treated and control xenografts was analyzed for 1 of the experiments and demonstrated that the CD133⁺ fraction was significantly elevated in the BMP4-treated tumours (CD133⁺ = 27.15%), as compared with the control tumours (CD133⁺ = 0.36%).

These initial experiments suggest that the BMP pathway plays a central role in colon biology, and that inhibition of the pathway impairs growth, while the administration of BMP4 may have a role in expanding the CSC subset. Further work is being carried out to determine if these results can be reproduced with other colon cancers and to study the molecular mechanisms underlying our findings.

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