because of their impact on treatment selection and consequent outcome. They have become the expected standard of care in many oncology settings and are used to aid complex decisions such as which patients should have adjuvant therapies, and which are likely to do poorly. We are a little behind in orthopaedic oncology in terms of prediction models, perhaps due to the rarity of musculoskeletal tumours. In this study from **Leiden (The Netherlands)**, the authors sought to use dynamic prediction to assess survival times at various points during follow-up in patients with high-grade limb osteosarcoma.[9] A total of 14 centres contributed data to this series, which contained treatment data on 2232 patients diagnosed with high-grade limb soft-tissue sarcoma, all of whom underwent surgery. The outcomes of these patients formed the basis of the dynamic prediction model, which included baseline and time-dependent covariates with the aim of delivering a model that was able to determine likely five-year survivability throughout their follow-up. Alongside this, the team investigated the effect of covariates at different timepoints throughout the follow-up period and adjusted the model accordingly. The model shows that surgical margin and tumour histology demonstrate a varying effect with time on survival, which is most evident immediately after surgery and falls away over time. The development of local or distant metastases during follow-up has a powerful effect on survival, which is taken into account in the model. Overall, the authors conclude that prediction models need to be updated as time passes following treatment, in order to grant an accurate prognosis. The model described here can be used to make better treatment decisions and more accurate prognoses, thus enhancing the ability of patients to make decisions about their care.

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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 2; Oncology Roundup 5; Research Roundup 1.***

The gonadal shield and DDH research

The use of gonadal shields is subject to geographical variation, with many centres using gonadal shields routinely in pelvic x-rays for assessing developmental dysplasia of the hip (DDH). There is reasonable evidence that we should be using gonadal shields to protect immature organs. Multiple papers report, however, that these shields are frequently misplaced or cover the intended bony architecture. If further exposure is required to glean the required information, then this is potentially deleterious, and if the shield itself does not cover the gonads, then this is also inappropriate. This paper from **Hong Kong** focuses on this issue from the perspective of loss of data in the clinical research scenario, noting that a loss of over 20% of data in a well-structured prospective study or randomized controlled trial significantly affects the quality of the results.[1] With regard to DDH, the authors argue that the gonadal shields frequently block the anatomy required to assess the congruency of the hip and development of the acetabulum. The authors retrospectively reviewed 138 pelvic radiographs taken for DDH surveillance over a one-year period in a single tertiary paediatric centre. Radiographs were assessed for the ability to determine critical anatomical measurements for DDH. During this time, a written protocol was in force mandating the use of a gonadal shield and guiding its use. Worryingly, gonadal shields were still only used in 42% of cases. In those with gonadal shields, only 26% of x-rays had acceptable protection of the patient's gonads, and 58% of cases had critical bony anatomy obscured. This was worse in female patients, showing gonadal protection in only 21% of girls *versus* 55% of boys. In 97% of female x-rays, the gonadal shield obscured the anatomy. Ironically, all adequately protected female pelves had obscured anatomy. This paper argues that the use of the gonadal shield reduces meaningful data, which is important both clinically and in a research context, where studies using shields would introduce bias at an unacceptable level. Hip dysplasia is more common in female patients, for whom the gonadal shield must be lateral to protect the ovaries. However, this usually leads to the appropriate anatomy being obscured, necessitating repeat radiographs. With this in mind, should we be using gonadal shields in these patients?

Recurrence and infantile tibia vara classification revisited

Infantile tibia vara usually results from medial proximal tibial physis growth asymmetry leading to genu varum, which is distinct from physiological bowing. The condition has classically been described by the Langenskiold classification, but the ability of the classification system to predict the recurrence of deformity following intervention has been widely questioned over recent years. The present study from **Fort Worth, Texas (USA)** tries to iron out the creases in the original work of Langenskiold and suggests a modified classification.[2] The original work suggested that patients with stage I to III pathology could be surgically addressed before the age of eight years and definitively treated with osteotomy. However, more recent work suggests that patients with stage III disease, or even stage II, often suffer recurrence, suggesting a more significant growth disturbance than originally predicted. The authors therefore set out to retrospectively review 22 years of cases at their institute between 1990 and 2012, and designed a modified classification system that they felt would best predict outcome. To form the basis of this classification, 82 cases (115 limbs) were included, all of whom underwent surgical correction and were assessed using the Langenskiold classification. New classification system scores were also recorded, in addition to a number of radiological parameters. The modified system includes a three-stage approach: a type A deformity is a partially lucent medial metaphyseal defect, with or without

'beaking'; a type B deformity has a downward-sloping curvature of the lateral and inferior rim of a completely lucent metaphyseal defect, which then has an upslope at the medial rim, with no epiphyseal downward slope; and a type C deformity has a vertical, downward-sloping deformity of both the epiphysis and metaphysis, with no upward curvature projecting medially at the inferior extent, and with the epiphysis sloping downward into the metaphyseal defect. Most patients were followed up through to skeletal maturity, with the range of follow-up being two to ten years. Overall, 67 limbs were corrected with a single surgery, whereas 48 required further surgery for deformity recurrence. Mean age at surgery was younger for those who recurred (4.3 years) compared with those who did not (6.2 years). Significantly more patients with modified Langenskiold type C recurred (71%) than either type A (22%) or type B (20%). Langenskiold stage III (50%) and stage IV (69.6%) both had high rates of recurrence. The authors therefore identify the age of five years as a significant watershed in the risk of recurrence, and extreme vertical sloping of the medial metaphyseal defect as a predictor, which is incorporated into type C in the new classification. As with all new systems, however, it will need to gain acceptance, and withstand scrutiny from the scientific community.

Femoral head reduction and periacetabular osteotomies for the treatment of severe femoral head deformities X-ref

■ Legg–Calvé–Perthes disease or severe hip dysplasia can lead to complex femoral head deformities; in severe cases, the femoral head is not contained by the acetabulum. This leads to the classic deformity of a hinged abduction hip, where the aspherical head impinges on the acetabulum and levers. Treatment for this condition is somewhat tricky, and an isolated osteotomy to one side of the joint can lead to the redirection of undesirable sections of the articular surfaces into weight-bearing zones, or can even result in frank incongruity. Femoral head reduction osteotomies have been relatively widely performed, in order to take advantage of the lateral third of the femoral head articular surface, which is usually less affected. However, this may worsen instability and concurrent periacetabular osteotomy is, therefore, an option. This study from **St. Louis, Missouri (USA)** reviews both the surgical technique and the short-term clinical outcomes of six patients who had combined femoral head reduction osteotomy and periacetabular osteotomies.[3] All of the patients were female, with a mean age of 13 years, and were treated over a five-year period. Clinical and radiological outcomes formed the basis of this study, with just over three years of follow-up. By final follow-up, the authors report a mean Harris Hip Score improvement from 53 to 83. The Western Ontario McMasters University Osteoarthritic Index improved by almost 30 points to a postoperative score of 90. All radiological parameters, including Tönnis angle, the lateral centre-edge angle, extrusion index, and the alpha angle showed significant improvement. No significant disability was noted at final follow-up in any cases. As ever with small cohorts of patients who are carefully selected, it is important not to get too carried away and overinterpret the data presented here. The authors admit that, while the central femoral head was either necrotic or the overall head shape was incongruous, the lateral and medial femoral head segments were selected to have healthy cartilage and to create a relatively spherical head when reduced. Furthermore, this is a big and technically demanding undertaking, and is therefore unsuitable for an occasional surgeon.

Grading illness severity in children with acute hematogenous osteomyelitis

■ Acute bone infection in children can result in life-threatening sepsis, early recognition of which guides both medical and surgical treatment, as well as heightening vigilance for sequelae such as septic emboli and thromboembolism. A severity score for children was previously proposed by a group from Texas in 2014, using C-reactive protein (CRP) at three separate timepoints (0, 48, and 96 hours), respiratory rate (> 12.5% midrange normal), number of febrile days, disseminated disease (multifocal disease, pneumonia, deep vein thrombosis, septic pulmonary emboli, and endocarditis), and admission to an intensive treatment unit as severity markers. This has subsequently been validated and further modified by the same group from **Dallas, Texas (USA),** using a larger sample size, which was prospectively collected between 2012 and 2014.[4] Over this period, 148 patients aged 0 to 18 years old with acute haematogenous osteomyelitis were recruited to this study and required MRI, microbiological culture, or histology confirmation of diagnosis for inclusion, as well as presentation within five days of onset of illness. Total length of stay, including any readmissions, was 6.4 days (0 to 69) with a mean follow-up of 172 days. Of the group, 68% of patients had positive cultures; 37% of patients presented with methicillin-resistant *Staphylococcal aureus* (MRSA) osteomyelitis and had a higher severity score, indicating a more severe infection. Overall, the general markers of severity correlated well with the novel scoring model, but a white blood cell differential band percentage > 1.5% was found to be significantly associated with severity, and was chosen to replace respiratory rate in the model. Overall, this paper succeeded in its aim of validating the previously proposed severity score, both with and without the modification, but the authors acknowledge the potential variation between different patient populations. Investigation by other groups would be very useful to demonstrate external validity and utility.

Irreducible hip dislocations below six months of age

■ This international database-linked study from seven centres in **Europe**, **North America**, and **Australia** discusses irreducible hip dysplasia within the first six months of life.[5] The International Hip Dysplasia Institute database is a prospectively collected observational study of patients with hip dysplasia. In this study, the focus was specifically on the outcomes of dislocated hips with a negative clinical Ortolani examination (i.e. dislocated hips that do not reduce on examination). Patients were included if they were diagnosed with idiopathic hip dysplasia (i.e. no collateral evidence of tetralogic or neuromuscular disease processes), and if they had a dislocation that was confirmed either radiologically (high dislocation on x-ray) or by ultrasound. Over six years (2010 to 2016), 59 hips in 52 patients with irreducible dislocated hips and at least 20 months of follow-up were included. The primary outcome was a successful hip reduction. Overall, 46 hips were treated primarily with a Pavlik harness. Of the remaining 13 hips, five had a primary open reduction and five underwent closed reduction. Two hips had Denis Browne splints applied, both of which were then converted to a Pavlik harness, with one requiring subsequent closed reduction, while one patient was placed in a von Rosen brace, then converted to closed reduction followed by open reduction. Examining the Pavlik harness group, 56% were successfully reduced with the harness. Two patients (three hips) had to abandon treatment due to femoral nerve palsy, which recovered on removal of the

harness. There was not a statistically significant difference between the mean age of those treated successfully (1.2 months) compared with those who failed (1.6 months). Avascular necrosis (AVN) was seen in four hips: two treated primarily with the Pavlik harness and two with closed reduction. This paper represents a large cohort review of the most severe form of hip dysplasia in babies, with a reduction rate of over 50% in the Pavlik harness group, which is excellent. However, these results highlight that this process is not without risks, including AVN and femoral nerve palsy. Left hips had a greater likelihood of successful reduction in a Pavlik harness than right hips; however, age and sex were not correlated with success or failure of treatment. We should remember that, despite being the largest reported cohort in this subject, the numbers here are still relatively small and type II errors are possible. However, the use of a Pavlik harness as a first-line treatment for dislocated and irreducible hips up to four months of age seems, based on the data presented here, to be supported. We look forward to future publications as the database continues to grow.

Infantile supracondylar humeral fractures

■ Supracondylar fractures in infants strike fear into the hearts of most orthopaedic surgeons, especially those who do not subspecialize in the area. Tiny bones with toddler padding and little in the way of bony landmarks make fixation challenging. Previous studies have highlighted a choice when treating these injuries: crossed wires from medial and lateral; or two lateral wires, avoiding the need for dissection and protection of the ulnar nerve. Here at *360*, we consider the use of two lateral wires to be entirely appropriate, but the technique and position of the wires is important in order to neutralize displacement of the medial column. This paper from **Cincinnati, Ohio (USA)** examines how these treatments fare in everyday practice.[6] A retrospective review spanning 17 years looked specifically at metaphyseal distal humeral fractures in infants aged two years or below. Critically, they compared lateral column only fixation with treatments that secured the medial column, which could include a medial entry wire or a lateral entry wire directed into the medial column. Pathological fractures and those in patients with osteogenesis imperfecta were excluded. Complications, further surgery, and assessments of postoperative radiographs were recorded. Baumann's angle was calculated on operative images and at time of bony union, with a difference between the two of > 10° considered significant. A lateral rotation percentage (i.e. Gordon index) ⩾ 50% at the time of healing was defined as substantial loss of reduction. The posterior sagittal cast index and ulnohumeral angle were also calculated. A total of 103 patients were included over this period, with an average age of 18 months. These fractures were more common in girls than boys, with a ratio of 2:1, and were generally sustained on falls from low heights. In this cohort, only one patient had a flexion-type fracture; the remainder were extension-type and the majority were Gartland type III. Overall, 46 patients had medial and lateral column fixation, 11% of which demonstrated loss of reduction. A total of 55 patients had lateral column fixation only, 36% of which were found to have loss of position. This difference between the two groups was significant, with 4.7 times higher odds of displacement in the lateral column group. Deep infection was reported in one patient. No postoperative nerve injuries were reported, but one patient underwent acute revision surgery at ten days. No corrective osteotomies were performed, although eight patients were noted to have cubital varus. In those with in-cast x-rays, the cast index was found to be associated with displacement. Where the cast index was < 20%, there was displacement in 5% of cases, compared with 53% of cases when the index was > 20%. Here at *360*, our opinion is that this likely represents the reliance on the cast to retain position following surgical stabilization. As a pragmatic real-world study, it would be useful to compare crossed wires against two lateral wires, but only where the lateral wires aim to cross the fracture site at the medial and lateral columns, respectively. In unstable fractures requiring insertion of metalwork, we would contend that there is limited or no role for fixation of the lateral column only.

Determining hinge abduction in Legg-Calvé-Perthes disease: can we reliably make the diagnosis?

■ Loss of sphericity of the femoral head in Legg-Calvé-Perthes disease (LCPD) may lead to a shift in the axis of rotation from the centre of the femoral head to the lateral edge of the acetabulum during abduction, resulting in the phenomenon of hinge abduction. The correct identification of this phenomenon is an integral part of determining the simplest and most effective treatment. Furthermore, the criteria are not clear for the diagnosis, as the prevalence of hinge abduction in LCPD has been variously reported from 4% to as many as 70% of cases. The distinction is important, as most surgeons would consider a hinging hip to be a salvageable situation and would opt for a valgus femoral osteotomy. A non-hinging hip, however, may be amenable to containment treatment. But how accurate are we in achieving the diagnosis? This interesting study from **Boston, Massachusetts (USA)** investigates the interobserver and intraobserver agreement when diagnosing hinge abduction in LCPD.[7] Four senior paediatric orthopaedic surgeons assessed 30 randomly ordered cases of LCPD consisting of two fluoroscopic images of hip arthrograms in anteroposterior and abduction views. The cases were assessed on two separate occasions four weeks apart, and were classified as either hinge or no hinge. Key diagnostic features were then elucidated through review of the literature and consensus-building sessions among the surgeons. A new series was then regraded using the same method, and intra- and interobserver agreement was calculated using the Fleiss κ. There was moderate agreement between experts for hinge abduction between the first and second surveys, and also between the third and fourth surveys. Intraobserver agreement was moderate to substantial in the first and second surveys, compared with substantial to almost perfect in the third and fourth. Despite the extensive experience of the reviewers there was, however, only just better than 50:50 agreement in what constitutes hinge abduction. The team also identified some key diagnostic features, including adequate visualization of the labral contour and the lateral epiphysis's ability to slip below the chondrolabral complex in abduction. Interestingly, medial pooling of the dye was not found to be useful. The diagnosis is, therefore, not always reliable, and we should bear this in mind when interpreting studies and reviewing evidence. The authors concluded that the use of hinge abduction as an inclusion criteria or outcome measure should be used with caution.

Paediatric supracondylar humeral fractures: early or late? X-ref

■ It is well established that fractures with vascular compromise should undergo emergency reduction and surgery, but what about paediatric supracondylar humeral fractures requiring surgery presenting out of hours with intact vascularity? This clinical presentation is not at all uncommon and, historically, these patients were often treated overnight by non-paediatric orthopaedic specialists, and with non-paediatric surgical theatre teams. A previous review, now ten years old, found a significantly higher risk of requiring open reduction in these injuries where surgery was delayed more than 12 hours when compared with those who had early surgery. Furthermore, there is a thought that out-of-hours non-specialist operating leads to higher complication rates. This group from **Aberdeen (UK)** performed an updated systematic review and meta-analysis to update the evidence.[8] Retrieved studies were grouped into early surgery

and delayed surgery categories, and the primary outcome measure was the requirement for open reduction. A meta-analysis was performed where appropriate. Overall, the authors were able to include 12 studies reporting the outcomes of 1700 fractures. In the pooled data, mean time to surgery, from the point of injury, was 10.7 hours for early surgery and 91 hours for delayed surgery. Interestingly, there was no significant difference between early surgery *versus* delayed surgery for the outcome of requirements for open reduction of the fracture, which was one of the key findings of the previous study. There is also no significant difference for the other reported outcomes, including iatrogenic nerve injury, further surgery, and pin site infections. Currently, therefore, the evidence supports the avoidance of out-of-hours surgery in the absence of compromised vascularity. However, there are significant limitations in what is reported in the literature, with all the studies included having a high risk of bias, and the quality of evidence for each outcome was low. The authors, therefore, correctly hesitate in calling this conclusion certain, and instead suggest that large prospective cohort studies would be of most benefit, especially for clinical dilemmas, such as the timing of surgery in patients presenting with a well-fused but pulseless hand. Here at *360*, we look forward to reviewing this evidence.

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Research

X-ref ***X-ref For other Roundups in this issue that cross-reference with Research see: Spine Roundup 4; Trauma Roundup 7; Oncology Roundup 9.***

Why can't we all measure the same thing in paediatrics? X-ref

Patient-reported outcome measures (PROMs) and surgeon-reported outcome measures (SROMs) are used to assess the individual benefits of treatments from the patient's perspective. Since the revolution in orthopaedics research, their use within the literature has – for better or for worse – become ubiquitous. Each outcome measure has its own advantages and disadvantages, and there is a wide variation in measurement properties, development history, intended use, and reliability. Their application to measurement of paediatric outcomes is also vulnerable to the impact of childhood development on a patient's interpretation of the questions and answers. However, we nevertheless tend, as a discipline, to group these varied outcomes together as PROMs or SROMs. This study from **New York, New York (USA)** highlights this problem by describing the range of PROMs and SROMs used in paediatric orthopaedic publications over the past ten years.[1] The authors searched several prominent orthopaedic journals and conducted a systematic review of the outcome measures. The authors waded through 4614 articles in the orthopaedic press and reviewed the 2251 that met their inclusion and exclusion criteria. Overall, 230 different outcome scales were identified, of which 115 were patient-reported and 115 were surgeon-reported. The authors went on to establish if these were appropriately applied and, sadly, only 1:5 SROMs and 1:3 PROMs were found to be used with an appropriate age and disease cohort. This paper makes for a difficult read, especially given the work done by the COSMIN (Consensus-Based Standards for the Selection of Health Measurement Instruments) group to promote the use of appropriate outcome measures.

To improve your surgical drilling skills, make use of your index fingers

Surgery, despite all of its technological developments, is a practical skill. Every surgeon has been through their apprenticeship to learn these skills, and so it is surprising that there is so little evidence to support the various elementary techniques used. In this interesting study from **The Netherlands**, the authors assess the precision and accuracy of the shooting grip technique in drilling the bone, and investigate whether experience influences the accuracy and precision of a surgeon's technique.[2] A total of 36 Dutch surgeons were enrolled into this study and were stratified by surgical experience. Each was asked to drill through a synthetic bone using four different techniques, one of which was a shooting grip aiming at the contralateral index finger. Each participant drilled five times per test, which was repeated four weeks later. The accuracy and precision of the drill holes were analyzed using an analysis of variance. The authors show that the highest drilling accuracy occurs when a clenched grip is used while aiming at the contralateral index finger. A shooting grip aiming at the opposite index finger shows higher precision than clenched grip without aiming at the index finger, but is similar to other grip-and-aim techniques. The authors further note, perhaps unsurprisingly, that more experienced surgeons are more accurate and precise than inexperienced surgeons. Based on these results, we should aim at our fingers, but not through them, as often as possible.

Late dislocation following total hip arthroplasty: spinopelvic imbalance as a causative factor X-ref

The pelvis is thought of by some spinal surgeons as the terminal vertebrae and, while this may seem excessive to others, it is clear that spinopelvic movement should not be ignored by the hip surgeon. That is the conclusion of this paper from **Los Angeles, California (USA)**, which assessed the mechanical causes of late total hip arthroplasty dislocation.[3] The authors considered 20 consecutive patients presenting with late dislocation of their hip arthroplasty. Inclination and anteversion of the acetabular component were assessed using pelvic radiographs; pelvic motion, femoral movement, and the sagittal component position were evaluated using lateral standing and sitting plain radiographs. Spinopelvic motion was quantified as the difference between the sitting and standing sacral slope, and the data fed into a new measurement of the authors' devising – the combined sagittal index – to evaluate the