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Abstracts

Real-time electromagnetic navigation in breast-conserving surgery: clinical feasibility study on palpable tumours. *Gabrielle Gauvin, MD^{*}; Tamas Ungi, MD, PhD^{†*}; Caitlin T. Yeo, MD^{*}; Andras Lasso, PhD^{†*}; John Rudan, MD^{†*}; Ross Walker, MD^{*}; Gabor Fichtinger, PhD^{†*}; C. Jay Engel, MD^{*}.* From the ^{*}Department of Surgery, Queen's University, Kingston, Ont.; and the [†]School of Computing, Queen's University, Kingston, Ont.

Background: Breast cancer is treated in its early stages with breast-conserving surgery. Current strategies still lead to a re-excision rate for positive margins as high as 47%. We proposed using NaviKnife, a real-time electromagnetic (EM) navigation system connected to a wire-localization needle and an ultrasound to define the desired tumour resection margins and allow the surgeon to follow its movement during surgery. The goal of this prospective phase 1 study was to assess the feasibility of using an EM navigation system in the operating room. **Methods:** Female patients with a single palpable tumour were recruited to undergo a partial mastectomy. Intraoperatively, an ultrasound was used to define the tumour contour, which was displayed on a computer screen using NaviKnife navigation. Feasibility was assessed via 3 components: confirmation of safety and sterility, measurement of the duration of the operation and tumour contouring, and completion of surgeon questionnaire. **Results:** Eleven patients (mean age 57.8 yr) with breast cancer ($n = 9$) or a benign breast lesion ($n = 2$) were recruited. The mean operative duration was 74.3 (range 48–94) minutes for cases of partial mastectomy with sentinel node biopsy ($n = 9$) and 35.5 (range 29–42) minutes for the partial mastectomy alone ($n = 2$). Mean tumour contouring time was 8.44 (range 5–12) minutes. There were no EM-specific complications or breaches in sterility during surgery. Feedback questionnaires stated that NaviKnife navigation was easy to use and did not interfere with the surgical procedure. **Conclusion:** This study demonstrates the NaviKnife system is feasible and safe to use intraoperatively in breast-conserving surgery.

Intraoperative margin assessment in wire-localized breast-conserving surgery: a population-level comparison of techniques. *Alison Laws, MD^{*}; Mantaj S. Brar, MSc MD[†]; Antoine Bouchard-Fortier, MSc, MD^{*}; Brad Leong, BSc[‡]; May Lynn Quan, MSc, MD^{*}.* From the ^{*}Foothills Medical Centre, University of Calgary, Calgary, Alta.; [†]Mount Sinai Hospital, University of Toronto, Toronto, Ont.; and [‡]Alberta Health Services, Holy Cross Centre, Calgary, Alta.

Background: Positive margins occur in up to 40% of wire-localized breast-conserving surgeries (BCS). Various methods of intraoperative margin assessment have been shown to improve margin status; however, optimal modalities remain unclear. Our study aims to determine the effect of intraoperative margin assessment techniques on final margin status. This is the first study to directly compare multiple modalities at a population level. **Methods:** All patients who underwent wire-localized BCS for nonpalpable invasive breast cancer from January 2010 to December 2014 in Alberta were identified using WebSMR, a synoptic OR reporting database. Multivariable logistic regression was used to assess the effect of any margin assessment technique on the risk of a positive margin, controlling for a priori-identified confounders. In addition, an interaction test was performed, followed by a

secondary analysis to assess the effect of individual modalities. **Results:** We analyzed 1649 patients who met inclusion criteria. Some form of margin assessment was performed in 1165 (70.7%) cases. The use of specific modalities included 560 (33.9%) gross assessment by pathologist, 400 (24.3%) specimen mammography, 55 (3.3%) frozen section, 10 (0.8%) intraoperative ultrasonography and with the remaining 140 (8.4%) a combination. Controlling for known confounders, use of any margin assessment technique was not associated with a lower risk of a positive margin (OR 0.79, 95%CI 0.54–1.16, $p = 0.22$). On secondary analysis, both gross assessment by pathologist and frozen section analysis were associated with a lower risk of a positive margin (gross assessment by pathologist: OR 0.51, 95%CI 0.34–0.75, $p = 0.001$; frozen section: OR 0.43, 95%CI 0.19–0.98, $p = 0.046$), whereas all other modalities did not demonstrate an effect. **Conclusion:** Overall, the use of any intraoperative margin assessment technique failed to improve margin status over wire localization alone. However, individually, both gross assessment by pathologist and frozen section analysis significantly reduced the odds of a positive margin.

Glove and instrument handling in cancer surgery: a survey of surgeons' beliefs and practices. *David Berger-Richardson, MD, CM^{†*}; Anand Govindarajan, MD, MSc^{‡§}; Rebecca A. Gladdy, MD, PhD^{†*}; J. Andrea McCart, MD, MSc^{†¶}; Carol J. Swallow, MD, PhD^{†*}.* From the ^{*}Division of General Surgery, Department of Surgery, University of Toronto, Toronto, Ont.; the [†]Institute of Medical Science, University of Toronto, Toronto, Ont.; the [‡]Lunenfeld-Tanenbaum Research Institute, Sinai Health System, Toronto, Ont.; the [§]Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, Ont.; and the [¶]Toronto General Research Institute, Toronto, Ont.

Background: It has been suggested that surgical gloves and instruments used during a cancer resection harbour malignant cells that can contribute to wound seeding and recurrence. This is unproven, and current beliefs and practices with respect to glove and instrument changing and the use of wound protectors are not evidence-based. To identify triggers to change, a survey was developed to explore surgeons' beliefs and practices regarding glove and instrument handling during cancer surgery. **Methods:** A survey was mailed to all 945 general surgeons listed in the public registry kept by the College of Physicians and Surgeons of Ontario (CPSO). Inclusion criteria for eligibility were 1) staff surgeon, 2) perform cancer resections, and 3) in active practice in Ontario. **Results:** In all, 459 surveys were returned (American Association for Public Opinion Research adjusted response rate: 46%). Respondent characteristics confirmed that the survey reached the target demographic, with composition of the cohort by years in practice, type of practice (academic, community) and fellowship training that reflected all Ontario general surgeons. Fifty-two percent of respondents reported that they change gloves during cancer resections with the intent of decreasing the risk of tumour seeding, and 40% reported that they change instruments for this purpose ($p < 0.01$ v. gloves). The most common rationale cited for changing gloves/instruments was “gut feeling” (42%), followed by “clinical training” (40%); “clinical evidence” was cited by only 3%. Seventy-three percent of respondents take measures to protect the wound during laparoscopic cancer resection (wound protector, specimen retrieval bag) versus 31% during open resection (wound barriers, irrigation)

($p < 0.01$). Respondents believe that gloves and instruments are equally likely to harbour malignant cells, but most do not believe that such retained cells contribute to tumour seeding. **Conclusion:** Among surgeons who perform cancer resections there is no consensus as to how gloves and instruments should be handled. There is a need to determine whether surgical gloves and instruments harbour malignant cells that are capable of seeding wounds.

Prognostic factors in determining the outcome of head and neck cutaneous melanoma. *Kristyn Buchko, BSc (Hons), K. Alok Pathak, MD.* From the Faculty of Health Sciences, University of Manitoba, Winnipeg, Man.

Background: Head and neck melanoma presents a unique problem in terms of complex anatomy and atypical nodal basin drainage, which makes sentinel lymph node biopsy challenging and obtaining wide surgical margins difficult. About 25%–35% of invasive melanomas are seen in the head and neck region. The purpose of this study was to evaluate surgical margins and other prognostic factors determining the oncological outcome of patients with invasive head and neck melanoma. **Methods:** We reviewed electronic and paper records of a historical cohort of 345 patients with invasive head and neck cutaneous melanoma seen in Manitoba between 1997 and 2012 who were treated with radical intent. Information was collected on tumour stage, margin status, treatment modality and pathological details. Disease-free survival (DFS) and disease-specific survival (DSS) were calculated using the Kaplan–Meier method and analyzed in a Cox proportional hazards model for independent variables using SPSS software version 22.0. **Results:** The mean age of patients at diagnosis was 65.6 ± 17.6 years; 63.5% of the patients were male. In total, 59.6% of the patients had stage I, 28.7% stage II, 9.0% stage III and 2.8% stage IV invasive melanoma. All patients underwent surgical resection, and 55 of 70 patients with T2 invasive melanoma underwent sentinel node biopsy. Eleven patients (20%) had positive sentinel nodes. DSS was 75% at 5 years and 66.7 at 10 years. Age of the patient at diagnosis ($p = 0.047$) and stage of disease ($p < 0.001$) had a significant, independent impact on DSS. Margin of resection did not have any significant influence on either DSS ($p = 0.347$) or DFS ($p = 0.348$). There was no difference in the oncological outcome of invasive head and neck melanoma excised with 1 cm or 2 cm margin. **Conclusion:** TNM stage and age at diagnosis were independent prognostic factors determining the oncological outcome of invasive melanoma of the head and neck region.

Impact of time from initial biopsy to definitive excision when residual melanoma is present. *Asblie Nadler, MD*;* *Karen J. Ruth, MSc*;* *Jeffrey Farma, MD*;* *Sanjay Reddy, MD*.* From the *Fox Chase Cancer Center, Department of Surgical Oncology, Philadelphia, Pa.; and the †Fox Chase Cancer Center Biostatistics and Bioinformatics Facility, Philadelphia, Pa.

Background: We examined the impact of time from initial biopsy to definitive excision — the surgical interval (SI) — for melanoma when residual melanoma (RM) is present in the final specimen. This study was undertaken to assess whether SI as it relates to RM affects prognosis. **Methods:** A retrospective review from 2009 to 2011 was performed. Fisher exact and Kruskal–Wallis tests were used to compare characteristics. Survival was estimated with

Kaplan–Meier methods and compared with the log-rank test. Cox proportional hazards regression was used to adjust for covariates. **Results:** A total of 179 patients with nonmetastatic cutaneous melanoma were included. The median age was 61 years; 51% were male ($n = 92$). All patients underwent radical excision of the primary lesion and 74% ($n = 132$) underwent sentinel lymph node biopsy. The median SI was 41 (range 8–1280) days. On final pathology, 45% ($n = 81$) had RM present. Recurrence-free survival (RFS) was significantly lower in patients with a longer SI (split at median ≤ 41 d for shorter SI v. > 41 d for longer SI) ($p = 0.035$). RFS at 24 months was 94.4% (95% CI 82.3–98.3) for a shorter SI and 83.5% (95% CI 68.6–91.8) for a longer SI. Overall survival (OS) at 24 months was 95.6% (95% CI 81.8–99.0) for shorter SI and 82.2% (95% CI 64.1–91.7) for longer SI ($p = 0.069$). RFS and OS did not differ by RM status. For SI and RM status in combination, patients who had RM and a longer SI had the lowest RFS at 72.9% (95% CI 44.5–88.4) compared with 92.9% (95% CI 84.3–96.9) for the other groups combined ($p = 0.022$). On multivariable analysis, adjusting for stage, age and depth, this was no longer significant (HR 2.99, 95% CI 0.90–9.98) ($p = 0.074$). **Conclusion:** Longer SI in the presence of RM trends toward worse RFS. Larger studies are needed to appropriately triage patients anticipated to have RM.

Total neoadjuvant therapy for pancreatic cancer: an institutional experience. *Asblie Nadler, MD;* *Francis S.W. Zib, MD, MSc;* *John Hoffman, MD;* *Elin Sigurdson, MD, PhD;* *Sanjay Reddy, MD.* From the Fox Chase Cancer Center, Department of Surgical Oncology, Philadelphia, Pa.

Background: There is increasing interest in the role of neoadjuvant therapy for patients with pancreatic cancer. Although adoption has been met with some resistance, some centres have strongly advocated its use, primarily because all patients are assured of receiving multimodal therapy and there is optimal surgical selection for those most likely to be cured. **Methods:** A retrospective review of an institutional database from 2005 to 2015 was performed. Patients who had undergone total neoadjuvant therapy (TNT), consisting of preoperative chemoradiation and systemic chemotherapy, for pancreatic adenocarcinoma followed by pancreatoduodenectomy were identified through the institution's cancer registry. Recurrence-free survival (RFS) and overall survival (OS) were calculated from the date of diagnosis. Statistical analysis was performed using SAS software. **Results:** A total of 88 patients were identified, 31 of whom met inclusion criteria. Sixty-one percent ($n = 19$) were male and the median age was 67 years. Five patients were considered resectable, 22 borderline resectable, and 4 unresectable at presentation. Twenty-nine percent ($n = 9$) of patients had a total of 11 vascular reconstructions (4 arterial, 7 venous) at the time of definitive surgery. Negative margins were obtained in 81% of patients. There were no deaths within 30 days of surgery, but there was 1 death within 90 days. The median follow-up was 35.2 (range 9.7–115.8) months, with 29% ($n = 9$) alive at the most recent follow-up. The median RFS was 21.3 months, with a 2-year and 5-year RFS of 42% and 14%, respectively. The median OS was 36.7 months, with a 2-year and 5-year OS of 68% and 27%, respectively. **Conclusion:** Total neoadjuvant therapy for pancreatic cancer offers favourable short- and long-term outcomes. It appears to be beneficial in ensuring patients complete multimodal treatment and in optimally selecting candidates for surgical resection.

Myosteatosi visible on preoperative CT scan is associated with reduced survival following resection of periampullary adenocarcinomas. *Jean-Michel Aubin, MD^{*}; Tariq Al-manasra, MD[†]; Elizabeth Tobola, MD^{*}; Santiago Salazar, BSc^{*}; Derek Leugner, BSc^{*}; Francis R. Sutherland, MD^{*}; Chad Ball, MD, MSc^{*}; Elijah Dixon, MD, MSc^{*}; Vickie Baracos, PhD[‡]; Oliver F. Bathe, MD, MSc^{*,†}.* From the ^{*}Department of Surgery, University of Calgary, Calgary, Alta.; the [†]Department of Medicine, University of Calgary, Calgary, Alta.; and the [‡]Department of Oncology, University of Calgary, Calgary, Alta.

Background: Cachexia is a common manifestation of pancreatic cancer and other periampullary adenocarcinomas. Two manifestations of cachexia that are measurable by CT scan are sarcopenia (low muscle bulk) and myosteatosi (fat infiltration of skeletal muscle). We postulated that sarcopenia and myosteatosi adversely affect perioperative outcomes and survival. **Methods:** In total, 123 patients who underwent a Whipple pancreaticoduodenectomy for pancreatic adenocarcinoma or a nonpancreatic periampullary adenocarcinoma had a preoperative CT scan available for analysis. Muscle diameters and attenuations were

measured at the level of the third lumbar vertebra. Sarcopenia was defined as muscle cross-sectional diameter below the 25th percentile, corrected by sex. Myosteatosi was defined as muscle attenuation below the 25th percentile. **Results:** Sarcopenia was not associated with any differences in complication rate or survival. Myosteatosi was associated with a higher incidence of delayed gastric emptying ($p = 0.002$). Myosteatosi was associated with reduced survival ($p = 0.0195$ on univariate analysis). On multivariate analysis, myosteatosi, high body mass index and pancreatic adenocarcinoma were associated with diminished overall survival. Factors significantly associated with myosteatosi included older age, sarcopenia, diabetes, markedly elevated CA 19-9 and higher Charlson comorbidity index. The coexistence of myosteatosi and sarcopenia was associated with particularly bad outcomes. **Conclusion:** Myosteatosi, but not sarcopenia, adversely impacts survival after resection of pancreatic and periampullary adenocarcinomas. Further investigation will be required to understand the tumour- and host-related factors that drive the infiltration of fat into skeletal muscle. We are currently evaluating skeletal muscle for associated transcriptional changes, and also analyzing the serum metabolome.