

ROUNDUP³⁶⁰

Children's orthopaedics

For other Roundups in this issue that cross-reference with Children's orthopaedics see: Hip Roundup 8; and Oncology Roundup 4.

Half a century of Pavlik treatment

■ Across the world Pavlik's method for the treatment of reducible developmental hip dysplasia has become the standard of care. The results are truly remarkable when used in patients with mild to moderate dysplasia. The Pavlik harness was first used in Japan more than half a century ago, and researchers in **Nagoya (Japan)** have sought to establish what the changing patterns in use of the device are. The study team administered the same questionnaire twice, once in 1994 and then 14 years later in 2008. The questionnaire was designed to take a snapshot of current practice in use of the harness, paying particular attention to reduction rates, final joint morphology and incidence of avascular necrosis in the femoral epiphysis. The Japanese surgeons were able to report the results of 2481 patients in 1994 and 1523 in 2008. The harness achieved reduction in 80.2% in 1994 and 81.9% in 2008, with a falling incidence of avascular necrosis (14.3% versus 11.5%). The final results were assessed using Severin changes, and 72.3% achieved an acceptable outcome in 1994, rising to 77.7% in 2008. The Japanese surgeons appear to be becoming ever more competent with the Pavlik harness, with higher rates of successful reduction

and lower complication rates with the harness over a 14-year period. This improvement in outcomes was statistically significant.¹ The Pavlik harness continues to be the gold standard in the initial treatment of DDH in almost every developed and undeveloped healthcare system. Although rates of success are improving, the not insignificant rates of AVN reported in this series highlight the importance of senior clinician input in the expert management of this nonoperative modality.

Step away from the child!: trends in fracture management

■ There is an ongoing trend towards more and more aggressive management of paediatric fractures, and nowhere is this seen more acutely than in the management of upper limb fractures. Researchers in **Cincinnati (USA)** have questioned whether this increased trend towards operative management is indeed matched by clinical research to support this change in treatment regimes. In a slightly unusual methodology, the study team elected to review all abstracts presented at the two largest paediatric meetings in North America; the Pediatric Orthopaedic Society of North America (POSNA) and the American Academy of Orthopaedic Surgeons (AAOS) over a 19-year period. Each paper was reviewed and the recommendations by the authors following data presentation classified as: neutral, more aggressive treatment recommended, or

less aggressive treatment recommended. The relationships between level of evidence, fracture location, and treatment recommendations were evaluated using correlations and regression analysis. Following defined exclusion, 190 studies that included data relevant to treatment decisions in paediatric forearm fractures were evaluated by two assessors, blinded to each other's ratings. The authors also evaluated the abstracts for year, type of presentation, sample size, study type, level of evidence, fracture location and type and treatment. Overall, nearly half of the abstracts recommended a less aggressive treatment regime, while 27% recommended more aggressive treatments. Interestingly, case series were significantly more likely to recommend aggressive treatments than comparative series, as were studies with smaller sample sizes. The higher the level of evidence, the more likely the study was to recommend conservative treatments, with 91% of level I or II, 80% of level III and 70% of level IV studies recommending conservative treatments. The recommendations did not appear to differ according to conference type, but operative studies were noted to be significantly more aggressive in recommendations for management. The majority of these studies were level IV evidence, although there has been a noted trend towards higher levels of evidence with time. The authors note a growing dichotomy between evidence-based medicine based on available clinical research

and the direction of travel with clinical treatment decisions. It is certainly important to ensure that this disparity is explored and understood. Either there are external factors at play (such as parental preference or remunerative incentives) or the majority of paediatric orthopaedic surgeons are flying in the face of the accumulated research. This study is interesting in its conclusion as it is contrary to the conventional wisdom that there is generally a more aggressive approach to paediatric upper limb trauma.² Despite the many methodological flaws, this is one of the most interesting and thought-provoking studies of interest to paediatric orthopaedic surgeons and trauma surgeons alike.

Posterolateral rotatory elbow instability in children

■ Posterolateral rotatory instability (PLRI) was an unrecognised condition until the early 1990s when Shawn O'Driscoll described a post-traumatic instability of the elbow in flexion and supination, resulting in luxation of the radial head and proximal ulna and, in extreme situations, the elbow itself. PLRI commonly occurs secondary to trauma, although other causes of ligamentous instability or elbow dysplasia may also be responsible. PLRI has (to our knowledge at 360) never been described in detail in children. Paediatric orthopaedic surgeons in **San Francisco (USA)** report a retrospective study of nine patients evaluated in three academic centres. All patients presented with

signs and symptoms of PLRI and underwent ulnar-collateral ligament reconstruction for posterolateral instability. The research team present a retrospective case series (Level IV evidence) based on review of medical records, with the aim of defining the clinical features, operative strategy and outcome of this rare diagnosis. Patients were followed up to just over two years following surgery. PLRI is seen when the elbow is subjected to axial load in a position of supination and valgus while the elbow is in flexion. The mean age at injury was ten years and the most common mechanism was a fall. In all cases, patients presented with a severe elbow injury; three fractures, three dislocations and three with a fracture dislocation. In the majority of cases, patients were initially managed non-operatively ($n = 5$), with two cases each of closed reduction and percutaneous pinning. Following injury, patients continued to complain of pain and instability in the elbow. Only a single patient demonstrated an awake pivot shift, but this sign is difficult to elicit, even in a compliant adult, and all patients demonstrated a pivot shift under anaesthesia. The authors elected to undertake surgical reconstruction with allograft (*palmaris longus*, *plantaris* and *semitendinosus*). By two years post-operatively all patients were stable with an improved range of movement.³ This paper presents a clear description of a rare complication of a common injury. It is of merit in that it alerts the general orthopaedic surgeon to the existence of PLRI in the paediatric population and provides a valuable description of the surgical reconstruction and results, albeit with a short follow-up.

Osteochondral lesions undiagnosed in patellar dislocations

■ First time patellar dislocation is a staple of any paediatric fracture clinic and, for the most part, injuries are treated non-operatively, with a reassuring word with the patient's

parents and a course of physiotherapy. Orthopaedic surgeons, safe in the knowledge that around 90% will never have another dislocation, rarely evaluate these injuries with more than a plain film. Clinicians in **Ann Arbor (USA)**, concerned that they (and others) may in fact be missing significant injuries if just a plain film evaluation is undertaken, decided to carry out a retrospective evaluation of patients presenting with primary patellar dislocations in their institution where MRI scans are regularly performed for this injury. The researchers evaluated the plain radiology and MRI findings, clinical features and surgical outcome in a retrospective cohort of 122 patients aged between 11 and 18 years with first time acute patellar dislocation. All patients underwent thorough radiographic evaluation including AP, lateral and Merchant radiographs in combination with an MRI scan. Osteochondral injury was identified in 46 patients on MRI scan, compared with only 25 with plain radiography, full thickness lateral condylar lesions in 11 (24%) and on the medial patellar facet in 35 (76.1%). MPFL injury was seen in nearly all patients ($n = 45/46$) and VMO oedema in over two thirds. Reconstructive surgery was undertaken in just over half of the patients ($n = 26/46$), consisting of internal fixation in six, loose body removal in 20 and MPFL reconstruction in 15 patients. By final follow-up, patients with grade 4/5 condylar injuries to the distal femur had lower IKDC scores than patients with less severe injuries, irrespective of the type of surgical treatment. Interestingly, patellar lesions that were treated without surgery had higher scores than those treated operatively but the numbers are small.⁴ We do wonder here at 360, that if patients with



OCDs in the patella do better than those treated operatively, if the MRI scan is really required? Surely if the patellar lesion is not visualised the surgical team cannot be tempted to treat it!

Oral bisphosphonates in osteogenesis imperfecta

■ Children with osteogenesis imperfecta are often treated with intravenous bisphosphonates which is extremely efficacious, however, there are no studies exploring the use of oral bisphosphonates on fracture risk. Researchers in **Sheffield (UK)** devised a randomised, parallel group, double-blinded, placebo-controlled trial involving children aged four to 15 with osteogenesis imperfecta to receive either daily risedronate or placebo for a period of a year. The study team were able to recruit 147 patients, of whom 97 were randomly assigned to risedronate and 50 to placebo. There was a significantly different improvement in lumbar spine bone mineral density in the treatment group *versus* placebo (16.3% *versus* 7.6% increase). At one-year follow-up there were considerably more clinically significant fractures in the placebo group (49% *versus* 31%), a benefit that continued through the subsequent two years of open label treatment (65% *versus* 53%). There were no differences in the reported event rates of gastrointestinal upset or musculoskeletal adverse events between the two groups.⁵ This study provides level I evidence that oral bisphosphonates may be used as a treatment option in patients with osteogenesis imperfecta and that it is not only efficacious but also well tolerated. The authors conclude that with the observed increase in BMD and reduction in one-year and three-year fracture risk, risedronate should be regarded as a treatment option for children with osteogenesis imperfecta.

Crossed or parallel pins in supracondylar fractures?

■ There is now little disagreement that off-ended (Gartland 3) supracondylar fractures with or without neurovascular compromise are probably best treated operatively, however, there is significant debate surrounding the best method of fixation. While cross pinning provides arguably better biomechanical fixation, the use of two lateral wires removes the risk of iatrogenic ulnar nerve palsy. Researchers in **Tianjin (China)** have seized the opportunity to perform a meta-analysis and evidence synthesis to establish the risk of iatrogenic nerve injury, quality of fracture reduction and subsequent functional outcomes (using Flynn's criteria). They performed a thorough search of the major medical literature indexes and were able to identify seven RCTs reporting the outcomes of 521 participants. In this well conducted meta-analysis the quality of the methodology of each study was assessed using the Detsky quality score. Appropriate statistical methodology was undertaken to assess for population heterogeneity between studies, and Egger's test was used to assess for publication bias. The review authors were unable to detect any differences in any outcome measure, bar the risk of iatrogenic nerve injury which was lower with the lateral technique (relative risk 0.3). There was no publication bias that the review authors were able to detect and no differences in radiographic or functional outcomes between the two study groups.⁶ The authors of this review have concluded that the lateral pinning technique is the preferred option, and based on these results we would wholeheartedly agree with them. It is perhaps, however, worth highlighting that the lateral technique is dependent on only two, as divergent as possible, stout K-wires not crossing at the fracture site (and preferably not crossing within the bone) should be accepted in order to maximise fixation.

Not too late nor too early: getting epiphysiodesis right

■ An operation that has stood the test of time in paediatric orthopaedics is the humble epiphysiodesis. Done correctly and at the right time, epiphysiodesis can be used to correct deformity and leg length discrepancy. The surgery itself isn't challenging and there are well described methods to calculate the optimal time to undertake epiphysiodesis. Despite this, there are still plenty of cases where surgeons get it wrong and the patient is left with a significant leg length discrepancy. The two main methods for timing epiphysiodesis are the multiplier method and straight line method. Researchers in **Gyeonggi-do (South Korea)** designed a study to establish which of these methods, or their variants, would most accurately assess the leg length discrepancy. The study team retrospectively reviewed the medical records of a series of 44 patients with leg length discrepancy treated with percutaneous epiphysiodesis. The patients were followed to skeletal maturity. The researchers used myriad growth remaining methods. Although they timed the epiphysiodesis with a

modified Green-Anderson's method, the authors also calculated the Green-Anderson original method, and Paley's multiplier method, using bone age and chronological age. Finally, they also used Moseley's straight line graph method. The researchers assessed the accuracy of each method by comparing expected leg length discrepancy with actual leg length discrepancy for each method. The most accurate method was the Green-Anderson original method, with the others all overestimating the level of correction involved.⁷

Fixation of supramalleolar osteotomies

■ Supramalleolar osteotomy is commonly performed for a range of tibial deformities, but is often performed for persistent tibial torsion. There are almost as many methods of fixation as there are osteotomies described. Surgeons in **Salt Lake City (USA)** set out to evaluate the outcomes of pin and plate fixation versus a plate and screw construct. While the plate and screw construct offers the advantages of stable fixation, a secondary procedure is nearly always required to remove the construct. A percutaneous pin

fixation method offers the potential for fixation without the requirement for a secondary procedure to remove the construct, but at the cost of a less sturdy fixation. The research team were able to assemble a hugely impressive 186 cases (125 patients), operated on at their institution over a ten-year period. The study team undertook a thorough chart review including complications, procedure details and correction. They report a selected comparative series of 87 cases of pin fixation and 64 of plate fixation, all followed up to union of the osteotomy. There were 47 procedures for removal of metalwork, of which 44 were in the plate group. Complications differed dramatically with a complication rate of 12.8% in the plate group and 3.4% in the pins group. The recurrence rate in both groups was low, with four recurrences in the pins and two in the plate group.⁸ The research team have adequately demonstrated that there is a significantly high complication rate in the plate and screws group when compared with the percutaneous pins cohort, suggesting this not to be the treatment modality of choice.

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