

COA Paper Session 12: Oncology •

Moderators Joel M. Werier, ON, and Paul Clarkson, BC

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Core Needle Biopsy is Highly Accurate in Diagnosing Bone and Soft-tissue Tumours

Piya Kiatisevi, Lerdsin General Hospital, Bangkok, Thailand; Torsten Nielsen, UBC; Malcolm Hayes, UBC; Peter L. Munk, UBC; Amy E. LaFrance, UBC; **Paul Clarkson**, UBC; Bassam A. Masri, UBC

Purpose: Core needle biopsy is increasingly accepted for the diagnosis of bone and soft-tissue tumours. Advantages over open biopsy include reduced morbidity, time and cost; however diagnostic accuracy remains a concern. Our objective was to assess and compare the diagnostic accuracy of core needle, open, and fine needle biopsies. **Method:** We reviewed 286 cases collected in a prospective database between 2004 and 2007. Of these, 229 had core needle, 32 open, and 25 fine needle biopsies. 230 had soft-tissue lesions, 56 had bone lesions. The results of these biopsies were compared to the final resection diagnosis for accuracy and, where inaccurate, any effects on management. **Results:** Ninety-two percent of the core needle, 100% of the open and 72% of the fine needle biopsies had adequate tissue to make a diagnosis. Of the adequate specimens, the accuracy of core/open/fine needle biopsy was 96%, 97% and 94% for determining malignant versus benign; of the correctly identified malignant lesions 97%, 100% and 80% were accurate for histological grade; and 79%, 84%, 59% for histological subtype. **Conclusion:** Core needle biopsy yields diagnostic results comparable to open biopsy for determining malignancy and grade in bone and soft-tissue tumours. Fine needle biopsy has a high inadequate sampling rate and should not be used for diagnosing bone and soft-tissue tumours. Given the reduced cost and morbidity associated with core needle biopsies we believe they should be used routinely for diagnosis where possible, and open biopsy reserved for situations where an inadequate specimen is obtained or core biopsy is not feasible.

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Gamma Probe Guided Surgery for Benign Bone Tumours: Surgical Results with Average Follow-up of 5 Years

Nanjundappa S. Harshavardhana, Queen's Medical Centre; Brian J.C. Freeman, Royal Adelaide Hospital; Alan C. Perkins, University of Nottingham; Ujjwal K. Debnath, Queen's Medical Centre

Purpose: Intra-op localisation of small nidus in Osteoid osteoma and Osteoblastomas is often difficult resulting in failed excision with persistent pain. We report two year follow-up results of the efficacy and reliability of using an intra-operative gamma probe in conjunction with fluoroscopy to aid resection in primary and revision surgeries. **Method:** Eight patients (6M; 2F) with a diagnosis of osteoid osteoma (7) and osteoblastoma (1) were seen at our centre. The mean age at presentation was 20.9 years (9–31y). The tumour was localised to cervical (2), thoracic(4) and lumbar (2) posterior

elements. All had back or neck pain of varying duration with a mean of 20 months (6-48mo). Three patients had failed treatments including CT-guided radiofrequency ablation in one and surgical excision under fluoroscopy in two. No case had previously utilised an intra-op gamma probe for localisation. All patients had work-up with plain X-rays, CT, MRI and 99 m Technetium bone scan to identify and localise the lesion. A pre-requisite for use of intra-op gamma probe was a positive pre-op bone scan. On the day of surgery, 600 MBq Tech HMDP (hydroxy-methylene-di-phosphate) was administered IV 3 hours prior to surgery. Fluoroscopy was used to confirm anatomical level, permanent mark made on skin and area exposed surgically. A 5 mm cadmium telluride (Cd Te) probe (which converts gamma radiation into electrical signal) and rate meter were used to scan the area containing lesion and counts per second(cps) recorded. The tumour nidus was then excised and cps from tumour bed and excised specimen recorded. **Results:** The mean follow-up was 5.85 years (2–12.3y). The mean cps for osteoid osteoma pre-excision was 203.8 (60-515), which fell to 72.5 (10-220) post-excision. The cps reduced from 373 to 40.5 post-operatively for Osteoblastoma. Complete excision was recorded every time and all patients reported characteristic disappearance of pre-operative pain. All had discontinued analgesic medication and returned to normal activity by three months. All patients were followed-up regularly when they filled NDI, ODI and SF-36. **Conclusion:** Gamma probe guided surgical excision facilitates accurate localisation of lesion, is less invasive and most importantly confirmation of complete excision of the tumour nidus consistently every time.

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Local Recurrence of Soft Tissue Sarcoma Following Primary Tumour Management by Musculoskeletal Oncology Teams

Sarantis Abatzoglou, McGill University Health; Abdurahman Adoubali, Hopital Maisonneuve-Rosemont; Cindy Wong, Mcgill University Health; Marc Isler, Hopital Maisonneuve-Rosemont; Robert É. Turcotte, McGill University Health

Purpose: Management of local recurrence (LR) remains unclear. Optimal management of primary tumour by specialised teams minimises this risk. However, previous treatments may impact on the available options when LR is encountered. We thus studied the outcome of this population with recurrent STS. **Method:** Retrospective review was carried based on our prospective sarcoma databases. DFSP and ALT were excluded. Among 618 primarily managed STS we found 35 cases of local recurrences (5.7%). Median f-up after LR was 14 mos (0-98). **Results:** Twenty were female. Mean age was 54 (Range 15 - 92). 22 involved lower limb, 11 upper limb and 2 the trunk. Mean delay from original surgery was 23 mos (3-75) and the mean size of LR was 4.7 cm (0.4-28.0 cm). Primary tumours were superficial in 4 and deep in 31 while recurrences were found superficial in 8 and deep in 26. Most frequent histology was MFH 8, Leiomyosarcoma 6, Liposarcoma, synovial sarcoma and MPNST had 4 each. 84% were high grade. Only 23 showed no metastatic disease at time LR was diagnosed. All 5 pts without

initial RT got RT for their LR. 7 pts with therapeutic level of RT to the primary tumour got full course of RT as well for their LR. 11 did not undergo surgery. 6/18 who had initial RT underwent amputation as opposed to 0/6 who did not. Trend to amputate was for younger age, deep and large tumour and previous RT. Ultimately, 21(60%) locally recurrent tumours showed metastatic disease; 6 prior diagnosis of LR, 6 concomitantly and 9 after with an average delay of 17 months (1-24). 6 pts developed additional local recurrences. **Conclusion:** Although infrequent local recurrence correlates with impaired outcome. Albeit challenging, limb salvage and additional radiotherapy remain possible despite optimal multi modality management of the initial tumour.

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Surgical Management of Recurrent Giant Cell Tumour of Long Bones. A Long-term Retrospective Study

Frank M. Klenke, Mayo Clinic; **Doris E. Wenger**, Mayo Clinic; **Carrie Y. Inwards**, Mayo Clinic; **Franklin H. Sim**, Mayo Clinic

Purpose: Giant cell tumor (GCT) of bone is a rare, usually benign, primary skeletal lesion. The disease's clinical course may be complicated by local recurrence subsequent to surgical treatment or the development of benign pulmonary metastases. Intra-lesional curettage is the standard treatment of primary GCT of bone. However, the value of intralesional procedures in recurrent GCT has not been well established. **Method:** Forty-six patients with recurrent GCT of long bones treated between 1983 and 2005 were followed retrospectively. Minimum follow-up was three years; mean follow-up was 11.1 (± 4.8) years. **Results:** Wide resections were performed in 18 patients. Intralesional, joint preserving procedures were performed in 28 patients. Subsequent recurrence occurred in nine patients (20%). Wide resection was performed if joint salvage was not achievable due to expansion of the tumor. Reconstructions following wide resection included arthroplasty (n=4), osteoarticular allograft (n=3), APC (n=1) and fibular autograft reconstruction of the wrist (n=3). Amputations were performed in two patients. Patients undergoing wide resections for local recurrence had a significantly smaller risk of subsequent recurrence as compared to patients treated with intralesional surgery (6% versus 32%, hazard ratio: 0.28, $p < 0.05$). In patients treated with intralesional surgery, application of polymethylmethacrylate (PMMA) in addition to local phenol treatment significantly reduced the risk of subsequent recurrence (PMMA + phenol: 7% vs. Phenol: 25%, hazard ratio: 0.23, $p < 0.05$). Soft tissue expansion was not associated with an increased risk of subsequent recurrence. At follow-up, all patients with subsequent recurrence were without local disease after additional intralesional surgery (n=3) or wide resection (n=5). Metachronous benign pulmonary metastases evolved in five cases. There was no correlation between the development of pulmonary metastases and the type of treatment of recurrent disease found. **Conclusion:** In recurrent disease of GCT of long bones and the possibility to salvage the adjacent joint intra-lesional surgery is the treatment of choice independent of whether soft tissue expansion is present. Intra-lesional surgery does not increase the risk of development benign pulmonary metastases. In cases with extensive tumor

formation and without the possibility to preserve the adjacent joint wide resection has a high chance for long-term recurrence free disease.

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Functional Outcomes of Distal Radial Reconstruction with Vascularised versus Non-vascularised Tissue Transfer

Paul Clarkson, UBC; Kelly L. Sandford, University of Aberdeen; Amy E. LaFrance, UBC; Anthony Griffin, Mount Sinai Hospital; Jay S. Wunder, Mount Sinai Hospital; Bassam A. Masri, UBC; Thomas J. Goetz, UBC

Purpose: Giant cell tumour (GCT) of the distal radius is associated with high local recurrence rates unless the tumour is aggressively resected, which often leaves a significant skeletal defect. The purpose of this study is to compare the functional outcomes of two commonly used reconstructive techniques, vascularised free fibular transfer (VFF) and non-vascularised structural iliac crest transfer (NIC). **Method:** Patients treated for giant cell tumour of the distal radius in either Vancouver or at Mount Sinai Hospital, Toronto were identified in the prospectively collected databases maintained in each centre. Twenty-seven patients were identified, 14 of whom underwent VFF transfer as their primary procedure. The two groups were comparable for age, sex and tumour grade. Functional outcomes were assessed with TESS, MSTs, DASH and the Ankle Osteoarthritis Scale. **Results:** Fourteen patients were included in the VFF group, 13 of which were performed as the primary index procedure, one followed prior cementation. Thirteen patients underwent NIC, one followed prior cementation. Two local recurrences occurred in the VFF group and one in NIC group, all treated with local excision. In the VFF group three patients underwent further surgery for cosmesis, hardware removal and tendon release respectively. One is scheduled for future surgery for tendon release. In the NIC group two patients suffered infections requiring debridement, one of which ultimately went on to require free fibular transfer. This patient's results were included in the NIC group as this was the index procedure. Functional scores showed no differences between the two groups on any of the parameters studied for the upper limb (Mann-Whitney test). The Ankle osteoarthritis scale had a median score of 9% for the six patients on which it was available. **Conclusion:** Both VFF and NIC are effective surgical techniques that result in a well-functioning wrist arthrodesis. VFF may be more useful where there is a significant skin defect from previous interventions. We were unable to demonstrate any difference in functional scores between VFF and NIC.

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Functional Implications of Fixed-hinge versus Rotating-hinge Knee Components for Total Femoral Endoprosthetic Replacement Following Oncologic Resections

Kevin B. Jones, University of Utah; Soha Riad, Mount Sinai Hospital, Toronto; Anthony Griffin, Mount Sinai Hospital, Toronto; Benjamin Dehesi, Mount Sinai Hospital, Toronto; Robert S. Bell, University Health Network,

Toronto; **Peter Ferguson**, Mount Sinai Hospital, Toronto; Jay S. Wunder, Mount Sinai Hospital, Toronto

Purpose: Few functional outcomes of total femoral endoprosthesis replacement (TFEPR) using contemporary modular systems are available. We compared functional results between TFEPR patients receiving fixed- and rotating-hinge knee componentry following oncologic resections. **Method:** Eighteen TFEPR patients were identified from a prospectively gathered sarcoma database. Six were secondary procedures and 12 primary. Four patients had metastatic carcinoma, 8 osteosarcoma, 4 non-osteogenic spindle cell sarcomas of bone, 1 Ewing's sarcoma, and 1 femur-invading soft-tissue sarcoma. All reconstructions used modular implants from a single company. Proximally, all were bipolar hip hemiarthroplasties, 12 including abductor reattachment. Distally, 8 had fixed- and 10 had rotating-hinge knee componentry. Toronto Extremity Salvage Score (TESS), and both Musculoskeletal Tumor Society Scores (MSTS) were compared between fixed- and rotating-hinge groups using the Mann-Whitney test. **Results:** Complications included 1 hip dislocation, 1 femoral malrotation, and wound problems requiring 3 debridements and 1 amputation. One metastatic carcinoma patient developed local relapse. Follow-up averaged 4 years (range 1 month to 14 years). At latest follow-up, 10 patients had died of disease. Eight remained alive, 6 disease-free, 2 with distant disease. Among patients surviving 6 months, 6 used no assistive devices, 5 used a single cane, and 4 were wheelchair bound, each at least partly due to distant disease progression. TESS averaged 74.5 ± 17.4 , MSTS1987 25.2 ± 4.4 ; and MSTS1993 58.6 ± 22.9 among the 12 patients for whom functional results were available from latest follow-up. No statistically significant differences or even trends were detected between fixed-hinge and rotating-hinge patients (lowest $p = 0.755$), but both instability problems were in the rotating-hinge group. **Conclusion:** While both rotating- and fixed-hinge TFEPR reconstructions may function well, consideration should be given to fixed-hinge knee reconstruction when massive myectomies or poorer conditioning make hip and knee stability a primary concern in the short-term.

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Complete Femoral Nerve Resection with Soft Tissue Sarcoma: Functional Outcomes

Kevin B. Jones, University of Utah; Soha Riad, Mount Sinai Hospital, Toronto; Anthony Griffin, Mount Sinai Hospital, Toronto; Benjamin Dehesi, Mount Sinai Hospital, Toronto; Robert S. Bell, University Health Network, Toronto; **Peter Ferguson**, Mount Sinai Hospital, Toronto; Jay S. Wunder, Mount Sinai Hospital, Toronto

Purpose: The functional consequences of femoral nerve resection during soft tissue sarcoma management are not well described. Sciatic nerve resection with a sarcoma, once considered an indication for amputation, is now commonly performed during limb salvage. We compared the functional outcomes of femoral and sciatic nerve resections in patients undergoing wide resection of soft-tissue sarcomas. **Method:** The prospectively collected

database from a tertiary referral center for sarcomas was retrospectively reviewed to identify patients with resection of the femoral or sciatic nerve performed during wide excision of a soft tissue sarcoma. Patient demographics, treatment, complications and functional outcomes were collected. **Results:** Ten patients with femoral nerve resections were identified, all women, aged 47 to 78, with large soft tissue sarcomas of varied subtypes. All patients received adjuvant radiotherapy, most pre-operatively. Six patients developed fractures with long-term follow-up, only two of which were in the prior radiation field. Musculoskeletal Tumor Society (MSTS) 1987 scores demonstrated one excellent, 4 good, and 5 fair results. MSTS 1993 scores averaged 71.4 ± 17.2 percent and Toronto Extremity Salvage Scores (TESS) averaged 61.7 ± 21.8 . There were no significant differences between the functional scores for patients with femoral or sciatic nerve resections ($P=1.0$). **Conclusion:** Femoral nerve resection appears more morbid than anticipated. The falls to which patients were prone, even years after surgery, subject them to ongoing long-term risks for fractures and other injuries. Nerve-specific functional outcomes should be considered when counseling patients prior possible resection of the femoral nerve for involvement by a soft tissue sarcoma.

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Immediate Tissue Transfer May Be Superior to Primary Wound Closure in Internal Hemipelvectomy Procedures

Arvindera Ghag, UBC; Kyle Winter, UBC; Erin Brown, UBC; Amy E. LaFrance, UBC; Paul Clarkson, UBC; Bassam A. Masri, UBC

Purpose: Resection of pelvic sarcoma with limb preservation (internal hemipelvectomy) is a major undertaking. Resection requires large areas of soft-tissue to be removed. Because of wound complications, we manage these defects with immediate tissue transfer (ITT) at the time of resection when a large defect is anticipated. This study compares the outcomes of ITT with primary wound closure (PWC). **Method:** Twenty patients undergoing 22 separate procedures (1995-2007) were identified in our prospectively maintained database. Demographics, tumour type, operative data and complications, and functional scores (MSTS-1993, TESS) were collected. **Results:** Twelve defects were managed with ITT, nine with pedicled myocutaneous vertical rectus abdominis (VRAM) flaps (one received double VRAM flaps due to the large defect), two with tensor fascia lata (TFL) rotation flaps (one augmented by local V-Y advancement, the other with gluteus maximus rotation flap) and one received latissimus dorsi free tissue transfer. Four wound complications necessitated operative intervention in this group: two debrided VRAM flaps went on to heal and the two TFL flaps required revision: one to VRAM flap and the other to a latissimus dorsi free flap which ultimately suffered chronic infection and hindquarter amputation was performed. Ten defects were managed with PWC, and 5 wound complications occurred, all five suffered infection, one developed hematoma and one dehisced. One wound resolved with debridement, two healed after revision to pedicled gracilis and gluteus maximus myocutaneous flaps. Two patients were converted to hindquarter amputation due to chronic infection.

Functional scores were collected on 8 of 12 living patients, at time of writing. The mean TESS scores were 83 and 73 in the ITT and PWC groups. Five patients in the ITT and 3 in the PWC group were deceased. **Conclusion:** Soft-tissue closure following pelvic sarcoma resection remains a difficult challenge, and our experience reflects that. There were fewer wound complications (33% v 50%) and slightly better function with ITT than PWC, but this was not statistically significant due to the small size of our study. Although small, this study suggests ITT should be considered whenever a large soft tissue defect is anticipated.

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Single Dose Antibiotic Prophylaxis for Lower Limb Arthroplasty

Inder Gill, Northumbria Healthcare NHS Trust, U.K.; **Ajay Malviya**, Northumbria Healthcare NHS Trust, U.K.; **Scott Muller**, Northumbria Healthcare NHS Trust, U.K.; **Mike Reed**, Northumbria Healthcare NHS Trust, U.K.

Purpose: To assess the infection rate following Lower Limb Arthroplasty using single dose gentamicin antibiotic prophylaxis compared to a traditional three doses of cephalosporin. **Method:** All patients undergoing Total Hip and Knee replacements over six months (October 2007 to March 2008) at three participating hospitals were prospectively followed to assess perioperative infection rates using Surgical Site Surveillance (SSI) criteria. All patients received single dose antibiotic prophylaxis using intravenous Gentamicin 4.5mg/kg. This was compared with previous data collected over a 6 month period (Jan to Mar 2007 and Oct to Dec 2005) from the same hospitals using 3 doses of Cefuroxime 750mg. Return to theatre data was collected independently after introduction of gentamicin to compare with previous data. The change in creatinine level postoperatively was also measured in a selected group of patients. **Results:** Four hundred and eight patients underwent Total Hip Replacements (THR) and 458 patients Total Knee Replacements (TKR) during the study period. This was compared with 414 and 421 patients who underwent THRs and TKRs respectively during a previous six month period. SSI was detected in 9 THRs (2.2%) and 2 TKRs (0.44%) in the study group as compared to 13 THRs (3.1%) and 12 TKRs (2.9%) in the control group. The infection rates in THRs were not significantly different between the 2 groups (p value=0.52) but were significantly reduced in the study group for TKRs (p value=0.005). The rate of Clostridium difficile infection was reduced within the hospital with the use of gentamicin, although other measures to reduce its incidence were also introduced. The return to theatre was 1.64% (23/1402) after introduction of Gentamicin as compared with 1.05% (21/2005) [p value=0.092] before this. This was a cause for concern although not significant. The day 1 postoperative creatinine level increased by more than 30 units in 6% of patients on Gentamicin. **Conclusion:** This study shows that the use of single dose prophylaxis using Gentamicin is effective for Lower Limb Arthroplasty. However, be wary of increased rate of return to theatre and the rise in creatinine level following use of gentamicin. Further period of evaluation and

study is needed before it is recommended for routine use in present or modified form.