

ROUNDUP³⁶⁰

Children's orthopaedics

Flexible plasters: flexible follow-up X

■ The disease burden of distal radial fractures in children is significant. While the majority of fractures are innocent and forgotten about, leaving no residual disability, the numbers of patients, their parents/carers and doctors engaged in treating torus and greenstick fractures the world over must be immense. Treatment regimens vary, with different centres favouring different follow-up and surveillance protocols. Researchers in **Oxford (UK)**, under the guidance of Professor Keith Willett, have contributed one of the few randomised controlled trials (Level I evidence) in paediatric orthopaedics. Reasoning that these fractures rarely require any further intervention and that the burden of unnecessary time, expense and radiation exposure to an often trainee-run fracture clinic may not yield improved functional outcomes, they designed a randomised controlled trial to test two alternate treatment strategies. Their trial included children with stable fractures of the forearm who were randomised to receive either treatment in a standard fibreglass forearm cast or a flexible forearm cast that could then be removed at home without the requirement for subsequent follow-up. The researchers included 317 children with minimally displaced stable fractures of the forearm (mean age of 9.3 years) who were randomised to one of the two treatment regimens. There were no baseline differences between the two

groups. The researchers followed the patients up at both one week following cast removal and at six months. Outcomes were assessed using the Child Health Assessment Questionnaire index score and EQ5-D score. In addition, satisfaction and health economic costs were calculated. The mean treatment cost in the group whose cast was removed at home was £150.88, and £251.62 in the group that received standard treatment. There was no difference seen in satisfaction between the groups or outcome scores at any of the follow-up points.¹ While, on the face of it, this may appear to be a 'no brainer' - the outcomes are the same and the treatment cheaper with the flexible cast - here at 360, we wonder if uptake will be as quick as the authors might hope. In countries where physician income is dictated by patient care encounters, the translation of this research into clinical practice may be a little slower as there would be a fall in income for the healthcare provider. Patient, healthcare provider and parent views on this 'slimmed down' follow-up protocol may also hamper adoption. Clinicians are often resistant to losing follow-up of their patients, and many patients and carers identify follow-up and quality of patient-provider encounters as determinants of outcome (see feature article).

Dual 8-plate or ablation for knee epiphysiodesis?

■ The 8-plate has grown in popularity for correction of leg length and angular deformities. Compared

with other options such as timed epiphysiodesis, the 8-plate offers a more flexible and simplified operative technique. Many paediatric surgeons have adopted the 'dual 8-plate' approach, particularly in those patients in whom prediction of ultimate leg length discrepancy might be difficult. The dual 8-plate has the obvious advantage that removing the plates will allow subsequent restoration of growth if needed. Investigators in **Albuquerque (USA)** designed a study to evaluate the efficacy of this method. Standardised methods for calculating leg length discrepancies are reliant on effective interruption of the growth plate, and the calculation of correction is only accurate if this is known. The investigators designed a comparative retrospective cohort study (Level III evidence) to compare epiphysiodesis and dual 8-plate insertion for correction of leg length discrepancy. Although just 27 patients are included in this paper (16 epiphysiodesis and 11 who had dual 8-plate insertion), the authors have come to a clear conclusion. They assessed radiological leg length on available follow-up films. Those patients in the drill epiphysiodesis group had a significantly more effective reduction in longitudinal growth (15.5 mm *versus* 5.62 mm). Even when follow-up length was taken into consideration with linear regression, the differences were still significant (10.78 mm *versus* 5.62 mm).² While the dual 8-plate method has its applications, this paper is critical in understanding

its limitations. As an incomplete epiphysiodesis is achieved, the treating surgeon should be wary of relying on the standard methods for calculating leg length correction. As there is an incomplete fusion, the estimation of remaining growth and timing of surgery will need to be carefully calculated to ensure adequate correction.

Ultrasounds for pulled elbow?

■ Authors in **Hiroshima (Japan)** have published an interesting paper shedding further light on the aetiology of pulled elbow. This very common injury in toddlers presenting to the emergency department is thought to be the result of luxation of the radial head through a pliable annular ligament. While perhaps not the most clinically relevant of papers, the findings are interesting nonetheless. The author performed primary ultrasound scans on 70 children presenting with a history suggestive of a pulled elbow to a single emergency department. The investigator was reliably able to demonstrate that the annular ligament, together with its supinator insertion, was trapped within the radiocapitellar joint in the majority of injuries. The author proposes an abnormal 'J' sign on ultrasound as diagnostic sign of pulled elbow. The 'J' sign was demonstrated to have resolved following treatment of this injury.³ Whether this paper will have any clinical impact on the management of this condition is debatable as most experienced emergency physicians or even triage nurses will have

performed the reduction manoeuvre on the child practically before they can take a seat in the waiting room. Perhaps there is a need in those with an unclear diagnosis or without resolution of the patient's symptoms following reduction. Irrespective of the clinical utility, this is an interesting paper which confirms the suspected pathophysiology of this clinical presentation and the effectiveness of the treatment employed.

Leg length without the radiation?

■ An unfortunate fact of leg length discrepancy and deformity surgery is that long leg views are required to assess and plan pre-operatively, check correction and monitor growth post-operatively. All this can add up to a sizeable radiation dose, particularly in a growing child. The research team in **Toronto (Canada)** evaluated the EOS system using a phantom limb model. EOS has been promoted extensively as an alternative to CT scanogram or plain films but has not previously been validated as a method for evaluating leg length discrepancy. This low radiation technology offers the obvious potential benefits of lower radiation doses, but is this at the cost of accuracy? The researchers calculated the radiation exposure to the phantom limb in addition to assessing the accuracy of the images created. They evaluated CT scanograms, long leg films and two evolutions of EOS (EOS slow and fast protocols). The EOS system was most accurate, being only 2.6 mm (EOS slow) and 3.6 mm (EOS fast) compared with 6.3 mm (CT scanogram) and 42.2 mm (standard radiographs) in absolute difference from the true length of the femur. The mean radiation dose was significantly lower for the EOS fast (0.68 mrad) compared with the EOS slow (13.52 mrad), CT scanogram (3.74 mrad) and conventional radiograph (29.01 mrad). These values all reached statistical significance, making the EOS system more accurate with lower radiation doses than CT scanogram or long leg

radiographs.⁴ Although pre-clinical phantom work, we were excited to read this article and hope that this is the first of many studies validating this new low-radiation technology. Not only can the system be used to obtain rapid standing and erect imaging of the skeleton, but with the appropriate computer software the images can (with some additional manipulation) be reconstructed into a 3D image akin to that obtained with CT. We would have to agree with the authors that 'this method has the potential to become the new standard for repeated assessment of lower limb lengths and alignment in growing children'.

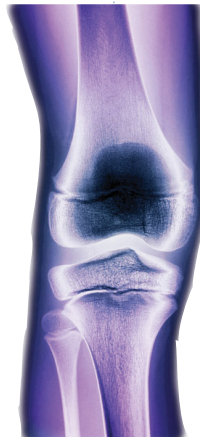
Boyd amputation 'successful' in limb deficiencies

■ Limb preserving amputations have had a variable history in orthopaedic practice, perhaps varying with fashions as much as trends in prosthesis design. However, in children, particularly those with hemimelias, the advantages of a limb sparing amputation are significant. Surgeons in **Sacramento (USA)** have shared the results of their impressively large series of 117 Boyd amputations (performed with a calcaneo-tibial fusion) in 109 patients in a paediatric limb deficiency population at a single institution over a 15-year period. The study team undertook a retrospective (Level IV evidence) case note and radiograph review, reporting distal tibial calcaneal pitch angle, posterior displacement ratio of the calcaneus and required fibular resection. The amputation was most frequently performed for post-axial deficiency in 66% at a mean age of 2.8 years (0.7 to 15.5) with an average clinical and radiological follow-up of over seven years. Subsequent additional procedures were required to optimise prosthetic fitting in 24% and manage complications in 9% (with

an overall complication rate of 14%). The chief complications were most frequently wound- or failure of tibio-calcaneal fusion-related.⁵ Despite providing an impressive array of patients, all to a good follow-up length with an excellent and very detailed description of surgical technique, this paper somewhat disappoints in that it does not contain any data on functional follow-up. Although the authors conclude that the Boyd procedure is an effective treatment, but additional procedures may be required after the initial intervention to optimise prosthetic use, we would be slightly more cautious given the profound lack of clinical follow-up data.

Gold standard club foot treatment

■ Club foot management is a tale of two treatments. Over the past few years there has been a swing away from operative treatments for all but the most recalcitrant club feet, towards splintage or serial casts, such that in most of the world the Ponseti method is the standard of care for club feet. In what is probably one of the most definitive papers on the topic, authors of a comparative case series of CTEV patients treated with either the Ponseti or surgical methods between 1983 and 1987 in **Chicago and Iowa City (USA)**. This is an important paper with long-term follow-up from both the Chicago group, who are advocates of extensive open surgery, and the Iowa group, the vanguard of Ponseti treatment. The authors describe a case series of 42 adults who had previously been managed for club foot (24 surgical, 18 Ponseti) with isolated club foot who were compared with 48 healthy age-matched control subjects. The assessment included physical and radiological examinations, instrumented gait analysis and quality-of-life measures at long-term follow-up, the duration of which is not stated.



The Ponseti group had significantly greater ankle plantar flexion, greater ankle plantar flexor and evertor strength, and a decreased incidence of osteoarthritis in the ankle and foot compared with the surgical group. The outcomes assessed (American Orthopaedic Foot and Ankle Society ankle-hindfoot and midfoot scales, International Club foot Study Group scores and normalised SF-36) demonstrated increased pain levels in the surgical group and lower scores for physical function and quality of life for both groups compared with controls.⁶ The conclusion states: 'This study supports efforts to correct club foot with Ponseti casting and minimising surgery to the joints, and highlights the need to improve methods that promote ROM and strength which are important for adult function'. The clinical relevance presented in this paper is perhaps less impressive (i.e. ankle plantar flexion ROM 25° versus 41°; radiological arthritis 30% versus 21%). This is based on the observation that the Ponseti group had increased ROM, greater strength, and less arthritis and while probably true, it obscures the fact that: 'Although individuals in each treatment group experienced pain, weakness, and reduced ROM, they were highly functional into early adulthood'. The alternative conclusion is that, in this, a small retrospective series, in which both groups were functional, there was a reduction in ROM and more frequent radiological evidence of arthritis in the surgically treated group. The conventional wisdom is that Ponseti casting is the superior method of treatment but for us this paper also highlights that the functional results of surgery are reasonable in early adulthood.

Quadrupled semitendinosus graft is effective in paediatric ACL reconstruction X

■ Treatment of paediatric ACL injuries is hampered by both fear of risk to the growth plate and a slight paucity of evidence. While unable to do something about the former,

surgeons in **Toulouse (France)** have contributed to the knowledge gap concerning paediatric ACL reconstruction in this retrospective, single-surgeon, single-centre study of 28 patients (20 boys, 8 girls). All patients presented with unilateral ACL tear and open growth plates. The paper reports the use of semitendinosus tendon in a four-stranded closed loop secured with resorbable screws. Outcomes were assessed using comparative knee laxity (GNRB arthrometer), radiographic limb morphology (Paley) and functional outcomes (Lysholm and Tegner score), and the incidence of further injury was evaluated at a minimum of two years. The mean surgical age for boys was 13.2 years (9 to 14.8) and girls 12.8 years (11.3 to 15), with an average follow-up of almost three years (2 to 5). The objective outcomes were excellent with mean differences in laxity at 134 N of 0.3 mm. There was no significant difference in leg lengths (0.3 mm). Similarly, there was less than 1° difference in all leg alignment measures. Throughout the follow-up period of the study, there were no meniscal symptoms but two patients

suffered a recurrent ACL tear. By final follow-up, the Tegner activity score was 8.4 and Lysholm score 95.4, with each patient returned to previous or higher activity levels.⁷ This paper represents one of a few reports of the early results of ACL reconstruction using a four-stranded closed loop hamstring technique, and has demonstrated satisfactory outcomes in the short term without any significant physal disturbance.

Predicting complications following cerebral palsy hip reconstruction

■ Attempting to answer a simple but important question - which patients will suffer complications following hip reconstruction for cerebral palsy - researchers from **Philadelphia (USA)** report a sizeable single-institution series. In this retrospective cohort review of 61 non-ambulatory children (93 hips) with cerebral palsy, all of whom underwent a femoral varus derotation osteotomy with or without an open reduction and/or pelvic osteotomy, the investigators set out to quantify the risk factors associated with surgical complications. The average patient was aged 8.1 years (2.6 to 14.7) and the mean follow-up

was to 5.9 years (2.1 to 15.9), with a combined cumulative complication rate (including failure to cure defined as redislocation/subluxation) of 47.6%. The authors established that spica casting was a risk factor for all complications, and patients younger than six years and children with a tracheostomy were at risk of resubluxation following surgery.⁸ The simple clear recommendation of this paper is that patients younger than six are at an increased risk of complications and that spica casting should be avoided if at all possible. The authors also recommend that failure to cure, defined as redislocation/subluxation, should be considered to be a major complication. The advantage of this study is that it stratifies for severity and quantifies the risk and type of complications in non-ambulatory patients (Gross Motor Function Classification Score 4/5). This is a simple paper with a straightforward clinical message.

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