of analysis. In order to make sense of large data sets, reliable methods for handling missing data are important to institute, as in many cases the exclusion of incomplete records is inappropriate, as it risks introducing inherent biases.

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Oncology

Reconstruction of the hip after resection of periacetabular oncological lesions X-ref

■ Periacetabular lesions are relatively common, either as metastasis or as a primary tumour. Unlike other areas of the musculoskeletal system, there are myriad options for reconstruction and even more opinions as to which are the best and which are most appropriate, either in general or specific cases. The range of reconstructive options include allograft, prosthesis, reimplantation of sterilized autograft, porous tantalum, and custom megaprosthesis. These authors from **Rochester, Minnesota (USA)** set out to establish exactly where we are with the evidence for reconstruction and outcomes.[1] The authors undertook a fairly extensive literature review and were able to identify 57 studies reporting the outcomes of 1700 patients, all with oncological lesions of the acetabulum. Among the 1700 patients, there were more metastatic lesions (41%) than any other type of lesion. The other lesions included chondrosarcoma (29%), osteosarcoma (10%), Ewing's sarcoma (7%), and multiple myeloma (2%). The authors sensibly divided the reconstructive options into the following groups: Harrington reconstruction; saddle prosthesis; an allograft and allograft prosthesis composite; sterilized autograft; porous tantalum implant; a custom-made prosthesis; and a modular hemipelvic reconstruction. Overall, there was an unsurprisingly high complication rate of 50%, with infection (14%) and instability (8%) being the most common. Similarly high were the rates of mortality, with 50% having died of disease progression; 23% were alive with disease, and 27% were alive with no evidence of disease at the final follow-up of, on average, 3.5 years.

Amputation for limb sarcoma: contemporary indications and outcomes

■ Another ongoing debate is that of amputation *versus* limb salvage for patients presenting with peripheral musculoskeletal sarcomas. Our interest was piqued by this paper from **Boston, Massachusetts (USA)** that sheds some interesting light on the role of amputation in contemporary sarcoma practice in today's era of limb salvage.[2] The authors report their own retrospective analysis of a series of 54 patients, all with limb sarcomas requiring amputations. The authors reviewed ten years of patient records to identify the 54 patients, all of whom had primary non-metastatic limb sarcomas and had also undergone amputation. There were three clear subgroups here of patients who underwent primary amputation (n = 18), secondary amputation after previous limb salvage (n = 22), and those with hand or foot sarcomas (n = 14). The authors cited a number of causes for limb amputation. In the primary group, the common causes were loss of function, bone involvement, multiple compartment involvement, and large tumour size. For those having secondary amputation, the common causes were proximal location, joint involvement, neurovascular compromise, multiple compartment involvement, multifocal or fungating tumour, loss of function, and large tumour size. With the hand and foot tumours, the causes for amputation were essentially joint involvement and prior unplanned surgery. The authors go on to identify differences based on amputation timing, and evaluate outcomes. They conclude that amputations chosen judiciously are associated with excellent disease control and survival. There is, in orthopaedics, as the pendulum swings, sometimes the risk of throwing out the baby with the bathwater. With the move towards limb reconstruction in all sarcomas, this paper is important in that it does note the role of amputation in suitable cases.

Clavicula pro humero technique after resection of the proximal humerus in children?

■ Among the many options for reconstruction of proximal humeral resections after wide resection for malignant tumours in children, the clavicula pro humero technique is a biological option that has a few small series documenting the results of the procedure. This technique uses the ipsilateral clavicle to reconstruct the proximal humerus. The clavicle is cut into its medial third and returned through a lateral pivot point corresponding to the acromioclavicular joint, allowing verticalization of the clavicular segment. Osteosynthesis of the distal humerus is then performed directly or through an interposed graft if a bone defect persists after clavicle rotation. This technique allows for maintenance of upper limb length, with growth potential of the lateral growth plate of the clavicle, stability of the 'new shoulder', and its mobility. This series from **France** looks at the results of eight children aged between eight and 18, all operated over an eight-year period in four university hospitals, who received a clavicula pro humero reconstruction.[3] Proximal and distal bone unions were achieved before ten months without an additional surgical procedure in two and six of

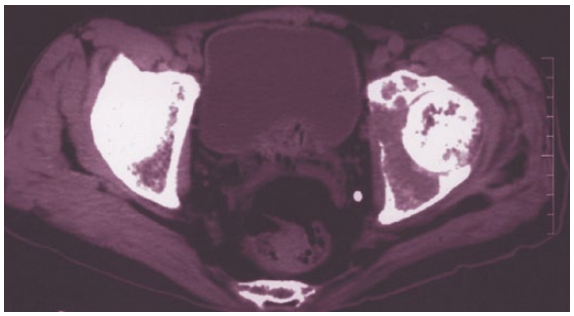
seven patients, respectively. A total of 14 local complications occurred, resulting in nine revision operations. The authors conclude that the clavicula pro humero technique achieves good oncological local control. Although union times are approximately two years, and some patients undergo augmentation with other grafts, it eventually provides a solid, painless, biological, and stable reconstruction, and creates a mobile acromioclavicular joint and generally good function. Nonunion of the proximal junction is the main complication of this technique. Because children require a reconstruction with potential longevity not likely to be achieved by other techniques, the clavicula pro humero technique may be a potential option in selected patients.

Low complications with flap reconstruction

Flap reconstruction plays an essential role in the surgical management of limb soft-tissue sarcoma (ESTS) for many patients. Although often a necessity in all surgical diagnoses, there are concerns about the risk profile associated with flap reconstruction. As flaps increase the duration and complexity of the surgery and establish another potential point for failure, their contribution to overall morbidity is unclear. This study from **Toronto (Canada)** attempts to shed some light on the added complications and morbidity associated with flap reconstruction in sarcoma.[4] The authors directly compare the complication rates in a massive number of patients: 897 patients who underwent ESTS resection followed by primary closure (n = 631) or flap reconstruction (n = 266). There is clearly a confounder here, as one would expect the flap reconstruction patients to have more extensive soft-tissue involvement. Available data were extracted for construction of a multivariable model including patient, tumour, and treatment variables. The outcomes were assessed, and postoperative medical and surgical complications were collected. Univariate and multivariate regression analyses were performed to identify independent predictors of complications. Overall, postoperative complications were common and occurred in 33% of patients. The authors identified that increases in body mass index (BMI), stage IV ESTS disease, lower limb tumours, and preoperative radiation were all independent predictors of complications in the study group as a whole. As expected, flap patients were significantly older, had more advanced disease, and were more likely to require neoadjuvant chemo- and radiotherapy. Although the authors observed an increased rate of complications in patients with flap reconstruction compared with primary wound closure (38% *vs* 31%, respectively), this difference was only significant on univariate but not multivariate analysis, leading them to conclude that there was no significant difference in complication rates following flap reconstruction compared with primary closure.

Lymph node metastasis in soft-tissue sarcoma

Perhaps the most important prognostic and treatment sign in all carcinomas and adenomas is the presence or absence of lymph node metastasis – to the point where breast surgery has been revolutionized by the 'sentinel node biopsy', which is thought to be accurate enough to guide the need for radical axillary clearance. The incidence and clinical significance of lymph node metastasis (LNM, N1) in soft-tissue sarcoma (STS) are, however, unclear despite the focus on lymph nodes in almost every other oncological speciality. The authors of this registry study from **Houston, Texas (USA)** identified 89 870 STS patients from the National Cancer Database and classified them by nodal stage.[5] There was confirmed metastatic pathology in 1404 patients, and a



further 1750 patients presented with clinically suspicious, but not pathologically confirmed, metastasis. Of those 3154 patients, around a third (n = 1310) also had a synchronous distant metastasis (M1). For patients with pN1Mo disease, the median overall survival was reported in this large series as 28.2 months. In this series, the impact of LNM at presentation in STS and osteosarcoma appears to be a prognostic factor only in the absence of synchronous lymph nodes being positive at presentation. The authors conclude that, despite clinical suspicion, pathological lymph node evaluation in STS is inconsistently performed. Lymph node metastasis occurs across anatomic disease sites and is unevenly distributed across histologies. Although patients with distant metastatic disease have a poor prognosis regardless of LNM status, in those without distant metastases at presentation, LNM is a negative predictor of osteosynthesis in a histology-dependent manner. An interesting observation was that cN1Mo disease was associated with worse osteosarcoma than pN1Mo disease, both across histologies and within histologies. As a possible explanation, the authors postulate that it is possible that patients with cN1Mo disease had a higher burden of metastatic disease than those with pN1Mo disease, such that lymph node enlargement was detectable on physical examination or imaging. Compared with those with pN1Mo disease, patients with cN1Mo disease, within a given histology, may also have received different treatment approaches and regimens affecting their disease outcomes.

Ewing's sarcoma and local failure

The choice of local therapy in Ewing's sarcoma is an individual decision based on patient and tumour characteristics, and has been much studied over recent years. In North America, definitive surgery is typically used for 'dispensable bones', whereas definitive radiation therapy is reserved for pelvic and axial tumours that cannot be resected with an acceptable morbidity. Radiation is nearly always added to surgery in cases of incomplete resection. This study from the Children's Oncology group **(USA)** aimed to identify factors associated with a higher risk of local failure in Ewing's sarcoma patients.[6] The study revolves around the data for 956 patients, all treated for Ewing's sarcoma. The overall local failure rate in this large group of patients was 7.3%. This breaks down into a 3.9% rate for surgery, 15.3% for radiotherapy, and 6.6% for surgery and radiotherapy. There was no statistically significant difference in local failure incidence by local treatment modality for axial non-spine, extraskeletal, or spine tumours, with an overall failure rate of under 11%. Limb tumours and pelvic tumours were vastly improved when surgery was added (14.8% *vs* 3.7% and 22.4% *vs* 3.7%, respectively). There was also a higher failure rate in the older patients (11.9% in patients aged ⩾ 18 years *vs* 6.7% in patients aged < 18 years). Being aged 18 or older and treatment with radiotherapy alone remained

independent prognostic factors for higher local failure incidence, even with multivariate analysis. While studies like this remain the best that we have for extrapolating treatment decisions and outcomes, it is clear that we should be a little cautious in interpreting results when they are such a biased sample. There are a few very useful take-home messages here; clearly, surgery is the preferred option if at all possible. However, the outcomes are not unreasonable for all options.

Preoperative evaluation prior to soft-tissue sarcoma excision: why can't we get it right?

There has been much attention on soft-tissue sarcomas (STS) recently, with some massive changes in the focus on early diagnosis and work-up, partly due to increasing evidence that many sarcomas are 'missed', leading to poor outcomes. In this retrospective review of 397 consecutive patient records (2000 to 2008) from **Nashville, Tennessee (USA),** the authors set out to review the quality of the preoperative evaluation for patients undergoing STS excision.[7] They identified the diagnostic work-up in terms of primary site advanced imaging (MRI or CT) and diagnostic biopsy procedures completed prior to the initial attempt at definitive surgical excision. Essentially, the aim of this paper was to define whether there was an association between the presence or absence of an appropriate preoperative work-up (preoperative advanced imaging studies, diagnostic biopsy) and the eventual outcome of an incomplete STS excision. Within this series, around a third of patients (n=149/397) underwent an incomplete primary excision prior to referral to this tumour centre. There was a significant difference in the quality of work-up, with complete excision associated with use of advanced imaging (91% *vs* 42%) and diagnostic biopsy (85% *vs* 16%). Those patients who had had a preoperative biopsy, a larger tumour size (>5 cm), and a referral from an orthopaedic surgeon had a reduced risk of incomplete excision in multivariate analysis. This study concludes that only a minority of patients referred following incomplete excision of a STS had undergone an appropriate preoperative work-up prior to referral, leading to increased long-term morbidity following definitive re-excision. Educational efforts to heighten awareness of suspicious soft-tissue lesions remain vital.

EURO-BOSS

The European Bone Over 40 Sarcoma Study (EURO-BOSS) is a landmark study in the sarcoma literature.[8] It represents a step away from the traditional retrospective cancer registry-type research in orthopaedic oncology and moves us into the brave new world of prospective international study of musculoskeletal tumours. This prospective study enrolled patients aged between 41 and 65 years, all presenting with high-grade bone sarcoma, who were treated with an intensive chemotherapy regimen derived from protocols for younger patients with high-grade skeletal osteosarcoma. The authors report the outcomes of over 200 patients, all treated for primary high-grade osteosarcoma and followed up to a mean of just under four years, giving a five-year overall survival of two-thirds in localized disease and one-fifth in metastatic disease. The take-home message is that, in patients aged over 40 years, an aggressive approach with chemotherapy does potentially offer survival rates comparable with those achieved in younger patients.

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Children's orthopaedics

Toxic shock and musculoskeletal infection: rare but not unheard of

Septic arthritis and osteomyelitis are fortunately rare in the paediatric general population but, when they do occur, they can be devastating. In the developed world, between 80% and 90% of these infections are caused by *Staphylococcus aureus* (of different varieties), and around 10% by group A beta-haemolytic *Streptococcus* (GABHS). Both organisms are capable of exotoxin production. When released into the systemic circulation, the endotoxin can act as a superantigen that is the pathway for toxic shock syndrome. This study from multiple centres in the **USA** aimed to examine the incidence of intensive care unit admissions for severe systemic, multi-organ involvement and toxic shock syndrome in patients with *S. aureus* (both methicillin-sensitive (MSSA) and methicillin-resistant (MRSA)) and GABHS.[1] The authors describe their own retrospective series, which reports on the local population of patients treated for septic arthritis or osteomyelitis over a nine-year period. The primary outcome was the reported rates of admission to an intensive care unit (ICU), although the authors also reported on differences in the course of the disease between organisms, as well as lengths of stay, number of surgeries, operative procedures, and cases of overwhelming sepsis. The authors collected a series of 208 patients (n=16) with osteomyelitis or septic arthritis, of whom 8% were admitted to the ICU; patients with GABHS were ten times more likely to require this than those with *S. aureus*. Patients with MRSA were equally as likely as those with GABHS to require ICU care. Vigilance and early treatment is obviously advantageous in these patients; those who deteriorated to the point of requiring ICU had an average of three surgical procedures each and an inpatient stay of a month. Besides recommending the prompt assessment and treatment of systemic symptoms,