

What is the evidence for follow-up in sarcoma?

■ One of the difficulties with surgical oncology (in any speciality) is, when exactly is follow-up long enough? Patients love to receive the 'all-clear' and the funding structures for many modern healthcare systems do not favour specialist follow-up for many conditions – even those that are difficult or impossible to follow up effectively in primary care. To make matters somewhat worse, the majority of follow-up protocols are expert opinion-driven and have not been tested with an evidence base. In an extremely valuable paper, researchers in **Toronto, Ontario (Canada)** undertook a simple two-part study. Initially they set out to establish what 'standard of care' was available in their own local centre based on follow-up frequency for patients, and then go further to establish if this was supported by the evidence for occurrence of new metastases.¹ The authors undertook a careful retrospective review of 680 patients, all presenting at their centre with bone sarcomas. They compared the follow-up protocols in use to the actual outcomes in terms of likelihood of local recurrence and metastasis, and used this to calculate the annual incidence of metastasis. From this, they established that their current follow-up protocols (0-2 years, 2-5 years, 5-10 years and > 10 years) were appropriate, or at least matched with the fall in annual incidence of recurrence and metastasis. This is a really helpful study in so far as it confirms that current follow-up protocols are more or less correct, and offers some guidance on what really should become the standard of care in the future.

Endoprosthesis in the very long term

■ The endoprosthesis offers a number of quite clear advantages in

treating bone tumours: restoration of function, maintenance of joint and limb length and orientation, while facilitating the *en bloc* excision of bone. Their gains are rapid, and patients return to function in the few weeks following surgery. The worry, of course, is that many bone tumour patients are young, and prosthetic survival in the longer term is complicated by wear, loosening, infection and periprosthetic fracture, all of which become more common year on year. There are few reports of the truly 'long-term' follow-up subsequent to the use of endoprosthetic replacement in malignant tumours. In an important study, surgical oncologists from **Birmingham (UK)** have reported their experiences of the first generation endoprostheses performed for bone tumours using cemented hips and hinged knee arthroplasties.² Their study is one of the few to report patients with more than 25 years of follow-up. The authors were able to identify 230 patients, the majority of whom had osteosarcoma (n = 132), with distal femur being the most common site. Over the nearly 30 years of follow-up reported as part of this study, the authors undertook 610 further operations, the frequency of which was dictated by the presence or absence of infection (4.7 vs 2.1 extra operations). Overall success rates in terms of limb salvage were, however, impressive, with an amputation rate of just 16% at 30 years of follow-up. Nevertheless, with an ongoing year-on-year risk of around 1%, infection rates were not insignificant. The main risk reported in this very long follow-up was infection, which was likely to be partly related to the number of revisions the patients underwent. So it seems that the coast, as they say, is never clear following an endoprosthetic arthroplasty; however, it can be

considered a reconstructive choice that for most patients can be a lifelong solution if both patient and surgeon are happy to accept the significant number of re-operations.

Wide local excision means wide local excision X-ref

■ Advances in chemotherapy and radiotherapy have transformed not only survival, but also the morbidity associated with surgical reconstruction, which can in many cases be minimised using neo-adjuvant therapies to shrink the tumour prior to excision. These adjuvant and neo-adjuvant regimes, however, are not without their morbidity, and it is not clear if adjuvant radiotherapy is required in completely excised localised Ewing's sarcoma. In a very large multicentre study led from **Villejuif (France)**, using an observational methodology and the large Euro-E.W.I.N.G study group, the authors set out to establish the cumulative incidence of relapse analysis using a competing risk approach to establish what the impact of post-operative radiotherapy was in relation to relapse.³ A previous cohort of patients recruited into a randomised controlled trial comparing two differing chemotherapy regimes (the EE99-R1 study³) was used to furnish the data. A competing risks model with multivariable analysis was used to establish the impact of the radiotherapy itself on the recurrence-based outcomes. The research team was able to report on the outcomes of 599 patients treated over a ten-year period, of whom 142 received post-operative radiotherapy to a follow-up average of 6.2 years and an overall survival in the series of 21%. There was a significant benefit of post-operative radiotherapy with a hazard ratio of 0.43. In short, this study has highlighted the perils of not sterilising the whole volume of tissue occupied by an Ewing's sarcoma either by

surgery or radiotherapy. Just cutting out what is left after the tumour has been shrunk with radiotherapy is not safe!

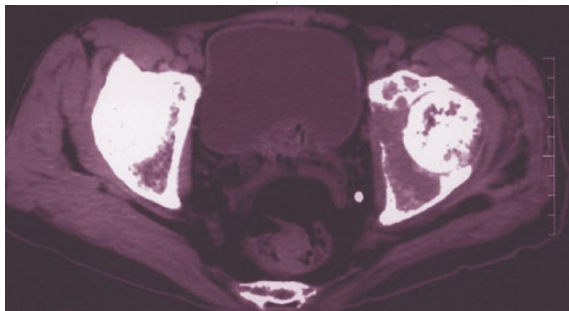
Is delay a problem in bone tumour surgery?

■ This is another paper highlighting the long delays in diagnosing bone tumours, however, like many other similar papers on the topic, it is not convincingly able to demonstrate that delays correlated with outcome. There is clearly some concern in the medical, scientific and general population about the effects of delay to diagnosis in malignancy. In fact, many countries now see this as a key performance indicator for their health systems. However, the difficulty with a tumour is that it is never clear exactly how long it has been there prior to diagnosis – only how long it has been symptomatic. Researchers from **Groningen (The Netherlands)** set out to establish what, if any, effect a delay to diagnosis had on outcomes.⁴ Their study revolves around the outcomes of 102 patients, each with a primary bone tumour of differing type (54 osteosarcoma, 29 Ewing's sarcoma and 19 chondrosarcomas). The diagnosis interval was defined for the purposes of their study as the time between onset of symptoms and establishment of a histological diagnosis, arbitrarily split into short (< four months) and long (> four months) delays. On average, there were longer delays to diagnosis with less aggressive tumours (688 chondrosarcoma vs 160 for osteosarcoma), with most medical delays occurring in the primary care setting. On the face of it, one might expect a delay in diagnosis to have a profound effect. However, overall survival rates were much more determined by oncological diagnosis than by delay to achieving that diagnosis. The explanation for this and other studies that suggest the converse likely lies

in the natural history of the disease. Aggressive tumours present earlier as they are more symptomatic – and perhaps not surprisingly, they often fare worse.

Timings of radiotherapy

■ Sticking with the general theme of timings to treatment in bone tumours, a French multicentre collaborative study based in **Lille (France)** set out to investigate the association between survival and timings of adjuvant radiotherapy in bone infection surgery.⁵ There is potential to improve outcomes



with earlier radiotherapy, however, it profoundly affects wound healing and, particularly where prostheses are involved, one has to be careful that complications associated with early adjacent radiotherapy do not outweigh the potential benefits. These authors set out to establish what, if any, was the impact of adjuvant radiotherapy time interval (TI) between surgery and adjuvant radiotherapy (RT). Their study concerned patients treated with soft-tissue sarcoma over a nearly 15-year period, and reports the outcomes of over 1100 patients. The TI was categorised somewhat arbitrarily (19-39 days, 40-79 days, 80-119 days and > 120 days). The conclusion reached by the authors based on their results was that the timing of radiotherapy does not make a difference to outcome. However, this observation is in direct opposition to reported data for other cancers such as breast, head and neck, where a delay in RT negatively impacts upon outcomes. Certainly food for thought,

however, if a delay to radiotherapy is clinically indicated, surgeons and patients should be confident that it will not have too profound a negative impact on outcomes.

Prophylactic fixation: the way forward

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■ The question of when to intervene in an ‘impending’ fracture is always a slightly tricky one. Most institutions are still using the criteria as defined by Mirels,⁶ which is currently the best validated prognostic score. It is not entirely

clear what the differences are in terms of the implications for both treatment and patients if a lesion is nailed primarily or after fracture. A study team in **New York, New York (USA)** have reported their retrospective series of 40 patients, all treated in a single institution, half of whom were treated for pathological fracture and half for ‘impending’ fracture (which was somewhat nebulously defined, as the surgeon thinks it might break).⁷ The cost of treatment over the course of the study was almost double in those with pathological fractures as compared with the prophylactic nailings, a saving of nearly \$21 000 per patient. This paper fairly conclusively demonstrates that prophylactic fixation of an impending fracture is cheaper than fixing a pathological fracture, and in all likelihood better for the patient as well. This then leads to a difficult question: do we have accurate enough predictors of those that would fracture, or will this lead to prophylactic fixation of many

bones that would not fracture in the patient’s lifetime!

The cost and utility of advanced imaging in cartilaginous tumours

■ The tendency over the past few years has been to move towards increasingly complex imaging modalities as a general rule, especially where there may be diagnostic uncertainty such as in cartilage tumours. This relentless march towards over-investigation is driven by a combination of factors, and it is not always a diagnostic need. Surgeons from **Nashville, Tennessee (USA)** have set out to establish what, if anything, is the advantage of this approach – are we just needlessly investigating patients?⁸ The authors reviewed the prevalence and cost of advanced imaging studies (AIS) in the evaluation of long bone cartilaginous lesions in 105 enchondromas and 19 chondrosarcomas. They classified advanced imaging as including MRI, CT, bone scan, skeletal survey, or CT biopsy. Of those patients diagnosed with an enchondroma, 85% presented from their primary care physician having already had an advanced imaging study. The average enchondroma patient presented with one unnecessary AIS, with an average unnecessary cost per enchondroma patient of around \$1350. The authors make the valid point that, given the 85% concordance between radiologists in their study for enchondromas and 100% concordance for chondrosarcomas, these studies are being requested and performed needlessly. Perhaps most importantly, the authors clearly outline imaging algorithms that could easily and safely be implemented to reduce the unnecessary imaging studies being performed in this setting.

Radiotherapy and limb salvage: a potent combination?

■ The use of radiotherapy in combination with wide local excision is a well-established treatment for limb salvage and, as the techniques have been refined, has led to survival

rates at a similar level as those for radical amputation with a far better quality of life. However, the correct timing and sequence of treatments for radiotherapy and wide local excision remain more than slightly controversial. Researchers in **Firenze (Italy)** pose, and partially answer, the question: is radiotherapy still needed in patients with high-grade sarcoma and clear wide local margins? Their study describes retrospective outcomes from a mixed cohort of 769 patients, of whom all but 365 were treated with wide local excision and then adjuvant or neo-adjuvant radiotherapy.⁹ The survival rates were slightly different, with the best recurrence-free survivals published at five years of 90% for neo-adjuvant radiotherapy, and 78% for adjuvant. This paper still leaves the question unanswered, primarily because it suffers from the bias that dogs all retrospective studies that span a long period. The enrolment of the patients in the groups was not randomised, and nor was it even throughout the study period. The decision to add radiation therapy was influenced by the size and location of the tumour, as well as the extent of the surgical resection. This, combined with the reported evolution of practice as a shift from adjuvant to neo-adjuvant radiation therapy during the observed study period, leaves us with more questions than answers.

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Children's orthopaedics

X-ref For other Roundups in this issue that cross-reference with *Children's orthopaedics* see: *Spine Roundup 7; Oncology Roundup 3.*

Anterior cruciate ligament in the paediatric population

X-ref

■ In a very topical paper given the recent Rio Olympiad, with many talented young athletes starting their training in an increasingly competitive atmosphere at a very young age (the youngest competitor, Nepalese Gaurike Singh, is just 13 years old), the injuries sustained are also becoming more akin to those of the adult population. Noting that there is an increase in reports of anterior cruciate ligament (ACL) injuries within the paediatric population, investigators from **Charlottesville, Virginia (USA)** have undertaken a review of a nationwide billing database to identify the numbers of patients presenting with and undergoing ACL reconstruction.¹ The authors identified patients over a four-year period and report the outcomes of over 44 000 unique paediatric ACL injuries. Of these, just over 19 000 underwent arthroscopic ACL reconstruction, and there was a definite preponderance of meniscal reconstruction when compared with the adult population. The authors analysed the national database to characterise the recent epidemiological trends of ACL injuries and reconstruction in the paediatric and adolescent populations. They found a significant increase in the overall diagnosis of ACL injury and ACL reconstruction in both paediatric and adolescent patients. Those patients

who underwent ACL reconstruction had significant increases in incidence of concomitant meniscal and cartilage procedures. The main message of this study is that the profile of the paediatric ACL injury is changing, with increasing numbers of injuries identified, and increasing at a rate that is well above that of the adult population. As sport becomes progressively more competitive and professional from a very early stage, it is clear that adult pattern injuries are also going to become a greater burden to paediatric orthopaedic surgeons.

The paediatric pelvis

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■ Despite the rarity of paediatric pelvic injuries, we have recently seen a small flurry of papers in the scientific literature. This is particularly welcome given that this is an injury that could do with having some light shone upon it. These authors from **Bochum (Germany)** have set about answering one of the biggest unanswered questions in paediatric trauma surgery: how do paediatric pelvic fractures fare in the longer term?² To answer this question the authors collated their series of 33 patients, all with paediatric pelvic ring injuries. The patients were treated at a single-level one centre and represented the full spectrum of injuries with ages ranging between four and 16 years. On average, patients were followed for over two years and handled according to local protocols. Stable injuries ($n = 17$) were treated non-operatively for the most part, and unstable injuries ($n = 15$) were treated operatively

where possible. Even in stable injuries there was appreciable residual clinical deformity in just over 40% of stable patients managed non-operatively, with an ischial height difference of over 5 mm. Symptomatically, 10% of children experienced a clinically relevant leg-length discrepancy and the majority of patients presented with unstable pelvic injuries and ongoing lower back pain throughout the two years of follow-up. The authors of this study concluded that in paediatric patients with pelvic ring injuries, radiographic deformity persisted and did not remodel. This is a unique and important finding. In addition, as perhaps might be expected, the complex displaced injuries have higher rates of operative intervention, residual deformity, and low back and sacroiliac joint pain.

Hip surgery in the non-ambulant cerebral palsy child

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■ Nearly all paediatric orthopaedic surgeons would agree that there is a significant place for hip reconstructive surgery even in the non-ambulant cerebral palsy (CP) child. That is just about where the agreement ends; the indications, interventions and expectations of results are all different between treating clinicians and institutions, and it is very difficult to research this group of patients. Surgeons from **Boston, Massachusetts (USA)** report a prospective cohort study of 38 consecutive non-ambulant CP patients (Gross Motor Function Classification System IV/V), all of whom underwent surgery for hip dysplasia.³ The

primary aim of this study was to evaluate the relationship between radiological markers of hip subluxation (migration percentage/acetabular index) and health-related quality of life (Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD)) score before and after reconstructive hip surgery. Clinical and radiological assessment immediately before surgery, at six weeks and regular follow-up intervals to two years after the surgery all demonstrated an improvement in the CCHILD score which correlated with an improvement in migration index. The migration percentage and CCHILD score were inversely related in the pre-operative period and this relationship continued throughout the follow-up period with a 0.2 point increase of CCHILD for each 1% correction in migration percentage. Management of hip subluxation in this patient group presents considerable ethical challenges. There is a paucity of evidence and decisions are generally made on the basis of the assumption that a significant proportion of these patients will eventually develop pain, and that even if they cannot express it in a conventional manner it will impact on quality of life for both child and carer. This study clearly suggests an improvement in health-related quality of life that can be predicted by the extent of surgical correction. There are however some important practical issues inherent in studying this patient population such as the imprecise scoring system in patients without verbal communication, in addition to methodological deficiencies including absence of a