X-ref *For other Roundups in this issue that cross-reference with Children's orthopaedics see: Oncology Roundup 2.*

MRI evaluation of contralateral pre-slip hips X-ref

For patients presenting with unilateral slipped capital femoral epiphysis (SCFE), management and prophylactic stabilization of the contralateral hip is a common area of debate. In the majority of cases, the initial presentation is with only unilateral symptoms, but previous studies on SCFE have reported the incidence of subsequent contralateral disease to be between 18% and 80%. Advocates of prophylactic fixation point to the lack of a perfectly accurate algorithm for predicting future slip and improved outcomes with prophylactic fixation, while those to the contrary highlight the potential morbidity of a procedure that may be unnecessary. This paper from **Columbus, Ohio (USA)** asks whether MRI at the time of initial presentation can detect 'pre-slip' or predict SCFE in the contralateral limb.[1] They report a case series of 33 patients who were prospectively enrolled as they presented with a primary idiopathic stable SCFE. The patients were treated for their presenting slip, and were followed up with serial radiographs as per the author's usual practice. Only patients who were asymptomatic in the other hip were included, and they underwent an MRI within a week of initial presentation of the contralateral hip. The surgeons were blinded to the results of this MRI, lest they interfere with the natural history in the absence of symptoms. Femoral neck buttressing, physeal and periosteal continuity or disruption, focal or diffuse physeal widening, synovitis, bone marrow oedema, joint effusion, and periarticular oedema were assessed on the MRI scans. Six patients (18%) had positive findings on MRI scans, four of whom subsequently developed SCFE. A single patient with a negative MRI developed a slip. Sensitivity analyses were performed for each radiological marker. An open triradiate cartilage plus MRI findings provided the most predictive information, with a sensitivity of 80% and specificity of 100%. The numbers of patients in this study are small, but it is impressive that two-thirds of patients subsequently developing a SCFE had MRI changes on initial presentation. The authors take this as a high enough sensitivity and specificity to prevent unnecessary prophylactic pinning and to predict those for whom surgery will subsequently be necessary, recommending that an MRI is obtained in all patients. However, given that one-third of subsequent slips would be missed, we are not so sure of this conclusion, and would desire a higher sensitivity if MRI were to be used as a single test.

Trends in slipped capital femoral epiphysis: is the rate declining?

Continuing with the focus on slipped capital femoral epiphysis (SCFE), the next paper asks whether the incidence is changing with time in the USA, especially as obesity levels increase even in the paediatric population. Researchers from **Birmingham, Alabama (USA)** used the Healthcare Cost and Utilization Project Kids' Inpatient Database to investigate the trends in SCFE incidence.[2] The authors used this large inpatient database to review six separate years at three-year intervals from 1997 to 2012, each of which was interrogated to give point estimates for incidence. From a treatment perspective, the authors also recorded operative approach, patient demographics, and clinical characteristics for each of the individual year cohorts, and analyzed them using multivariate analysis. Patients aged between nine and 16 years of age were included, all of whom underwent closed or open surgical treatment for SCFE. Atypical cases, such as those with endocrine abnormalities, were excluded. The results showed that, surprisingly, the overall incidence of SCFE procedures decreased by 28% over the study period. Unfortunately, the database does not capture body mass index, and so it was not possible to link the change to obesity levels within this group. Open procedures decreased in frequency in younger patients and increased in older children, reflecting changing surgical attitudes to treatment options, such as the modified Dunn procedure, which was published in 2007. Bilateral closed procedures also increased over the study period by 7%, but it was not possible to ascertain whether this was due to increased bilateral presentation or prophylactic pinning. While this paper highlights some points of interest that warrant further study, it is not sufficiently granular to draw any conclusions with certainty.

Botulinum toxin type A *versus* placebo for idiopathic clubfoot

Here at *360*, we recognize that high-level evidence is often difficult to obtain in the paediatric population, due to both the rarity of conditions and the challenges of conducting randomized trials with children. Given the mobility of the population, it is even more difficult to report the outcomes of these trials a number of years on. We therefore congratulate the authors of this paper for demonstrating that double-blind randomized control trials in this population are possible. Clubfoot is largely treated worldwide with Ponseti method casting, with long-term outcomes demonstrating high satisfaction rates. In 2005, the Vancouver group proposed the use of botulinum toxin to defunction the calf muscle if equinus deformity fails to correct, as opposed to surgical correction in the form of Achilles tenotomy as described originally by Ponseti. In a randomized controlled trial published in 2015, the same group reported the efficacy of botulinum, utilizing an ultrasound probe to demonstrate lengthening of the Achilles tendon with associated reduction in the gastrosoleus complex in the botulinum group, compared with no toxin injection. This two-centre randomized controlled trial from **Vancouver and Toronto (Canada)** recruited 62 patients, with 32 randomized to the botulinum toxin group while 30 underwent placebo injection; both parents and clinicians were blinded to the intervention arm.[3] The injections were performed in clinic in those patients who failed to correct equinus at four weeks after the commencement of casting, followed by a further four weeks of casting. Success was determined by a dorsiflexion of greater than 15°. Non-responders were those at this stage who did not gain the required correction at four weeks; these patients underwent a further botulinum toxin injection and four more weeks of casting. Further non-response was either treated with further botulinum toxin injection or Achilles lengthening, depending on the base site. The rates of primary non-response were the same, with 11 in each group. All patients in the placebo group corrected following the rescue botulinum toxin injection and casting. Only seven of 11 patients in the botulinum group responded, with four considered non-responders; these patients all underwent surgery (one posteromedial release and three tendoachilles lengthenings). No difference in overall outcomes was found between the groups, which the authors argue may be related to the small sample size and the crossover to botulinum toxin within the placebo non-responders. This paper poses an interesting alternative to the Achilles tenotomy to gain dorsiflexion in these patients,

although it is hard to explain why no toxin was less effective than the placebo in improving foot position initially. The overall surgical rates of only 8% by two years is arguably an excellent result in these children, as the Ponseti method would generally see 70% undergoing Achilles tenotomy. Long-term results are required, however, to demonstrate that the resultant correction is maintained.

DVT among children with or without osteomyelitis X-ref

■ Venous thromboembolism is, if anything, overpublicized in adult patients, with detailed guidance in most health systems for use of prophylaxis. Prophylaxis use is dependent on the type of surgery or immobilization, operative time, and individual patient risk factors, and, despite the plethora of research guidance, it varies from country to country. In children, venous thromboembolism is rare, and prophylaxis is generally not given. There is, however, an increased risk of thromboembolism in patients with musculoskeletal sepsis, particularly related to methicillin-resistant *Staphylococcus aureus* infections. This paper from **Dallas, Texas (USA)** retrospectively reviewed all patients with deep vein thrombosis (DVT) and with osteomyelitis diagnosed in the paediatric population (birth to 18 years inclusive) from 2008 to 2016 in the Children's Health system of Texas database.[4] Adults and children with chronic occlusions were excluded from the analysis. Demographics, comorbidities, hospital stay, and course of illness and treatment were collected. From the database of over 991 000 patients, only 224 children were identified to have a DVT, with a prevalence of 1 in 4000 patients. In those patients who were diagnosed with a DVT, 12% had a concomitant diagnosis of osteomyelitis; 466 children were diagnosed with osteomyelitis, and the rate of DVT among these patients was 6%. Unsurprisingly, patients with osteomyelitis who had an associated DVT were significantly more likely to have a bacteraemia than those with no DVT (81.2% *vs* 38.4%), a longer period of ongoing bacteraemia on blood cultures (4.1 *vs* 0.9 days), a higher rate of requiring surgery (92.9% *vs* 54.6%), and a more proximal site of osteomyelitis such as the pelvis, femur, or proximal tibia as compared with other locations (89.3% *vs* 41.1%). The severity of the osteomyelitis as measured by the level of initial C-reactive protein (CRP), number of febrile days, and severity of illness score was significantly higher in the osteomyelitis with DVT group. Delay to diagnosis from admission was lengthy, at six days where osteomyelitis was present and 18 days when it was not. This is the largest study of osteomyelitis-related DVT to date, adding to the current evidence that deep venous thrombosis is more common in patients with acute osteotomyelitis, particularly those with staphylococcal infections. Vigilance in this group is paramount, and the authors go so far as to suggest ultrasound screening for DVT in all cases of osteomyelitis in children who have a CRP > 8 mg/dl, bacteraemia, or chest radiograph findings. Given the relatively small number of patients and the potential consequences, we would not disagree with this on the current evidence.

Paediatric medial epicondyle fractures of the distal humerus X-ref

■ Traditionally, the paediatric medial epicondyle fracture has been treated conservatively with good results. Recently, however, there has been an increasing tendency to treat such fractures operatively. Various studies have associated outcomes, including grip strength and instability, with the level of displacement of the fracture; other studies have shown no difference. This excellent article from **Liverpool (UK)** summarizes the current literature and offers a pragmatic approach to management.[5] For the more junior *360* reader, a sound review of the basic principles is included; for more experienced readers, the controversies are highlighted. Members of the British Society of Children's Orthopaedic Surgery (BSCOS) have recently identified the medial epicondyle fracture as one of the most important areas in paediatrics requiring quality research. It is relatively uncontroversial that open fractures and incarcerated epicondyle fragments should be treated surgically, but indications in the situation of elbow dislocation are less clear. The anatomy of the developing distal humerus is reviewed, with the change from a horizontal physis below six years of age, developing to a vertical physis in 12-year-olds, a point sometimes overlooked in both decision making and research. Due to its soft-tissue attachments, the medial epicondyle has a tendency to displace anteriorly. This can make assessment of displacement difficult, and the accuracy of radiographs in estimating this is predicted to be only 60% at best. Axial humeral views had the best accuracy but are not a routine procedure, and are harder to obtain. CT obviously provides the best assessment but also confers the highest dose of radiation. MRI guides assessment of chrondral damage or lateral collateral ligament injury but is often not readily acutely available, and it may be difficult for younger children to tolerate. Once the level of displacement is ascertained, the optimal management is not currently known, with the exception of frankly incarcerated fragments. The medial epicondyle has a high rate of fibrous nonunion but these are often largely asymptomatic. Cases where malunion occurs can result in elbow instability but, equally, surgical management can result in higher degrees of stiffness. This review highlights the lack of clear evidence on the treatment of these fractures. It supports the rationale for the forthcoming SCIENCE trial (Surgery or Cast for Injuries of the Epicondyle in Children's Elbows), which is being coordinated from the Oxford Clinical Trials Research Unit, UK, and is sorely needed to answer this question.

San Diego pelvic osteotomy in patients with closed triradiate cartilage

■ Dysplastic hips with associated dislocation are not uncommon in neuromuscular disorders such as cerebral palsy and myelomenigocele. There are a range of osteotomies described to prevent the unwanted sequelae of untreated dysplasia including dislocation, poor sitting balance, scoliosis, and pressure sores. Originally, most of the osteotomies described, such as the Pemberton osteotomy, Dega osteotomy, and San Diego osteotomies, were performed in patients with an open triradiate cartilage and relied on acetabular hinging upon this structure to reduce the volume in a dysplastic hip joint and provide posterolateral coverage. The San Diego is an incomplete osteotomy centred just superiorly to the acetabulum heading towards the triradiate cartilage, and this review from **Chicago, Illinois (USA)** retrospectively compared its effectiveness in patients with both closed and open triradiate cartilage.[6] This was a single-surgeon series analyzing all patients

over ten years of age undergoing San Diego osteotomy for any type of neuromuscular hip dysplasia over a seven-year period. Pre-and post-operative films were reviewed independently. Reimer's migration index, central-edge angle, and acetabular angle were recorded for two groups of patients with closed and open triradiate cartilages, respectively. The study reports the outcomes of 43 patients, the majority of whom have cerebral palsy, who were followed up to a mean of 23 months. Around half of patients (n = 20) had closed triradiates but, despite this, the osteotomy was effective at correcting coverage. The mean Reimer's index improved from 51% to 11% pre- to postoperatively in the closed group, and 61% to 11% in the open group, with no difference between the two groups. Acetabular shape also improved, with the acetabular angle in both groups being corrected from 50° to 40° in the closed group and 53° to 42° in the open group. Finally, CEA improved by 39° (7° to 69°) in the open group, and 30° (9° to 80°) in the closed group; for all these measurements, there were no significant differences between the two groups. This paper adds to the limited evidence provided previously that suggests this osteotomy may be utilized in the skeletally mature neuromuscular patient. The authors postulate that the osteotomy is equally effective in this patient group due to the relatively poor bone quality seen in the non-ambulatory patient, where the intact portion of the pelvis tolerates bending forces and deforms plastically, where this would not be possible in a child with more normal bone quality.

Osteochondral autograft for advanced osteochondritis of the capitellum X-ref

■ Osteochondritis dissecans of the capitellum is a challenging problem, especially in athletes. Not only is the prevention of long-term arthritis pain a priority, but so is return to play in a joint where high compressive forces are generated. Smaller lesions, especially those involving mechanical symptoms, are often treated with fixation or debridement plus marrow stimulation techniques. Larger lesions may require an osteochondral graft, which is often harvested from the knee with resultant morbidity. This group from **Tokyo (Japan)** have previously described a technique of chondral osteochondral autograft for this problem and now present the long-term results of their series at a mean follow-up of almost five years.[7] Overall, 72 patients with a mean age of 14 years were treated and then followed up with clinical and radiological follow-up, as well as patient-reported outcomes. The range of movement increased significantly, from between -21° and 122°, to between -4° and 136°. Clinical scoring was excellent in 60 patients, good in nine, and fair in three; 70 of the patients returned to their original sport. Radiologically, graft union was achieved by three months in all patients. Harvest of the graft is not straightforward for the average orthopaedic surgeon who is not trained in thoracic work. However, the rate of donor site morbidity is generally lower than with a harvest from the knee, but can involve penetration of the thoracic cavity, with all of its consequences. This is an encouraging technique, the results of which seem to be durable, and the authors should be commended on its development.

REFERENCES

1. **Balch Samora J, Adler B, Druhan S, et al.** MRI in idiopathic, stable, slipped capital femoral epiphysis: evaluation of contralateral pre-slip. *J Child Orthop* 2018;12:454-460.
2. **Gutman IM, Gilbert SR.** Trends in slipped capital femoral epiphysis: is the rate declining? *J Child Orthop* 2018;12:428-433.
3. **Alvarez CM, Wright JG, Chhina H, Howren A, Law P.** Botulinum toxin type A versus placebo for idiopathic clubfoot: a two-center, double-blind, randomized controlled trial. *J Bone Joint Surg [Am]* 2018;100-A:1589-1596.
4. **Ligon JA, Journeycake JM, Josephs SC, et al.** Differentiation of deep venous thrombosis among children with or without osteomyelitis. *J Paediatr Orthop* 38;10:e597-e603.
5. **Stevenson RA, Perry DC.** Paediatric medial epicondyle fractures of the distal humerus. *Orthop Trauma* 2018;32:360-366.
6. **Murar J, Dias LS, Swaroop VT.** San Diego pelvic osteotomy in patients with closed triradiate cartilage. *J Child Orthop* 2018;12:461-471.
7. **Sato K, Iwamoto T, Matsumura N, et al.** Costal osteochondral autograft for advanced osteochondritis dissecans of the humeral capitellum in adolescent and young adult athletes: clinical outcomes with a mean follow-up of 4.8 years. *J Bone Joint Surg [Am]* 2018;100-A:903-913.