

bone graft improves the complication profile of surgical treatment of giant cell tumours.

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Children's orthopaedics

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

[Foot & Ankle Roundup 1](#); [Hip Roundup 2, 3, 4, 6](#); [Wrist & Hand Roundup 8](#); [Trauma Roundup 3, 8](#); [Knee Roundup 7](#).

Sever's disease under the spotlight X-ref

■ Sever's disease (calcaneal apophysitis) is a disabling condition resulting in heel pain and diminished quality of life. Although common, there is as yet little consensus as to which conservative treatment strategy yields the best results. We were delighted here at 360 to read the report of a 3-arm randomised controlled trial of conservative measures from [Amsterdam \(The Netherlands\)](#).¹ Their study randomised 101 patients to either expectant management, a heel raise or a calf strengthening programme. Outcomes were primarily assessed with pain scores and a satisfaction scale at six weeks and three months. Surprise, Surprise! At three months of follow-up, all of the patients were improved over baseline and there was no significant difference in pain, patient satisfaction, or scores on the Oxford Ankle and Foot Questionnaire between the groups. However, the heel raise programme offered an earlier satisfaction advantage over the other treatment modalities.

Acetabular remodeling in varus femoral osteotomy X-ref

■ Controversy continues over the type and timing of hip surgery to

maintain concentric reduction in children with cerebral palsy. The ability of the acetabulum to remodel following proximal femoral surgery also remains controversial. The majority of centres worldwide use the varus femoral osteotomy as part of their treatment strategy in at least some dysplastic cerebral palsy hips, either in isolation or combined with a pelvic osteotomy. This retrospective study from [Colorado \(USA\)](#) gives us some useful insights into what the longer-term outcomes might be of remodeling following varus osteotomy.² In what is essentially a retrospective case series, the medical records including radiographs of a consecutive series of 87 patients (174 hips) with cerebral palsy undergoing varus derotational osteotomy for the treatment of hip subluxation from 2003 to 2009 were reviewed. The average age at surgery was 4.6 years (2.4 - 10.6) and acetabular remodeling was assessed by measurement of the acetabular depth ratio (ADR). Progression of the ADR with age was determined in 917 normal children (1834 hips) for comparative purposes. The patients were divided into two groups based on the Gross Motor Function Classification System (GMFCS I, II, III and GMFCS IV and V). As perhaps might be expected, the ADR increased post-operatively across the whole group. However, there were some predictors of better outcomes, with a lower GMFCS level (I, II, III), female sex and a lower neck shaft angle

associated with an improvement in ADR. This study is an immense help to those wishing to stratify patients for whom an isolated femoral osteotomy may be satisfactory without the need for concomitant acetabular surgery. It has also demonstrated the presence of acetabular remodeling in terms of an improvement in ADR following VDRO in patients with cerebral palsy.

Outcomes following paediatric hip fractures X-ref

■ The femoral neck fracture in a child is one of the most worrying injuries for the paediatric orthopaedic surgeon. The risks of avascular necrosis are not insignificant; with no reasonable treatments should this occur. While a serious condition, the rarity of the diagnosis means little is known about the risk factors. In an excellent paper with a simple message, researchers in [Boston \(USA\)](#) reviewed 70 patients suffering from a femoral neck fracture, over an 11-year period.³ In their series, injuries occurred across the whole age range (1.3 - 18). Across all cases, osteonecrosis occurred in 20 (29%), with a median time to diagnosis of 7.8 months following injury. The predictive factors identified for development of osteonecrosis included increasing fracture displacement and fracture location (transphyseal being the worst). Perhaps surprisingly, the authors could find no association between patient age, fixation quality or type, the use of capsular decompression or energy of

injury. Osteonecrosis will continue to cause pain and disability in patients presenting with paediatric femoral neck fractures; sadly, no modifiable factor was found in this series to be predictive of outcome, with high rates of osteonecrosis reported here.

Osteotomy for adolescent SUFE X-ref

■ Paediatric surgeons in [Middlesex \(UK\)](#) report an interesting paper that is worthy of note.⁴ The application of osteotomy of the femoral neck for severe (> 50%) slipped upper femoral epiphysis is somewhat controversial, with opinion divided between those who advocate *in situ* pinning irrespective of the degree of slip, *versus* those who believe that the resultant anatomical deformity is a source of significant disability which justifies the risks of femoral neck osteotomy. In this simple series of 57 patients, follow-up was achieved to a mean of seven years with the vast majority (88%) achieving a full level of pain-free function. The reported AVN rate of 10.5% compares favourably with other series published. This paper is in line with other literature in that the authors advocate that this procedure should only be undertaken by high-volume surgeons in specialist centres, via a blood supply-sparing approach to the femoral neck. What is unusual is that the authors here advocate that the surgery should not be undertaken within an acute timeframe, allowing the initial acute inflammatory response to the slip to

resolve prior to surgery. The authors argue that enforcing a period of rest in "slings and springs" reduces the risk of AVN (and certainly, it is of note that the two patients in their own series who underwent acute surgery both developed AVN). While there is clearly no control group in this paper, the outcomes and arguments presented are fairly convincing.

Is pressure related to stability in SCFE? X-ref

■ The relationship between slipped upper femoral epiphysis (SCFE) and avascular necrosis (AVN) is a crucially important one to understand – poor outcomes are clearly associated with AVN, and optimising the longer-term outcomes is, to a certain extent, about avoiding the devastating effects of AVN on the young hip.

While it is reasonably well established that stable SCFE has a much lower rate of AVN than unstable SCFE, the pathophysiology underlying this relationship is not so well understood. Reasoning that this may be a pressure-related phenomenon and that understanding the process may lead to more successful treatments, investigators in **Virginia (USA)** undertook

a prospective study of patients undergoing surgery for SCFE with intra-operative hip capsule pressure measurement.⁵ A total of 28 hips with 15 unstable SCFEs were entered into the study and intra-operative pressures measured with a side bore needle at the time of fixation. A control group subset (sadly just 11 patients) underwent measurement of their unaffected hip. The study team established fairly convincingly (despite the small numbers of patients) that a stable SCFE is not associated with an increase in intracapsular pressure (21.8 mmHg vs 27.0 mmHg), while an unstable SCFE was (48.2 mmHg).

It is always tempting to over-read dramatic results in small studies such as this. However in SCFE, which is a relatively uncommon condition, it is unlikely that there will be any larger studies investigating this any time soon. Here at 360 we would certainly take these findings at face value, despite the small numbers, and there is clearly an association between SCFE stability and intra-operative hip pressure. What we cannot infer from this study is whether it is causative of eventual AVN. Perhaps some further work is required here but we are yet to be convinced that this is the whole answer.

Familial screening for occult DDH? X-ref

■ Screening for developmental dysplasia of the hip (DDH) is a tricky subject to unpick. There are no

standardised national imaging-based screening programmes for newborns, however, the majority of developed centres offer their own screening for newborns based on a risk score, and some offer screening for all babies. While the best type of screening remains debatable the vast majority of orthopaedic surgeons would support a screening programme

given that the efficacy of both non-operative and operative treatments decline with missed diagnoses. What has never been exactly clear to us here at 360 HQ is what the relationship between affected siblings is in the general population. In a cleverly designed study, surgeons in **Utah (USA)** combined their surgical and genetic databases to identify 19 whole local families known to have a single member requiring surgical treatment for DDH.⁶ They then undertook radiographic screening and clinical outcome scores of all 120 members of these 19 families in an attempt to identify the rates of occult



DDH in what is a supposedly 'normal' population. Perhaps as would be expected, the hip outcome scores in the operatively treated patients were poorer on the operative side compared with the non-operative side. Perhaps what wouldn't have been predicted, however, was the high rate (27%) of DDH apparent using a combination of centre edge angle and Severin scoring. Occult acetabular dysplasia appeared to be purely incidental in the younger patients (< 30 years), however, in the older population (made up of just six individuals), the affected side had poorer outcomes. This paper nicely summarises the need for a screening programme of some kind and does lend weight to the argument that individuals with DDH-affected siblings ought to be high on the screening list. Of course, what it doesn't answer is the question of the impact of occult acetabular dysplasia. Until large population studies are able to report on the natural history of hip impingement and acetabular dysplasia, it is difficult to know the precise value of these outcomes.

ACL injury in the adolescent more disabling than previously thought X-ref

■ Perhaps unsurprisingly, the outcome studies evaluating paediatric ACL reconstruction have previously focussed on the real concerns of growth arrest around the proximal tibial physis following tunnel drilling. However, what haven't been terribly well studied are the outcomes following surgery. Researchers in **Durham (USA)** set out to establish if adolescent patients undergoing primary ACL reconstruction really do consistently recover adequate functional movement patterns.⁷ They designed a retrospective cohort review reporting the outcomes of 39 adolescent patients (17 skeletally immature and 22 skeletally mature). These were compared with a reference population of 16 primary ACL reconstruction patients identified from an

adult reference population from the same centre. All patients followed a standardised operative and rehabilitation protocol and outcomes were assessed using the Functional Movement Screen (FMS) and the Lower Quarter Y-Balance Test (LQYBT) to assess their outcomes in terms of single-limb dynamic balance at nine months after primary ACL reconstruction. At nine months' follow-up, the FMS scores for all groups indicated an increased risk for lower extremity injury despite the ACL reconstruction. Patients who were skeletally immature had an inferior active straight leg raise and aside from this there was no significant asymmetry difference in LQYBT anterior posterolateral asymmetry between the three groups. The adolescent groups demonstrated wider ranges of anterior reach asymmetry than the adult group, indicating an increased risk for injury. This study defines the need for maturity-specific rehabilitation strategies for adolescent patients undergoing primary, anatomic, transphyseal ACL reconstruction using a hamstrings autograft. It also reinforces the suggestion that immature and adolescent patients are still at increased risk of injury nine months following their ACL reconstructions and probably shouldn't be allowed to return to sport at this stage.

The paediatric scaphoid fracture X-ref

■ Children and adolescents do suffer scaphoid fractures and there is little comparative evidence to establish if there is ever an indication for surgery. The surgical team in **Boston (USA)** have undertaken a comparative study of surprising power including 312 paediatric patients, all presenting to a single centre over a 15-year period with an isolated scaphoid fracture.⁸ This retrospective cohort study considers the outcomes of patients aged between eight and 18 years with isolated scaphoid fractures. Sadly, the follow-up was only partial, with

just 20% (n = 63) returning the outcome measures which were the DASH score, DASH work and sports modules, and the Modified Mayo Wrist Score (MMWS) at a mean of 6.3 years from injury. In what is a bit of a mixed bag of patients, 39 presented with an acute fracture, with six requiring surgery. Of the 24 who presented with nonunion, 20 were treated surgically and all patients in both groups healed. Multivariate analysis demonstrated that chronic fracture presentation and osteonecrosis were independent predictors of a poorer outcome and that surgical treatment itself did not appear to influence outcome. This

is a relatively common injury in the paediatric population and despite the major limitation of low rate of recall, this is an interesting paper for general orthopaedic practice. The authors have demonstrated, with some caveats, that outcome in this age group is influenced by nonunion and osteonecrosis, as would be expected in an adult population. There is no difference in outcomes between casting and surgery, and, as such, if casting can be used then it should be used. However, surgeons should not be afraid to fix those scaphoid fractures where surgery is indicated, even in the paediatric population.

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Research

X-ref For other Roundups in this issue that cross-reference with *Research see: Hip Roundup 1, 3, 4, 7; Knee Roundup 1, 3, 4, 5, 7; Children's Orthopaedics Roundup 2; Trauma Roundup 2; Shoulder Roundup 3; Ankle Roundup 3.*

Antifungals in cement? X-ref

■ Treatment of fungal-associated infections can be a complicated business. Often difficult to culture and even more difficult to eradicate, fungal-associated periprosthetic infections don't benefit from the same research focus as the more common bacterial infections, although they can be far harder to remove. A mainstay of revision arthroplasty is the use of antibiotic elution in cement – plenty of research abounds to guide the antibiotic mix to maximise elution properties, and ensure thermal stability without compromising on the mechanical properties in the cement. Where there is a distinct evidence gap is in the use of antifungals in cement mixing. Researchers in **Rochester (USA)** have plugged one of the evidence gaps with their simple but important paper on the use of amphotericin B in cement.¹ Previous research has been a little ambiguous with conflicting reports

as to the likely efficacy of amphotericin B, mainly due to concerns about its elution characteristics. In a simple science experiment using a flow chamber, the research team manufactured custom polymethyl methacrylate beads with a high concentration (7.5%) of amphotericin B. Following polymerisation, measurements suggested that over 3.3% of the loaded amphotericin was detectable, suggesting potential efficacy. Use of the flow chamber gave a combined overall elution of 0.33 µg/mL during the first eight hours of the experiment, and over the first 24-hour period 2.79 µg/mL/h was eluted; an efficacious dose, and representing 0.2% of the available amphotericin B. In short, high-dose preparation of bone cement with amphotericin B can be expected to elute therapeutic doses of the antifungal when used in cement spacers and custom beads.

The mini C-arm: more radiation than a radiograph? X-ref

■ The mini C-arm is often the imaging device of choice in the paediatric and hand surgical worlds. This decision is usually twofold. The lack of requirement for a radiographer,

combined with the perceived lower radiation levels make it an attractive option. This said, there is little literature surrounding the radiation doses when this modality is used in paediatric fracture surgery. Researchers in **Hershey (USA)** set out to establish if the radiation exposure using mini C-arm for the reduction of paediatric fractures really is as low as we believe it to be.² In a prospective study, the research team recorded the kilovolts, milliamps, and exposure time required to reduce the upper extremity fractures of 86 consecutive paediatric patients. They then used this information to estimate the radiation exposure (mR) that each received. In their centre, the closed reduction and casting in the emergency department was performed by a surgeon in training (PGY2/3), using mini C-arm and post-reduction, in cast, anteroposterior and lateral images were routinely saved. The average exposure (mR) for distal radial fractures was 63; forearm 109; elbow 53; and hand 69 mR. Perhaps not surprisingly, the radiation exposure was operator-dependent and the less experienced (PGY2) residents had a higher exposure per reduction. Conventional anteroposterior/lateral

forearm radiographs were estimated by the authors to require 20 mR. There is a tacit assumption that the mini C-arm uses less radiation than a conventional source and this is often used as a driver to acquire portable radiograph equipment. The authors of this study demonstrate an unexpected contrary finding and recommend that residents receive appropriate training. It is clear that, in the case of manipulations of paediatric fractures if the C-arm is not required to effect the reduction, surgeons would be doing their patients a favour by using simple plain films after reduction and plaster.

Beating infection one step at a time X-ref

■ The pages of 360 wouldn't be complete without a paper describing the problems associated with, or a method aimed at, reducing the incidence of periprosthetic joint infection (PJI). After all is said and done, it is perhaps the most disastrous complication of any orthopaedic surgery. This fascinating paper from **Philadelphia (USA)** crossed the editorial desks at 360 this month, describing the progress this unit has made to advance their fight against PJI.³ It details the stepwise manner