

# ROUNDUP<sup>360</sup>

## Children's orthopaedics

### A multi-level approach to equinus gait

■ Equinus gait can be a difficult to treat and debilitating condition. Surgeons in **Melbourne (Australia)** have been taking a multilevel approach to their management of equinus gait for the past few years. They have now reported their series in a retrospective, consecutive cohort study (Level IV evidence) of 40 children all with spastic diplegia (grade II or III on the gross motor function classification), all of whom had had surgery for equinus gait between 1996 and 2006. The authors performed a distal gastrocnemius recession in all cases or differential gastrocnemius soleus complex lengthening, on one or both sides, as part of single-event multilevel surgery. Outcomes were assessed primarily through use of the gait variable scores (GVS) or gait profile scores (GPS). The equinus gait was successfully corrected in the majority of children, with a low rate of overcorrection (2.5%) but a substantial incidence of recurrent equinus (35%), as determined by sagittal ankle kinematics. Mild recurrent equinus was usually well tolerated and conferred some advantages, including contributing to strong coupling at the knee and independence from using an ankle-foot orthosis. Recurrent equinus is also relatively easily managed as opposed to a crouch gait. This study demonstrated satisfactory correction at the ankle level in most children, as well as a clinically

relevant and statistically significant correction of the overall gait pattern. It would seem that both Zone 1 (proximal) procedures are associated with a significant rate of recurrent equinus, as determined by kinematics, and a relatively low rate of overcorrection. Based on the results presented here, we at 360 would suggest that the aim of 15° to 20° of dorsiflexion intra-operatively may be overly aggressive with perhaps a 5° goal yielding comparable clinical results.<sup>1</sup> Despite a clear clinical message this study is not without its weaknesses in reporting variable single-event multilevel surgery prescription and in the duration of follow-up. In addition, the variable surgical prescription, including both soft-tissue and osseous procedures at multiple levels, has both known and unknown impacts on the ankle level and dynamic ankle function. Despite these weaknesses these results are superior to the widely documented poor results of single-level surgery. For the time being at least, a multilevel surgical approach will remain the treatment paradigm for the foreseeable future at this centre and many others.

### Does screening lead to needless intervention?

■ Researchers in **Nottingham (UK)** set out to establish the utility of hip screening using prospectively collated data collected from the The Nottingham Hip Instability Clinic. The data were collated between 1990 and 2005 on all children with risk factors for DDH or clinical instability. During

that timeframe 112 084 live births occurred within the Nottingham Health Authority area, and of these children, 13 491 (12.0%) were referred for assessment at the Nottingham Hip Instability Clinic. Most of the children were under ten weeks old (84.6%) at the time of presentation, with around a quarter presenting based on family history or breech presentation alone, while in the older children (3 to 5 months) 60% were referred due to the presence of physical signs. Overall, just 455 children (0.4% of the population) received some sort of treatment. The authors were able to clearly demonstrate that treatment extent and complexity markedly increases with diagnostic delay. In early presenters (< six weeks), the majority (86% n = 289) could be treated with abduction splintage with less than one in ten children requiring an open reduction. By the time children were three to five months of age, 14% (n = 5) required open treatment, while all children presenting after ten months required an operative procedure (in the majority open reduction and/or femoral or pelvic osteotomy). The number as well as the complexity of required procedures also increased with diagnostic delay. Patients presenting at ten months had a seven-fold increased risk of requiring any operative procedure than the early presenters did. The cost of procedures ranged from £1515.88 for an uncomplicated Pavlik harness treatment regime to £19 645.00 for those requiring open reduction surgery with both pelvic

and proximal femoral osteotomies. The mean cost of treatment for each age group increased unsurprisingly from approximately £2000 at birth to £15 000 after ten months.<sup>2</sup> None of the findings of this study surprise us and we would echo the authors' conclusions as to the importance of early diagnosis and treatment of patients with DDH. The justification for this can be based on the escalation of treatment and cost, not to mention the detrimental effect on the patients, their families and the longevity of their affected hip and its function. The health economic effect observed by these authors is likely a gross underestimate as they simply recorded the tariff costs and did not take into account additional costs such as complications, excess hospital stay or clinical follow-up.

### Salvage of subcapital slipped epiphysis

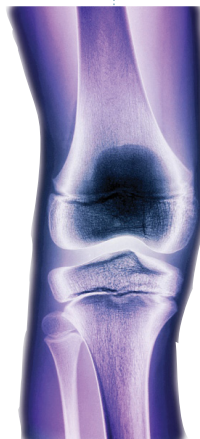
■ Salvage of the symptomatic slipped femoral epiphysis is a bit of a tight spot to be in. Common approaches include neck and intertrochanteric osteotomies commonly performed with or without a surgical dislocation of the hip. A trend towards arthroscopic management is also starting to emerge. However, all of these options deal with the sequelae of the deformity rather than correcting the underlying problem.<sup>3</sup> Surgeons in **Salt Lake City (USA)** have been taking a rather left field approach, performing a surgical dislocation and subcapital osteotomy to take on the problem at the level of the deformity. The authors report on

a retrospective case series of 12 hips from 11 patients with symptomatic femoroacetabular impingement following slipped capital femoral epiphysis. The patients presented at an average age of 15 years and were all managed with surgical dislocation and a subcapital osteotomy at an average age of 15 years. Patients were followed-up to a mean of 61 months. The study team were able to improve the appearance of the radiological deformity for all patients and this was associated with an improvement in the average Harris hip score from 55 to 74 points. In four cases (33%), there were significant complications including two cases of avascular necrosis of the hip.<sup>4</sup> Although the authors in their conclusion support this approach in the management of patients with femoroacetabular impingement, here at 360 we would be a little more reticent to recommend such a treatment with such a significant complication rate and no real long-term follow-up showing improved longevity of the hip. In addition, although improvements in the Harris hip score were noted, previous work has demonstrated the Harris hip score to be poorly representative of clinical outcome in slipped epiphysis. This study supports the results in other studies of the high complication rates of intracapsular osteotomy and the default position for most surgeons remains an inter-trochanteric flexion, valgus, external rotation osteotomy of the femur. Given the high risks and slightly unconventional approach, we will be sticking with the currently accepted approach.

### Growing prostheses for children's oncology

■ Children with osteosarcoma are a special group. Not only do they face the difficulties of living with cancer and cancer treatments at a very young age but they also face the difficulties of multiple surgeries due to the need to match leg lengths. For a number of years the solution to this has been the use of a 'growing' prostheses that avoids

the risk and complications of extra surgery. Despite their widespread use, there is surprisingly little literature to support the use of them. The oncology group in **Bologna (Italy)** have stepped up to the mark and present a series of 32 children (16 boys and 16 girls; mean age nine years) with bone sarcomas of the femur, all treated with limb salvage using expandable prostheses. The surgeons used a range of prostheses, including Kotz Growing prosthesis, the non-invasive Repiphysis and the Stanmore expandable prosthesis. Patients were followed up to the mean follow-up of 49 months. The primary outcomes of survival analysis and functional evaluation were performed. Overall survival was 94% and 84% at 48 and 72 months, respectively. Survival of the primary prostheses was 78% and 66% at 48 and 72 months, respectively. There was some variation in survival between prostheses with the Kotz performing best and significantly outperforming the Repiphysis prostheses. There was a not insignificant rate of implant-related complications with over half of patients suffering at least one complication and nearly a quarter being revised (causes of aseptic loosening, infection, and breakage). The surgical teams were able to achieve a mean total lengthening of 28 mm (4 mm to 165 mm) in 84 procedures (2.6 procedures/patient). Three of the nine children who reached skeletal maturity had limb-length equality and six had a discrepancy of 15 mm to 30 mm. The mean Musculoskeletal Tumor Society score was excellent (79%) without a significant difference between the type of prostheses ( $p = 0.934$ ).<sup>5</sup> Here at 360 we believe that this paper emphasises the importance of continued study and innovation in this area of orthopaedics. With similar results,



many centres default to biological reconstruction or innovative amputation in children with sarcomas of the femur with more durable and functional results.

### How big is big enough?: flexible nailing revisited

■ Flexible intramedullary nailing has been a revolution in paediatric trauma surgery, offering a minimally invasive surgical option for treating a variety of paediatric fractures. However, the operative technique is demanding, requiring the surgeon to obtain stable elastic fixation achieving three-point fixation using the elastic properties of the nail and the proximal and distal ends of the nail. Surgeons in **Kurgan (Russia)** and **Nancy (France)** hypothesised that the diameter of the nail effects the elastic properties and the wrong size may predispose to loss of reduction. The authors attempted to join the hypothetical dots and set about testing the hypothesis that a correlation exists between

occurrence of the complications and the ratio of the diameter between flexible nail and medullary canal (given as: nail diameter (ND)/MCD ratio). Secondary outcomes were to assess the interobserver variability in the measurement of MCD, and to define a threshold to be respected to optimise the results. The study team reported on 81 consecutive diaphyseal fractures, all treated with FIN. The radiographs were evaluated and the ND/MCD ratios were determined by two independent observers. Serial follow-up radiographs were reviewed to determine secondary loss of reduction. Loss of reduction was defined as an angulation of at least 5° prior to bony union, and by three months delayed union was diagnosed. Comprehensive statistical analysis was undertaken to assess both interobserver variability of MCD and to assess the dependency

(statistical link) between complications and ND/MCD ratio and eventual confounding variables (age, weight, gender, and fracture location). Nearly 20% of patients ( $n = 14/81$ ) had loss of position (axial deviation) but there was a low delayed-union rate. Interobserver variability of MCD was excellent (intra-class correlation: 0.96). Occurrence of complications was significantly associated with a low ND/MCD ratio (but not with any of the examined confounding variables). Further analysis clearly demonstrated that in FIN an ND > 40% to the MCD will help to avoid complications and still respect the technical principles. Measuring the medullary canal diameter in order to choose correct nail size is reproducible between different observers. In adolescents with a medullary canal diameter of > 10 mm in femoral or tibial fractures, alternative methods of osteosynthesis to FIN should be considered.<sup>6</sup> This is just the sort of paper we like. There is a clear clinically relevant point. A simple measurement and selecting the appropriate nail size is essential in reducing the risk of complications.

### Ultrasound and the pink pulseless hand

■ Perhaps one of the most difficult decisions a surgeon of any discipline has to make is whether or not to explore the vascular supply in a child with a pink pulseless or white pulseless hand with a supracondylar fracture. Opinion is often divided between orthopaedic and vascular surgeons, with the latter favouring exploration in many cases. Surgeons in **Rome (Italy)** have published a rather neat study investigating the value of duplex ultrasound in Gartland III supracondylar fractures with vascular compromise. The authors were able to include 48 consecutive patients of whom just over 20% ( $n = 11$ ) had vascular compromise associated with the fracture. Of these, the majority were pink and warm ( $n = 8$ ) and cold in just over 6% ( $n = 3$ ). All of the 11 patients underwent ultrasound investigation

and in the majority pathology was demonstrated in the brachial artery. In six cases of warm hands a kinked artery was demonstrated and in one a thrombosis. All of the white hands had significant arterial pathology (laceration or thrombosis). Following reduction and percutaneous pinning the authors explored both pink and white pulseless hands (n = 6). The authors of this paper suggest that practice should be revisited and that perhaps expectant management of the pink pulseless hand is not appropriate in light of their results. However, we are not certain they present any evidence to support this. This series certainly underlines that rarity of vascular injury and compromise following supracondylar fracture (only 6% of injuries) and also seems to us to support the practice of expectant management in well perfused pulseless hands. In none of their cases was a laceration seen in a pink pulseless hand. What this article does, however, demonstrate is that ultrasound is a sensitive modality for diagnosis of brachial artery pathology in the presence of a supracondylar fracture.<sup>7</sup> Certainly

food for thought, but we are sure, here at 360, that this argument will continue unabated.

### Slipping forearm fractures

■ Paediatric forearm fractures are common injuries with a constellation of severities ranging from minor undisplaced greenstick fractures to the severely displaced irreducible both bone forearm fractures. Like distal radial fractures in the skeletally mature, many of these injuries are treated conservatively. Unlike their adult cousins, however, the prediction of later slip is difficult and there is scarce literature to aid the paediatric orthopaedic surgeon. Reasoning that predicting which fractures are likely to slip could help not only with follow-up protocols, but deciding which fractures to treat operatively, researchers in **Rotterdam (Netherlands)** designed a prognostic study with the aim of identifying factors associated with later displacement. They entered 247 patients presenting with displaced forearm fractures into the prospective prognostic (Level I) study. All patients were treated conservatively

and the study team collated data on patient demographics, dominant hand, fracture displacement and treatment. Using a multivariate logistic regression model the risk fractures for displacement were assessed. The authors established that around a third of fractures displace in a cast (89% of which were in above elbow plaster). Displacement occurred most commonly at around three weeks (although this is limited by follow-up intervals). The team were able to identify a number of factors that were independently predictive of subsequent displacement including fracture of the non-dominant arm, complete fracture, ulnar translation and shortening of the fracture.<sup>8</sup> This paper is one of those little gems we come across every now and again here at 360. In patients in whom there is little chance of remodelling and in whom these risk factors are present, it would seem sensible to be vigilant for early displacement.

### REFERENCES

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