and discussed their results. They established that early presentation to a MDTB was associated with better compliance with national clinical practice guidelines, and specifically adherence to recognized tumour care pathways (biopsy and imaging prior to surgery). They also established that those patients with a preoperative discussion had a higher quality of initial surgery, and fewer reoperations. This also translated to better outcomes, with local relapse-free survival and overall relapse-free survival reported as being significantly better in patients presented to a MDTB before initiation of treatment. The authors also undertook a multivariate analysis to check for confounders and established that these factors remained significant. The results here really do speak for themselves. Presentation to, and discussion with, the MDT prior to embarking on significant tumour surgery is an essential part of achieving a good result.

The top research priorities in orthopaedic oncology

■ Champions of evidence-based medicine, this group from **Hamilton (Canada)** have published a really useful consensus document targeting priorities for research achieved using a modified Delphi approach.[6] The aim was to achieve a priority-setting exercise to allow the limited financial and clinical resources available to orthopaedic oncologists to direct researchers effectively towards the most clinically relevant questions. The priority setting exercise used a formal consensus-based approach involving clinician-scientists and stakeholders to identify the top priority research questions using a three-step modified Delphi process. The process involved the full range of stakeholders including orthopaedic oncologists, researchers, and funding agency and patient representation. Clinically relevant research questions were elicited from the 114 participants (61 of whom returned them). These questions were then rated using a Likert scale and those that reached the *a priori* consensus thresholds progressed for consideration at an in-person consensus meeting. At this meeting, four priority questions were agreed upon: 1) Does less intensive surveillance of patients with sarcoma affect survival?; 2) What are the survival outcomes over time for orthopaedic oncology implants?; 3) Does resection *versus* stabilization improve oncologic and functional outcomes in oligometastatic bone disease?; and 4) What is the natural history of untreated fibromatosis? We applaud the authors for their attention to detail and for publishing this useful paper.

Immune surveillance plays a role in locally aggressive giant cell lesions of bone

■ Could immune surveillance be a start to molecular basis for follow-up? This paper from **Boston, Massachusetts (USA)** may be the answer to the consensus document above.[7] The giant cell lesion of bone, although thought to be only locally aggressive, is able to form metastasis. These lesions carry with them a relatively low yield for long-term surveillance, but do at times metastasize. Patients therefore often carry a long-term follow-up burden. This paper concerns the potential for immune surveillance that may offer a route to a molecular test for recurrence. In this basic science paper, the authors aimed to characterize the expression of the human leucocyte antigen (HLA) class I and class II antigens and tumour-infiltrating lymphocytes. They then went on to try to identify the role of B7-H3, an immune modulating surface antigen. The candidates for this study were 93 patients previously treated at the Massachusetts General Hospital, all with tissue core biopsy. The research team then went back to look at the lymphocytes in these historic samples. The authors identified lymphocytes in all tumour biopsies with a lower mean number of CD8+ T cells in aggressive tumours (median 4.8 *vs* 15.8). In keeping with this, HLA I was highly expressed by multinucleated giant cells in all tumours, but was low in expression in mononuclear stromal cells in patients with aggressive tumours. Overall, low HLA class I expression combined with low CD8+ T cell infiltration was most highly associated with tumour aggressiveness (OR7.81). So, there is the potential here for both a biological marker of giant cell aggressiveness, and perhaps even a marker of activity that would eventually transform follow-up for giant cell tumours into an annual blood test rather than regular imaging and clinical reviews.

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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 8***

Scoliosis management in patients with Duchenne's X-ref

■ In this valuable look back from **San Diego, California (USA)**, the authors present 30 years of a single institution's experience in treating spinal deformities in children with Duchenne muscular dystrophy (DMD).[1] The complexities of treating scoliosis in patients with muscular dystrophy are well known; however, there are few long-term series on which to inform clinical practice, particularly when contemplating surgery. In this 30-year retrospective series, the authors were able to identify 60 patients, all with DMD, treated operatively for their scoliosis. There was a mixture of operative techniques, as one would expect with such a long-term follow-up series. Of the 60 reported patients, 47 were treated using the Luque wire constructs and the remaining 13 were treated using a posterior pedicle screw construct. In the Luque group, there was a high rate of intraoperative and postoperative complications, with an overall complication rate of 68% (n=31/47). A total of 12 patients (26%) had implant-related complications and an overall 4% infection rate was found. In contrast, the pedicle screw group (although much smaller) reported an overall 54% complication rate (n=6/13), with only a single (8%) implant-related complication

in the form of proximal junctional kyphosis, with no need for revision at final follow-up. The infection rate in the pedicle screw group was very high, at 23% (three patients). Although the authors attempt to draw comparisons between the two instrumentation types, the pedicle screw group really is so small that there is little of use that can be gleaned from this comparison. Nonetheless, this review does demonstrate a clear transition from Luque instrumentation to pedicle screw instrumentation in the mid-2000s. There is also a noticeable trend in this group's practice towards increased fixation to the pelvis using pedicle screw constructs, with good arguments presented by the authors for the need to avoid progression of pelvic obliquity and the potential for subsequent surgeries. There was also a change in practice with regard to the timing of surgery, and the series is notable in that there was a trend towards delaying treatment in the pedicle screw group, as the more recent patients treated using pedicle screw constructs were older and heavier with larger preoperative Cobb angles.

Preliminary results of magnetically controlled growing rods for early-onset scoliosis X-ref

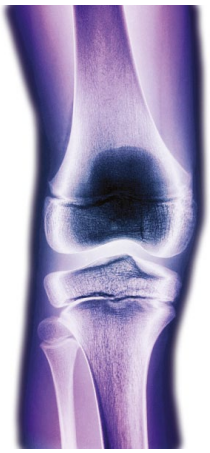
■ Magnetically controlled growing rods have been developed to offer the potential for better control of growth in paediatric scoliosis. The constructs offer the tempting scenario of controlled growth in a more continuous manner without the need for a second, smaller surgery to lengthen the rods, as has previously been necessary. There have been a number of small case series and case reports of complications; however, we were delighted to see this report of a large number of cases giving an overview of what one can expect from such implants. A team from **Hamburg (Germany)** presents their results using magnetically controlled growing rods (MCGRs) to treat patients with progressive early-onset scoliosis (EOS).[2] Magnetically controlled growing rods have been in use for about four years now (Food and Drug Administration approval in February 2014, USA), and the preliminary reports are slowly coming in. The MCGR allows gradual outpatient distractions under the control of an external remote device. The attraction of the approach is that the standard familiar operative technique can be used but with a growing rod between the pedicle screws. These authors report on their first consecutive 35 patients treated using this technique, with 24 patients meeting the inclusion criteria for the study (minimum 12-month follow-up and four or more lengthening episodes). In terms of surgical correction achieved – within this cohort, at least – the authors were able to report a 54% immediate correction of scoliosis after surgery. Prior to surgery, the mean primary curve was 63° (SD 15°; range 40° to 96°), which had improved to 29° (SD 11°; range 11° to 53°) immediately postoperatively after MCGR. The mean preoperative thoracic kyphosis decreased from 43° (SD 24°; range -32° to 86°) to 27° (SD 12°; range 9° to 50°) after surgery. This was maintained throughout the follow-up period, with a mean major curve of 26° after the most recent lengthening. With regard to thoracic height, there was a statistically significant constant increase in T1 to T12 length and T1 to S1 height over the course of the reported follow-up period, suggesting that the magnetic rods themselves are working and allowing for growth. There were no reported intraoperative complications and only a single postoperative complication requiring a revision with exchange of the rod. There were no infections, rod breakages, or neurological complications. The authors here conclude that MCGR is a safe technique that produces predictable results while at the same time significantly reducing the risk of infection seen in traditional growing rod techniques.

Tranexamic acid to reduce transfusion requirements in paediatric scoliosis surgery X-ref

■ With more than half of scoliosis patients needing blood transfusions after surgical correction, strategies are constantly being devised and improved to amend this. There has been widespread use of tranexamic acid (TXA) in all branches of orthopaedic and general surgery, with reports of efficacy in conditions as diverse as blunt trauma and hip and knee arthroplasty. Tranexamic acid is not widely used in children, however, and in many countries is not licensed for paediatric use. The authors of this study from **Baltimore, Maryland; New York, New York; and Boston, Massachusetts (USA)** compared two dosing regimens (low and high dose) of TXA in order to reduce intraoperative blood loss during paediatric scoliosis surgery.[3] The efficacy of TXA has been hypothesized to be dose-dependent, but so far there has been no consensus on the best dosing regimen in adults, let alone in children. The two dosing regimens investigated in retrospect were the low dose (72 patients) of 10 mg/kg loading dose and a 1 mg/kg/h maintenance dose; and the high dose (44 patients) of 50 mg/kg loading dose and a 5 mg/kg/h maintenance dose. Patient characteristics were nearly identical between the two groups. Compared with the low-dose TXA group, the high-dose TXA group had decreased estimated blood loss (695 ml *vs* 968 ml, p = 0.01), and a decrease in red blood cell transfusion requirements both intraoperatively (0.3 units *vs* 0.9 units, p = 0.01) and over the course of the whole hospitalization (0.4 units *vs* 1.0 units, p = 0.04). The higher-dose TXA was associated with decreased intraoperative and postoperative transfusion requirements, even after risk adjustment for potential confounding variables. The high-dose group had significantly less intraoperative blood loss (≈ 30%) and a decreased red blood cell transfusion requirement (≈ 60%) when compared with the low-dose group. The authors argue that TXA dosage schemes used in studies in the available literature are not based on the pharmacokinetics of TXA, as such studies have not yet been conducted in the paediatric orthopaedic population. To maximize efficacy and minimize side effects, guidelines should be based on pharmacokinetic data and pharmacokinetic modelling to ensure that the minimally effective dosage scheme is recommended, which is clearly the ideal case. Until these data are available, it would seem that some of the best applicable data are in this study and that the authors' 'high-dose' regime is probably the benchmark.

Performing a definitive fusion in juvenile cerebral palsy patients is a good surgical option X-ref

■ The management of cerebral palsy (CP) children takes up a substantial proportion of paediatric orthopaedic surgical time and effort. The combination of cognitive difficulties and often progressive selective spasticity causes well-described problems in the hips, feet, and spine. The progressive neuromuscular spinal deformities seen in children with CP are not only common (with the overall incidence reported at between 20% and 25%) but almost ubiquitous in spastic quadriplegic patients, with a reported incidence of 74%. The challenge to managing this progressive condition is that the addition of progressive and differential muscle pulls with a growing spine results in a high failure rate of instrumentation. For this reason, there is an increasing propensity to fuse the spine early to prevent later progressive deformity. This study from **San Diego, California (USA)** evaluates the outcomes of early definitive spinal fusion in



patients with juvenile cerebral palsy scoliosis.[4] Fusing early raises concerns of an ultimately shorter trunk or progression of spinal deformity and pelvic obliquity by means of the 'crankshaft' phenomenon. These authors present a small series of 14 CP children who underwent spinal fusion at the age of ten years and younger (skeletally immature). All but one of these patients were fused to the pelvis to reduce the risk of the crankshaft phenomenon. The authors report that, by the first follow-up examination, there was a mean 71% correction rate of scoliosis and an 84% correction rate of pelvic obliquity across this small group of patients. During the subsequent two-year follow-up, the authors report some slight losses of correction in both the main curve and pelvic obliquity; however, this was a relatively minor loss of correction and none of the patients required revision surgery due to deformity progression during this period. The authors postulate that it is possible that the long construct secured to the pelvis, combined with the slower growth typically seen with CP patients, may lessen the risk of crankshaft. Despite the small numbers of patients in this study, the authors draw the very sensible conclusion that "progressive scoliosis in juvenile CP patients requires the surgeon to balance the need for further growth with the risks of progression or repeated surgical procedures. Our study demonstrates that definitive fusion once the curves approach 90 degrees results in significant radiographic and quality of life improvements".

MRI as reliable and reproducible as CT in assessing paediatric hips

MRI scanning is not associated with any radiation and is therefore an attractive imaging modality in children. However, due to the method of image acquisition (roughly measuring the release in energy following excitation of hydrogen-dipoles secondary to a radio frequency pulse in a magnetic field), bony architecture is not as well visualized as it is with CT, and multiplanar reconstruction following acquisition is not possible. In order to take advantage of the reduced radiation burden associated with MRI scanning, femoral version measurement techniques have been developed. However, there are few validation studies and, as such, the accuracy of this diagnostic modality is not established. We reported on a paper validating the MRI scan following operative reduction in hip dysplasia in the last edition of *360*,[5] and hot on the heels of this paper comes a report from authors in **Aurora, Colorado (USA)** who undertook a diagnostic accuracy study with the aim of establishing whether MRI alone could be used, and what the reliability, repeatability, and accuracy of MRI-based femoral neck version measurements are in the paediatric population.[6] The study focuses on a cohort of patients who underwent MRI scanning with a delayed gadolinium-enhanced MRI of cartilage (dGEMRIC) protocol. The mean age for the cohort of 36 patients that formed the basis for this study was 15 years. There was a comparative interrater reliability for the CT and MRI protocols (0.91 *vs* 0.90) and a comparative intrarater reliability (0.96 *vs* 0.95), with highly concordant measurements in terms of femoral neck version. Essentially, these authors found that axial images at the pelvis and knee during MRI allow for reliable measurement of femoral version. The use of a rapid sequence acquisition MRI protocol also removes one of the drawbacks of MRI scanning in children, namely the requirement to stay stationary for a significant period of time.

Radial dysplasia: what is the optimal treatment? X-ref

Radial dysplasia is a relatively common condition affecting around 1 in 7000 births. The appearance of a shortened dysplastic radius with a bowed ulna and radially deviated hand is the classic presentation. Despite the comparatively common presentation, there is a still a lot of debate and a lack of clarity as to what constitutes optimal treatment. This prompted a team in **London (UK)** to undertake an extensive systematic review to clarify the long-term outcomes of surgical and nonsurgical treatment of the wrist (secondary) deformity.[7] The review team carried out a comprehensive search of the indexed medical literature and, in addition, queried the trials registries at ClinicalTrials.gov and the World Health Organization (WHO) Clinical Trials Registry Platform, searching for both published and unpublished studies reporting long-term outcomes for patients treated for radial dysplasia. There were 104 studies identified in the initial search, 12 of which were included in this review after screening. The usual GRADE method (Grades of Recommendation, Assessment, Development, and Evaluation) was used to assess the studies, and results were pooled for the change in forearm angle. Primary outcomes including range of motion (ROM) and clinical outcome scores were also subject to meta-analysis. The major finding of this study was that the hand-forearm angle worsened in patients who received nonsurgical treatment (from 66° to 84°), while the various surgical approaches achieved different outcomes. The analysis of the available data would suggest that soft-tissue distraction with centralization or radialization procedures yielded the best achievable hand-forearm angle correction at 16°. In terms of wrist motion, the radialization option gave best active wrist motion at 46°. An improved wrist ROM could be achieved with a complex microvascular second metatarsophalangeal joint transfer yielding a better active ROM at 83°. Although the quality of evidence here is somewhat compromised by a range of biases, the inherent limitations in the study designs, and the small numbers of patients, what evidence there is would suggest that soft-tissue distraction plus centralization or radialization is likely to achieve the best hand position in radial dysplasia.

Clicky hips: to scan or not to scan?

The traditional clinical screening tests applied to all neonates and six-week-old babies in order to establish whether a hip is dislocated and reducible, or in joint and dislocatable, are the Ortolani's and Barlow's tests. These have previously been demonstrated to have only moderate diagnostic accuracy; consequently, in most healthcare systems, babies with risk factors or with either a positive Ortolani or positive Barlow test are usually referred for ultrasound scanning. There are also specialist referrals commonly made for so-called 'clicky hips'. The actual diagnostic value of a clicky hip is unclear, and without this information it is uncertain whether patients with a clicky hip should continue to be referred. The paediatric team in **Blackburn (UK)** have attempted to determine the clinical significance of a clicky hip.[8] They report a 20-year prospective study of their one-stop paediatric hip clinic and report the clinical significance of a clicky hip in 362 infants referred over a 20-year period. All hips were assessed both through clinical examination and ultrasound imaging. The mean age at presentation was 14 weeks and

the cohort consisted overwhelmingly of normal Graf type I hips (97%, n=351/362), requiring no treatment or follow-up. Of the remaining 11 children, nine (2.5% of the total cohort) had Graf type II hips, all resolving on follow-up scans. There were just two children requiring treatment: one with Graf type III hip dysplasia and one child with an irreducible hip dislocation. Given the large number of patients in this cohort (nearly 400), the very low specificity (0.5%), and the unknown sensitivity of the clinically clicky hip, we would agree with the authors of this paper – only a strong family history or positive 'special' tests should trigger a referral to a specialist paediatric service, and not clicky hips alone.

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Research

X-ref *For other Roundups in this issue that cross-reference with Research see: Hip Roundups 1, 3 & 4; Knee Roundup 8; Spine Roundups 2 & 7*

Serum fructosamine: a simple and inexpensive test for assessing preoperative glycaemic control X-ref

■ It seems to make sense that glycated haemoglobin (HbA1c) levels, which are a marker of glycaemic control, would give an indication of the likelihood of complications, especially given the known association between diabetes and pretty much every complication under the sun. However, evidence is mixed; reports are conflicting and meta-analysis has been far from conclusive. In this age of bundled payments, risk adjustments, and penalization of surgeons and healthcare providers for both complications and readmissions, it is important for us to use the correct parameters to risk-adjust our patients. This study from **Philadelphia, Pennsylvania (USA)** highlights and reports on the use of serum fructosamine as a potential method for risk-scoring patients with diabetes.[1] Fructosamines are glycated compounds consisting of a sugar and a primary amine. Although there are some recognized biological pathways, the clinical significance is unclear. The fructosamine test is a surrogate measure of glycaemic control over a two- to three-week period; however, a significant clinical role for the diagnostic test has not yet been found, with HbA1c the most commonly utilized test. The authors report 829 patients undergoing total joint arthroplasty, recruited over a single year, in whom they measured the serum HbA1c, fructosamine, and blood glucose levels. As there are no widely accepted reference ranges for fructosamine tests, the fructosamine threshold established was that which equated to the American Diabetes Association 7% cutoff for HbA1c, giving a fructosamine level of 292 µmol/L. Patients were followed up and the association between high fructosamine levels and total joint arthroplasty complications was reported. In this cohort, there were 119 diabetic patients (14.4%) and 308 patients (37.2%) with HbA1c levels in the prediabetic range. Of these, there were 51 patients with fructosamine levels of ≥292 µmol/L, of whom 20 (39%) did not have an HbA1c level of ≥7%. In this series, there was a clear correlation between fructosamine levels and odds of deep infection (odds ratio (OR) 6.2), risk of readmission (OR 3.0), and reoperation (OR 3.4). Given that in the same patient cohort the HbA1c levels were not correlated with complications such as deep infection, readmission, or reoperation after total joint arthroplasty, fructosamine may be the screening test of the future for our patients.

Preferably not my surgery: overlapping surgeries

■ Concurrent surgery debates have occurred throughout most surgical fields, and studies have previously been focused on safety outcomes. The advantages for the surgeon and healthcare provider are obvious, with the ability to maximize output from the senior surgeon without requiring double the resource. Nevertheless, despite this approach being high on the agenda of many healthcare founders, there is surprisingly little research into the patient's approach to being part of 'conveyor-belt' medicine. This team of researchers from **Chicago, Illinois (USA)** turned the tables on the previous research and focused on patient acceptability rather than the safety aspects.[2] The authors of this survey-based study investigated the attitudes of 200 patients and family towards concurrent and overlapping surgical procedures. They asked respondents to assess their comfort level with different surgical scenarios, and also explored their beliefs on possible underlying reasons for such surgical situations. Although this is plainly something of a 'soapbox' study and it is clear that the authors may not be entirely in equipoise about the prospect of concurrent or overlapping surgical procedures, the paper is valuable in that it sheds further light on what is sure to be a long and drawn-out debate. There was little enthusiasm in the cohort for the approach and, on average, respondents were neutral about the prospect of surgical procedures involving overlap of two noncritical portions. They were, however, not comfortable with overlap involving a critical portion of one or both surgical procedures. The resounding message was that patients believe hospitals allow the practice of overlapping surgical procedures to increase revenues. As we take care of our patients, we need to be cognizant about disclosing concurrent surgeries and gauging the comfort level of our patients and their family members.

Physician-owned hospitals: always a bad thing?

■ Government regulations in the USA enacted as part of the Affordable Care Act are being imposed on physician-owned hospitals. Ostensibly, this is to improve outcomes and drive down costs, with the logic being that physician-owned hospitals will have a more profit-centred approach than their government-,