ROUNDUP360

Children's orthopaedics

For other Roundups in this issue that cross-reference with Children's orthopaedics see: *Foot & Ankle Roundups 2 and 3; Research Roundup 2; Spine Roundup 2.*

Long-term changes in hip morphology following osteotomy

The intimate relationship between the tri-radiate cartilage and capital epiphysis allows the growth and development of a congruent hip joint in most circumstances, even if it is not a concentric one. Operation on the dysplastic hip for DDH is known to result in a significant change in morphology in the longer term, however, very long-term follow-up and results are unknown. Researchers in **Taipei (Taiwan)** set about attempting to fill this void in knowledge. They designed a long-term study (mean 18 years) examining the results following index pelvic osteotomy. Successful follow-up consisted of radiological (acetabular coverage) and outcome measures (including SF-36 and Harris hip score) at the time of most recent follow-up. Of the original group of 446 unilateral DDH patients, the study population presented consisted of 360 patients aged between 12 and 36 months at the time of surgery. Of these, just 42 patients were successfully followed up and presented in the study, representing just 12% of the procedures performed on the eligible population. Radiographic morphology was assessed using measures of the vertical centre edge anterior margin angle, anterior acetabular head index and weight-bearing zone acetabular index with the unoperated side used as a control. The authors were unable to find anything of note to report in this potentially promising paper. The only significant difference was in the Pemberton osteotomy group, where decreased weight-bearing zone acetabular index was seen (and symptoms of anterior impingement in three patients in this group). There were no differences in SF-36 or Harris hip scores between groups at the time of final follow-up. The findings of this paper suggest that the Pemberton osteotomy provides an improvement in anterior cover compared with the Salter osteotomy, potentially at the expense of symptoms of impingement.[1] It seems to us that, intuitively, one would expect an alteration in the radiological measurements in the Salter group. The absence of this finding has two possible explanations. Either the Salter osteotomy is not an effective method of altering anterior cover, or alternatively, the radiological measurements are insufficiently sensitive to demonstrate them. This does not, however, appear to translate into any difference in function or symptoms. If perhaps more of the eligible patients had been followed up and reported, the conclusions of this paper are likely to have been more useful.

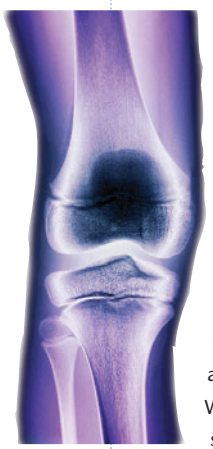
Arthrogrypotic wrist contractures are surgically amenable

Arthrogryposis is notoriously recalcitrant to surgical intervention. Patients are often left with difficult to manage and evolving deformities. Particularly disabling can be serious flexion contractures in the hand and wrist. There are a number of options for treatment of such contractures but the outcomes are far from clear. Researchers in **San Juan (Puerto Rico)** have set out to establish the long-term outcome of their preferred surgical intervention of dorsal carpal wedge osteotomy in the treatment of wrist flexion contractures in patients with arthrogryposis. The study included all patients treated at a single institution over a 24-year period. The authors were able to achieve a minimum of two years' post-surgical follow-up. The authors retrospectively examined prospectively collated data, including pre-operative position of the wrist, arc of movement and range of extension. Outcomes were assessed using functional questionnaires to assess the patient's perception of, and the clinical results, of surgery (including Manual Ability Classification System, and the ABILHAND-Kids). The authors were able to include an extremely impressive 75 wrists (46 patients) in their review. The average age at surgery was 4.3 years (9 months to 18 years) with average follow-up to 5.7 years (2 to 10.3 years). Additional operations were required in 13 patients, usually involving a thenar slide, tricepsplasty or an elbow release. The surgical team achieved an obvious improvement in resting position of the wrist from 55° to 11° which was accompanied by an improvement in the location of the arc of movement; however, the range of wrist movement did not change. The satisfaction scales indicated that the patients and their parents were satisfied after surgery (9.1 out of a possible 10), and functional scoring demonstrated an improvement in the ability to conduct specific manual tasks.[2] This paper is useful to the paediatric orthopaedic surgeon in that the pathology described is common in paediatric practice and this demonstrates a predictable improvement following a relatively straightforward operative procedure. Although the study has a low level of evidence, it is nevertheless a useful endorsement for this procedure.

Paediatric femoral lengthening over a nail: effective but beware complications

Deformity and limb length correction in the femur is fraught with difficulty. The combination of differing anatomical and mechanical axes combined with a thick soft-tissue envelope can make limb lengthening a daunting prospect and not for the faint-hearted. Researchers in **St Louis (USA)** have been using a technique with a combination of nail and external fixator for several years. They cite advantages of early removal of the external fixator and note that this procedure is well described in the adult, but not the child. They present a retrospective review of a series of 37 patients in support of the technique. All patients underwent external fixator lengthening of the femur, augmented with intramedullary stabilisation. The

procedures were performed over a lengthy 11-year period (just three per year) in a single institution by a single surgeon. Outcomes are reported in a retrospective case series (Level IV evidence) at a mean of just over five and a half years (15 to 148 months). The patient cohort was a disparate group of pathologies, with 14 cases of congenital short femur, nine proximal focal femoral deficiency, one Russell-Silver syndrome, one spondyloepiphyseal dysplasia, eight physeal arrests, three enchondromatosis and a single fracture with shortening. All patients underwent the same standardised surgical technique, initially inserting a lateral entry unlocked femoral nail. A monolateral external fixator was subsequently applied and used to power the femoral lengthening. Once lengthening had been achieved, distal interlocking screws were then inserted at the time of removal of the fixator which was combined with early weight-bearing and aggressive mobilisation of adjacent joints. The authors report a mean femoral lengthening of 7 cm (3 to 11.4), representing 20.4% of the pre-operative range (6.55 and 30.4). Sadly, a third (n = 13) of patients developed major complications requiring return to the operating room. By final follow-up all but two patients went on to have a functional limb with mobile joints. Femoral lengthening was achieved in an average of 80 days (31 to119), equating to a mean lengthening index of 1.21 days per mm. Infection is common in these forms of external fixator, and 19 patients (51.3%) required antibiotics for superficial pin-site infection, and deep infection was reported in four patients (10.8%). Three cases occurred after consolidation and required removal of the intramedullary nail with reaming of the femoral canal. Deep infection resolved in all patients with this approach.[3] This paper will be of interest to surgeons involved in limb lengthening. Its retrospective nature is subject to the usual limitations but, nevertheless, it is a useful single-surgeon case series which has been well presented. The authors describe the complications in detail and, most impressively, although there are a significant number of congenital femoral deficiencies, there was only one major joint subluxation. It seems to us the take home message is that this is a difficult technique, subject to significant complications, the majority of which are manageable. This makes the approach attractive in view of the improved lengthening index but this is at the expense of fairly major complications. We wonder if the newer generation of lengthening nails may offer the best of both worlds.



Current management of paediatric supracondylar fractures

Current management strategies are often different to the reported literature, with papers published by a few experts and champions of a particular implant or technique. There is still in this world of high methodological and research rigour, space in journal pages for simple observations of practice. Authors based in **Augusta (USA)** have done precisely this, and undertaken a poll of the ever prescient issue of supracondylar management. They report the results of a short survey sent to Paediatric Orthopaedic Society of North America (POSNA) members. The paper is the consolidation of responses from 309 surgeons, and consists of an opinion on the demographics of their practice, and their algorithm for surgical management, including timing and method of fixation. The majority of respondents saw at least 25 cases per year of these injuries and it was estimated that approximately 50% to 60% of all fractures seen were type III. The majority (81%) preferred to splint type III fractures overnight and plan for fixation the following morning, assuming there was no evidence of: 1. impending compartment syndrome; 2. open fracture; 3. vascular injury; 4. skin compromise; 5. ither issue necessitating obvious emergent fixation. One in five responders indicated that these fractures in their hands were fixed within eight hours of injury, irrespective of timings. Nearly two-thirds of respondents had changed their approach, particularly with regards to the timing of operative intervention in light of recent literature demonstrating comparable outcomes with delayed treatment. With regards to fixation methods, the jury is clearly still out with even distribution of methods (37% three lateral pins, 33% two lateral pins, 30% cross pin configuration). Over half of surgeons indicated that recent literature demonstrating comparable outcomes with two lateral pins *versus* cross pin configuration had not changed their approach to management. While limited by a low response rate (around a third of members), the questions posed were simple but not facile, and give an overview of the "body of reasonable opinion" associated with this injury.[4] The results are compared with a similar survey[5] conducted in the United Kingdom approximately ten years ago and there appears to be a trend towards delayed treatment and lateral pin configuration compared with the data presented in the study.

MRI perfusion index predictive of Perthes' progression

Perthes' disease is a modern enigma. A condition of unknown cause, with uncertain best treatment for which the prognosis on a case-by-case basis can only be estimated, can be challenging at the best of times. There is genuine excitement here at *360* over this exciting paper from Dr Kim and his group at Texas Scottish Rite Hospital for Children in **Dallas (USA)**, who report the results of their routinely performed perfusion MRI scans of the hip in children with Perthes' disease for well over ten years. There are no currently available widely accepted techniques to determine the prognosis for any particular patient until the point of maximum femoral head collapse and deformity when salvage surgery may be the only option. This new technique dangles the attractive carrot of determining the severity of the disease at a very early stage, before femoral head collapse occurs. This then offers the potential for surgical intervention to contain the femoral head and prevent deformity. In 20 patients in the early stages of Legg–Calvé–Perthes disease, Waldenstrom I or early stage II, between the ages of five and 13 with unilateral disease, pre- and post-gadolinium MRI scans were obtained. Digital subtraction images were used to calculate the MRI perfusion index, a measure of perfusion of the femoral head. This was then correlated with radiographic deformity in the hip after a minimum period of two years. The authors found the MR perfusion index to be highly variable in the early stages of Perthes' disease, ranging from 0 to 0.7. Deformity index at two years showed a moderate correlation with MR perfusion index ($r = 0.56$, $p = 0.01$, $R2 = 0.31$). In those patients treated non-operatively, the correlation was stronger ($r = 0.79$, $p = 0.006$, $R2 = 0.63$). A lower MR perfusion index early in the disease correlated with a greater femoral head deformity at two-year follow-up. This correlation was stronger in the non-operative group which may indicate the beneficial effects of surgical intervention.[6] The relatively new International Perthes Study Group based at the Texas Scottish Rite Hospital for Children have already adopted pMRI as a tool in therapeutic decision making, and hope to provide further studies investigating the utility of this exciting new technique. Not quite gold standard as yet, but this paper offers a tantalising glimpse of a potentially

game-changing investigation in paediatric orthopaedics.

Abduction bracing effective in residual acetabular deformity

The treatment of residual acetabular dysplasia (acetabular index (AI) > 30°) is commonly undertaken with abduction bracing, a practice that researchers in **Philadelphia (USA)** have noted is without much scientific basis. They report a very simple but elegant retrospective study to attempt to prove (or disprove) the efficacy of such treatments. A retrospective review of patients treated in their institution over a four-year period, all presenting with residual acetabular dysplasia (AI > 30° at six months of age) following treatment for DDH, was conducted. Patients requiring open surgical reduction and those with an underlying neuromuscular cause for their dysplasia were excluded. In the authors' institution, practice variations mean some children are braced based on an AI > 30° at six months, where some are not. The research team compared those patients who were placed in an abduction brace at night and nap time from six to 12 months of age with those who were not. The study cohort consisted of 76 hips in 52 patients, all with residual dysplasia on the six-month radiograph. A total of 39 hips (27 patients) were unbraced while 31 hips (21 patients) were braced. The researchers excluded six hips in four patients due to crossover between the treatment and control groups. Over the six-month study period the braced cohort had a significantly better improvement in AI of 5.3° compared with that in the unbraced cohort which was 1.1° ($p = 0.001$).[7] This elegant retrospective comparative series (Level III evidence) lends weight to the practice of bracing children with residual acetabular dysplasia. It seems that, at the very least, all orthopaedic surgeons treating infants with DDH should give serious consideration to ongoing abduction bracing until the acetabular index falls to within normal values.

Hurler syndrome in the spotlight

The lives of children with mucopolysaccharidosis type 1 (Hurler syndrome) have changed significantly with the advent of allogenic haematopoietic cell transplant (HCT); this significantly increased life expectancy but has brought the problem of hip dysplasia associated with this condition to the fore. Disabling hip joint arthritis is now being seen in adolescents and young adults with this condition. Researchers in **Minneapolis (USA)** have highlighted this particular problem with their recent large series of 51 children with Hurler disease. The patient cohort spans a 23-year period and the authors found that hip dysplasia was ubiquitous (100%), and in their hands, 40 hips (39%) required surgical reconstruction at a mean age of six years. The mean follow-up of this series is short (5.4 years) but even within this timeframe there was a significant radiographic improvement in all of the surgically treated hips.[8] This particular paper provides a wealth of information on the management of hip dysplasia in patients with Hurler syndrome and is a 'must read' for anyone providing orthopaedic care to these patients.

The Pavlik works for femoral fractures too!

It is becoming more and more commonplace to use the Pavlik harness for the treatment of infant femoral fractures. Although not common, these fractures still make up nearly 2% of the total paediatric fracture workload, and a significant proportion of infantile fractures. A study team from **Memphis (USA)** report their experience with femoral fractures sustained in infants under the age of six months managed with the Pavlik harness. In what is a small retrospective review of just ten patients, the authors report satisfactory radiographic results, at an average final follow-up of five years. The patients presented at a mean age of 2.2 months, all having sustained an isolated femoral fracture and were treated in a Pavlik harness. Treatment was required for an average of 43 days. Outcomes were assessed with a retrospective notes review, satisfaction surveys and follow-up radiographs. At final follow-up (mean five years), residual average angulation was 3° valgus (0° to 8°) and 5° pro-curvatum (0° to 24°). There was a single mild (7 mm) measurable leg-length discrepancy at final follow-up and no complications were noted. This treatment modality in infants under six months of age is considered routine in most centres in the developed world. The authors found insignificant average deformities and a single clinically insignificant leg-length difference of 7 mm.[9] While this paper represents only slightly more than a small audit it does add to the existing literature by providing evidence (albeit limited) for long-term follow-up in these cases.

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