

loss of function in terms of patient-reported outcome measure (PROM) scores, despite surgery restoring and maintaining objective range of movement.

Vitamin D for fracture healing?

■ There is seemingly no end to the supply of papers that review the association between vitamin D deficiency and a variety of complications, including poorer outcomes in hip fracture surgery and nonunion rates. On the other hand, what we are short of is papers that suggest ways to deal with the problem. Our interest here at 360 was piqued by this paper from **Charlotte, North Carolina (USA)**, which seeks to establish whether the authors' proposed intervention of an early high-dose vitamin D supplement will have an effect on outcomes in patients with vitamin D deficiency and a long bone fracture.⁷ We applaud this team for performing this study as a randomised controlled trial, given the difficulties of enrolling such patients. The team identified 113 patients with long bone fractures who were at risk of vitamin D deficiency. In all, 100 patients were either deficient or insufficient, and were then randomised to receive a single dose of vitamin D₃ orally (100 000 IU) within two weeks of injury (treatment group, n = 50) or a placebo (control group, n = 50). The study team recorded patient demographics, and fracture location and

treatment, as well as their primary outcome measure of time to fracture union and secondary outcomes of complications. The bottom line is that there was no difference in nonunion rates between the two groups, with two patients (4%) having a nonunion in each group. In addition, there were no adverse events in response to supplementation. It is tempting to conclude from this report that vitamin D supplementation doesn't treat hypovitaminosis; however, perhaps a better take-home message is that the rate of nonunion is low, even in patients with profoundly low vitamin D levels.

Predicting tibial fracture union

■ The simple tibial fracture continues to vex even the most experienced of orthopaedic traumatologists. The tibia is unusual in that it is loaded almost exclusively in compression with an anatomical axis that aligns with the mechanical axis, thick compact cortices, and a poor soft-tissue envelope over one-third of the bone. Despite the best treatment, the tibia sometimes just doesn't heal. In a simple but important paper, researchers from the R Adams Cowley Shock Trauma Center in **Baltimore, Maryland (USA)** asked whether the likelihood of fracture healing can be predicted simply from information available at the time of fracture presentation.⁸ Their paper collated data on 35 potential risk

factors for nonunion in 382 patients, all of whom were treated for a mid-shaft tibial fracture with an intramedullary (IM) nail. The research team then undertook a bivariate and multivariate analysis to establish risk factors for union. Their sample was a representative one, with 56 patients going on to nonunion and 326 healing. The authors describe the nonunion risk determination (NURD) score based on seven factors, which were as follows: requirement for flap reconstruction; presence of compartment syndrome; presence of chronic medical conditions; open fracture; male gender; American Society of Anaesthesiologists (ASA) grade; and percentage of cortical contact. In addition to the above, the NURD score includes factors predictive of union, namely spiral fractures and low-energy injuries. Each is assigned a score, and the total NURD score was then calculated in terms of risk of nonunion. A NURD score of 0 to 5 had a 2% chance of nonunion; 6 to 8 had a 22% chance of nonunion; 9 to 11 had a 42% chance of nonunion; and > 12 had a 61% chance of nonunion. In this development cohort of patients, the NURD score performs well, and gives the surgeon and patient (and possibly negligence lawyer) something to think about. With a 20% rate of nonunion and some clearly defined risk factors for nonunion, we suspect that – if independently validated in a second cohort of patients – the NURD score

is here to stay, and not just because of the catchy name!

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Oncology

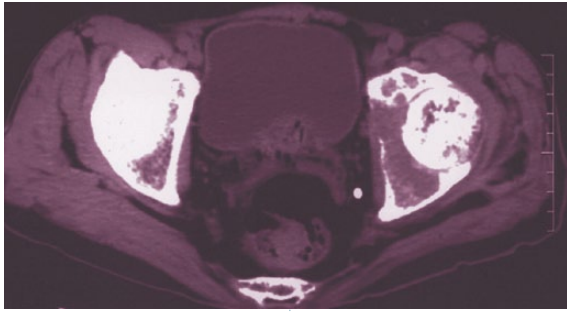
Dedifferentiated chondrosarcoma: a survival analysis

■ The Surveillance, Epidemiology, and End Results (SEER) database has shed some significant light on a variety of relatively rare bone neoplasias over the past few years, and this paper from **Chicago, Illinois**

(USA) is no different.¹ The authors are able to report on the survival estimates for dedifferentiated chondrosarcoma. This rare malignancy has a range of previously reported survival rates of around 5% to 25%. In the ten-year period of the study (2001 to 2011), centres forming part of the SEER database reported the

outcomes of an impressive 159 dedifferentiated chondrosarcomas, and, consequently, a relatively accurate survival estimate with Kaplan–Meier survival analysis is the basis of this important study. The headline result is an 18% five-year overall survival and a 28% disease-specific survival. Unusually for such a rare tumour,

there were enough patients here to make a rational attempt to identify covariates associated with survival. The authors established that patients with extremity tumours had a poorer prognosis than those with axial skeleton or chest wall tumours (hazard ratio (HR) 0.6). Patients with stage III+ disease (HR 2.51) and those



with tumours larger than 8 cm (HR 2.17) were at higher risk of mortality within the follow-up of the study than those without. In terms of surgically associated prognostic factors, patients treated with amputation (HR 0.43) or limb salvage (HR 0.41) did significantly better than those without surgery, and those with metastatic disease (HR 3.25) at the time of presentation were at high risk of death. This paper paints a rather bleak picture of this unusual bone tumour. The five-year survival rates are arguably poorer results than some of those previously published, and there is still no cure in sight. If no metastases are present at the time of presentation, a complete surgical excision offers the only chance of a cure.

Do orthopaedic oncologists agree on the diagnosis and treatment of cartilage tumours of the appendicular skeleton?

■ This paper from **Santiago (Chile)** demonstrates the difficulties of reaching an agreement on appendicular cartilage lesions.² There is a long history of confusion among the pathology world at the more benign end of the cartilage tumour scale, with poor inter- and intra-rater reliabilities when diagnosing either benign enchondroma or low-grade chondrosarcomas. We were somewhat surprised to learn that these concordance exercises have not been undertaken using orthopaedic oncologists. This simple paper therefore set out to determine whether orthopaedic oncologists

agree about the diagnosis of cartilaginous neoplasms. The study involved presentation of initial clinical and imaging information with the aims of achieving inter- and intra-observer agreement, establishing the most important clinical and imaging features that guide diagnosis, and determining agreement ratings for proposed treatment plans. A total of 39 patients, all with intramedullary cartilaginous neoplasms of the appendicular skeleton with a cross-section of tumour grades, were presented with their clinical and imaging information to a panel of ten experienced oncologists who classified the neoplasms as benign, low-grade malignant, intermediate-grade malignant, or high-grade malignant. Additionally, the authors collated information on proposed treatment strategies. The inter- and intra-observer reliability were moderate $\kappa = 0.44$, and good $\kappa = 0.62$, respectively. The panel identified three factors which were helpful in making the diagnosis: cortical involvement in 65% of evaluations; neoplasm size in 51%; and pain in 50%. These results underline the relatively poor concordance among expert panels when attempting to establish the diagnosis of bone tumours.

Survivors of Ewing's sarcoma X-ref

■ Very little is known about the long-term outlook for survivors of Ewing's sarcoma in childhood. We were delighted to see this study from researchers across the **USA and Canada** that reports on

the longer-term survival in these patients.³ The authors used, as a basis for their study, the Childhood Cancer Survivor Study, which includes patients with Ewing's sarcoma who were treated between 1970 and 1986. The authors aimed to establish the truly long-term survival and chronic comorbidity among this unique cohort of patients in order to gain an insight into what the future truly holds for survivors of childhood cancers. This cohort contained 404 patients, all of whom had a childhood diagnosis of Ewing's sarcoma. At final follow-up, these patients had a mean age of 35, and their 35-year survival rate (estimated with Kaplan–Meier) was 70%. When this was broken down, there was a cumulative incidence of late recurrence of around 15% and this was the most common cause of death in the cohort. Sadly, there were a number of treatment-related deaths, with a cumulative incidence of 11% in this series. The majority of these were due to subsequent neoplasms, which came in a variety of forms and had a cumulative incidence of 2.4% at 35 years and a malignant neoplasia incidence of 14%. These included osteosarcoma, acute myeloid leukaemia, breast cancer, and thyroid cancers. The unfortunate message from this impressive paper is that short-term (five-year) results are not entirely reflective of outcomes for survivors of Ewing's sarcoma. In this series of 404 patients, a total of 30% of these survivors will either die of late recurrence, a second cancer or through complications of treatment.

Deltoid-preserving for a primary malignant bone tumour?

■ Our interest was piqued by this paper in the *BJJ* this month, asking whether it is safe to preserve the deltoid when undertaking limb salvage procedures in the proximal humerus. There is unquestionably a good reason why patients and surgeons should want to preserve the deltoid;

the functional benefits are clear. However, the wisdom of its preservation is the subject of this paper from **Paris (France)**.⁴ This case series aimed to ask whether preservation of the deltoid provides a safe and functional reconstruction or whether *en bloc* resection of the deltoid and proximal humerus is a more reliable option. These authors undertook a comparative retrospective case review of 45 patients from their institution who had undergone resection of proximal humeral tumours through either a deltoid-sparing or an *en bloc* approach. There were 29 patients in the deltoid-sparing group and 16 in the deltoid resection group. The authors' practice was to establish, through analysis of MRI imaging studies, whether there was a complete separation of the tumour from the fat. They undertook a competing risk analysis to establish the risks of tumour recurrence in the two groups. The authors report that there was no significant difference to the probability of survival in either group (7% sparing *versus* 26% resecting). A deltoid-sparing procedure was more likely if patients presented with a small tumour with less bone involvement, with a continuous fat rim on MRI and if the axillary nerve could be identified. Although interesting, we do take some issue with the conclusions the authors have reached. This paper really suffers from selection bias, and all that the authors have demonstrated is that you can spare the deltoid and get a low local recurrence rate, but only in smaller, less invasive tumours that don't come near the deltoid. This is really just a report detailing case selection and nothing else.

Does treatment volume affect outcomes in spinal metastatic disease? X-ref

■ One of the most common metastatic deposits faced by the spinal and orthopaedic oncology surgeon is that of spinal metastasis. These are commonly from both

haematological malignancies and the usually tough mnemonic of breast, bowel, prostate, and thyroid tumours. One of the difficulties with treatment is understanding the outcomes; with no widely accepted and validated outcome score, and a huge range of potential treatments, understanding what determines outcomes in spinal metastasis is getting rather urgent. One factor that is always slightly troubling, both to quantify and sometimes to live with, whatever side of the fence you stand on, is that of surgical volume and the effect that expert surgeons and centres may have on outcome. We were delighted to see this series of 3135 patients treated by 1488 surgeons in 162 institutions, tackling the difficult topic of how many one should 'do' in order to appear an expert. These authors from **Boston, Massachusetts (USA)** sought to determine whether hospital and surgical teams had a volume threshold for outcomes when measured in terms of 90-day complication and re-admission rates.⁵ Low-volume hospitals had higher odds of post-operative complications (odds ratio (OR) = 1.47) and re-admissions (OR = 1.36). Those treated by low-volume surgeons had a higher likelihood of complications (OR = 1.40) and re-admissions (OR = 1.38). This should perhaps not be a surprise to any of us, as it is more difficult to achieve good outcomes with this kind of challenging operation with a high risk of peri-operative morbidity and mortality. Nor is it unexpected, therefore, that there is a volume-to-outcome relationship. However, we were slightly surprised to find that there is around 40% excess odds of complications in the low-volume hospitals, and with low-volume surgeons. From these data, it certainly seems that this type of specialist surgery should be undertaken by surgeons with a particular

interest, and who have the volume of experience to achieve excellent outcomes.

Focal ultrasound instead of irradiation for painful bone metastasis?

■ The traditional treatment for painful bony metastasis that has not fractured, and is not suitable for or has already undergone stabilisation surgery, is the use of localised radiation therapy. Although this has its own potential benefits on the surface of things, there are some disadvantages. Radiation therapy can have local and systemic side effects and, for those intact lesions, definitely results in some difficulty if the patient goes on to fracture, with high rates of infection and wound-healing complications. An alternative approach that has some promise is that of MRI-guided focused ultrasound (MRgFUS), the efficacy of which is reported in this study from **Taipei (Taiwan)**.⁶ The authors undertook a matched-pair analysis of patients presenting with bony metastasis, which compared the therapeutic effects of MRgFUS with conventional radiotherapy. Given the disparity in potential cohort size, the authors used a 1:2 matching process, and matched the groups in terms of age, sex, primary cancer, pre-treatment pain score, and treated site. The authors report a case-matched series of 63 patients (21 MRgFUS and 42 radiotherapy), with outcomes assessed as response for pain control. Both treatments were effective in terms of overall pain control. However, what was perhaps most interesting is that MRgFUS was more efficient than radiotherapy in terms of providing rapid palliation, and there was a significantly higher pain response rate at one week following intervention (71% vs 26%). This is one of the first reports concerning

the use of MRgFUS and it establishes the modality as a potentially useful first-line treatment in management of painful bone metastasis. Perhaps most importantly, although there was an overall equivalent response rate, the MRgFUS cohort had much more rapid relief of symptoms, with the majority finding relief within one week.

Quality of life with a spinal metastasis

■ Following on from the timely paper above, looking at the surgeon outcomes following spinal metastatic surgery, these authors from **Shanghai (China)** set out to determine the long-term quality of life associated with spinal metastasis with no known primary origin.⁷ They included patients treated between January 2009 and January 2014, all for spinal metastasis of unknown origin. The paper focuses both on these outcomes and on the outcomes of a subgroup analysis, reporting the differences in outcome between those who received surgical treatment and those who received radiotherapy alone. The quality of life in these groups was evaluated using the Functional Assessment of Cancer Therapy-General (FACT-G) measure over a six-month period. In all, the authors report 287 patients, of whom 191 had surgery plus radiotherapy, and 96 had radiation therapy alone. As we might expect, there were some differences in treatment strategies and the authors also explored to a limited extent how this might affect outcomes. Complete follow-up was available for the majority of patients, with 177 patients completing all outcome measures, and 110 deaths during the study surveillance period. The authors are able to report that the surgery group had significantly higher adjusted

quality-of-life scores than the radiation therapy group in each domain of the FACT-G questionnaire. It appears that surgery followed by radiotherapy is the most effective way of increasing quality-of-life scores following presentation with spinal metastasis of unknown primary origin. Although the authors evaluated the various potential covariates, the only significant differences appeared to be with the use of a circumferential decompression which, when achieved, resulted in the best quality of life.

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