

4. **Goedhart LM, Gerbers JG, Ploegmakers JJ, Jutte PC.** Delay in diagnosis and its effect on clinical outcome in high-grade sarcoma of bone: a referral oncological centre study. *Orthop Surg* 2016;8:122-128.
5. **Fourquet J, Sunyach MP, Vilotte F, et al.** Time interval between surgery and start of adjuvant radiotherapy in patients with soft tissue

- sarcoma: A retrospective analysis of 1131 cases from the French Sarcoma Group. *Radiother Oncol* 2016 [Epub ahead of print] PMID:27207359.
6. **Mirels H.** Metastatic disease in long bones. A proposed scoring system for diagnosing impending pathologic fractures. *Clin Orthop Relat Res* 1989;249:256-264.

7. **Blank AT, Lerman DM, Patel NM, Rapp TB.** Is prophylactic intervention more cost-effective than the treatment of pathologic fractures in metastatic bone disease? *Clin Orthop Relat Res* 2016;474:1563-1570.
8. **Wilson RJ, Zumsteg JW, Hartley KA, et al.** Overutilization and cost of advanced imaging for

- long-bone cartilaginous lesions. *Ann Surg Oncol* 2015;22:3466-3473.
9. **Müller DA, Beltrami G, Scoccianti G, Frenos F, Capanna R.** Combining limb-sparing surgery with radiation therapy in high-grade soft tissue sarcoma of extremities - Is it effective? *Eur J Surg Oncol* 2016;42:1057-1063.

Children's orthopaedics

X-ref For other Roundups in this issue that cross-reference with *Children's orthopaedics* see: *Spine Roundup 7; Oncology Roundup 3.*

Anterior cruciate ligament in the paediatric population

X-ref

■ In a very topical paper given the recent Rio Olympiad, with many talented young athletes starting their training in an increasingly competitive atmosphere at a very young age (the youngest competitor, Nepalese Gaurike Singh, is just 13 years old), the injuries sustained are also becoming more akin to those of the adult population. Noting that there is an increase in reports of anterior cruciate ligament (ACL) injuries within the paediatric population, investigators from **Charlottesville, Virginia (USA)** have undertaken a review of a nationwide billing database to identify the numbers of patients presenting with and undergoing ACL reconstruction.¹ The authors identified patients over a four-year period and report the outcomes of over 44 000 unique paediatric ACL injuries. Of these, just over 19 000 underwent arthroscopic ACL reconstruction, and there was a definite preponderance of meniscal reconstruction when compared with the adult population. The authors analysed the national database to characterise the recent epidemiological trends of ACL injuries and reconstruction in the paediatric and adolescent populations. They found a significant increase in the overall diagnosis of ACL injury and ACL reconstruction in both paediatric and adolescent patients. Those patients

who underwent ACL reconstruction had significant increases in incidence of concomitant meniscal and cartilage procedures. The main message of this study is that the profile of the paediatric ACL injury is changing, with increasing numbers of injuries identified, and increasing at a rate that is well above that of the adult population. As sport becomes progressively more competitive and professional from a very early stage, it is clear that adult pattern injuries are also going to become a greater burden to paediatric orthopaedic surgeons.

The paediatric pelvis

X-ref

■ Despite the rarity of paediatric pelvic injuries, we have recently seen a small flurry of papers in the scientific literature. This is particularly welcome given that this is an injury that could do with having some light shone upon it. These authors from **Bochum (Germany)** have set about answering one of the biggest unanswered questions in paediatric trauma surgery: how do paediatric pelvic fractures fare in the longer term?² To answer this question the authors collated their series of 33 patients, all with paediatric pelvic ring injuries. The patients were treated at a single-level one centre and represented the full spectrum of injuries with ages ranging between four and 16 years. On average, patients were followed for over two years and handled according to local protocols. Stable injuries ($n = 17$) were treated non-operatively for the most part, and unstable injuries ($n = 15$) were treated operatively

where possible. Even in stable injuries there was appreciable residual clinical deformity in just over 40% of stable patients managed non-operatively, with an ischial height difference of over 5 mm. Symptomatically, 10% of children experienced a clinically relevant leg-length discrepancy and the majority of patients presented with unstable pelvic injuries and ongoing lower back pain throughout the two years of follow-up. The authors of this study concluded that in paediatric patients with pelvic ring injuries, radiographic deformity persisted and did not remodel. This is a unique and important finding. In addition, as perhaps might be expected, the complex displaced injuries have higher rates of operative intervention, residual deformity, and low back and sacroiliac joint pain.

Hip surgery in the non-ambulant cerebral palsy child

X-ref

■ Nearly all paediatric orthopaedic surgeons would agree that there is a significant place for hip reconstructive surgery even in the non-ambulant cerebral palsy (CP) child. That is just about where the agreement ends; the indications, interventions and expectations of results are all different between treating clinicians and institutions, and it is very difficult to research this group of patients. Surgeons from **Boston, Massachusetts (USA)** report a prospective cohort study of 38 consecutive non-ambulant CP patients (Gross Motor Function Classification System IV/V), all of whom underwent surgery for hip dysplasia.³ The

primary aim of this study was to evaluate the relationship between radiological markers of hip subluxation (migration percentage/acetabular index) and health-related quality of life (Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD)) score before and after reconstructive hip surgery. Clinical and radiological assessment immediately before surgery, at six weeks and regular follow-up intervals to two years after the surgery all demonstrated an improvement in the CPOCHILD score which correlated with an improvement in migration index. The migration percentage and CPOCHILD score were inversely related in the pre-operative period and this relationship continued throughout the follow-up period with a 0.2 point increase of CPOCHILD for each 1% correction in migration percentage. Management of hip subluxation in this patient group presents considerable ethical challenges. There is a paucity of evidence and decisions are generally made on the basis of the assumption that a significant proportion of these patients will eventually develop pain, and that even if they cannot express it in a conventional manner it will impact on quality of life for both child and carer. This study clearly suggests an improvement in health-related quality of life that can be predicted by the extent of surgical correction. There are however some important practical issues inherent in studying this patient population such as the imprecise scoring system in patients without verbal communication, in addition to methodological deficiencies including absence of a

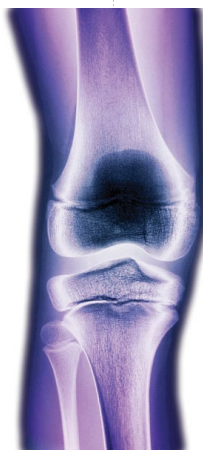
control group and short follow-up. This paper provides some objective justification for surgical reconstruction and would be of general interest to surgeons in paediatric practice.

Bracing of early hip dislocation

■ The management of early hip dislocation is almost exclusively conservative (in the first instance at least). However, the majority of papers to support the use of a brace in particular are single centre or small retrospective series. We were delighted here at 360 to see the publication of this paper reporting a multicentre, prospective cohort study of brace use in the treatment of infant hip dislocation. The authors aimed to quantify the success rate and identify variables associated with brace failure. This study from seven institutions across **North America, Europe and Australia** was managed using REDCap (research electronic data capture) tools (REDCap; Vanderbilt University, Nashville, Tennessee). The authors defined a successful treatment as obtaining and maintaining reduction of the hip following bracing with no subsequent surgical intervention.⁴ Bracing overall was a success in 162 of 204 (79%) dislocated hips. Variables associated with a significant risk of failure include femoral nerve palsy during brace treatment; treatment with a static brace; an initially irreducible hip; treatment initiated after the age of seven weeks; right hip dislocation; and Graf type IV hip. Hips with no risk factors had just a 3% probability of failure while more than four risk factors resulted in a 100% probability of failure. This study confirms conventional wisdom associated with this condition, but does so with the first prospective, multicentre study and level I evidence. It identifies risk factors associated with failure and quantifies that risk, informing decision-making for medical staff and parents and is therefore of great interest to paediatric orthopaedic surgeons.

Will head perfusion measurements help in Dunn osteotomy?

■ The holy grail of paediatric surgery is perhaps the successful management of slipped upper femoral epiphysis (SUFE). This is probably one of the most challenging conditions in any branch of orthopaedic surgery with a variety of presentations, difficult to achieve surgical reduction and high-stakes complications. It is the complications that are devastating; few conditions can be as life-altering as avascular necrosis (AVN) of the femoral head in a child. This study from **Aurora, Colorado (USA)** assessed the accuracy of AVN prediction following the Dunn osteotomy for SUFE – if head perfusion measurements can indeed predict issues with death of the femoral head, then this could be used to aid intra-operative decision-making.⁵ The study reports the outcomes of 29 modified Dunn procedures, all performed for unstable slipped capital femoral epiphysis. Assessment was made of epiphyseal perfusion before dissection of the retinacular flap, and after fixation by the presence of observed active bleeding and/or intracranial pressure monitoring. In this series, avascular necrosis developed in seven patients (26%) after a minimum follow-up of one year, assessed by plain radiographs. The assessment of femoral head perfusion by either method was effective in identifying patients who subsequently then developed AVN. The study size, however, was insufficient to identify clinical factors predictive of osteonecrosis. Perhaps it is not surprising that a total lack of blood flow before dissection and after fixation, as assessed using clinical observation or instrumented pressure measurement, was highly indicative of AVN. However, the



authors demonstrate that AVN is identifiable at the time of index surgery and this is of great interest to paediatric orthopaedic surgeons. Like many similar studies, it is relatively easy to pick holes in this small study. Nonetheless, we feel at 360 that it has a lot to offer. Among the many limitations is the retrospective nature of this analysis, coupled with an early change in methodology and the small numbers in the series. What this study really offers is the raising of an interesting question.

Pavlik harness not always successful

■ The Pavlik harness is the saviour of many children's hips. Designed to allow for gradual reduction, easy to apply and with usually excellent results, it has saved thousands of children from open reduction of the hip. However, it isn't always successful; predictors of failure are of particular interest, as knowing when to intervene and not allow conservative treatment to continue if doomed to failure is clearly part of the art of current paediatric hip surgery. Paediatric surgeons, again in **Aurora, Colorado (USA)** have added to what is already known on this important topic with their retrospective study of 150 patients who underwent the treatment of developmental dysplasia of the hip (DDH) using the Pavlik harness at a mean age of 30 days (4-155 days).⁶ Follow-up was for a minimum of two months, and 90% were followed for a minimum of six months. In this series, Pavlik treatment failed in 27% (21 of 78 cases) of Ortolani positive hips, 5% (3 of 60 cases) of Barlow positive hips and 8% (6 of 77 cases) of hips with dysplasia. After controlling for potential confounding variables, male sex (OR 6.9; 95% CI 2.0 – 24.2; $p = 0.002$) and Graf type IV (OR 4.4; 95% CI 1.3 – 15.4; $p = 0.019$) were identified as

independent predictors of failure. In short, male infants with Graf type IV hips have a higher risk of Pavlik harness treatment failure. This paper adds detail to what is already known on the topic, with the addition of the male sex as a risk factor.

Tibial eminence fractures: arthroscopic or open?

X-ref

■ Despite the flurry of papers concerning true anterior cruciate ligament (ACL) ruptures in the paediatric knee, the signature ligament injury in the paediatric population is the tibial eminence fracture or ACL footprint avulsion. Due to the viscoelastic nature of paediatric ligament, it usually has a higher ultimate tensile stress under most loading conditions than the bone into which it fits, thus avulsion fractures are more common in children. The range of treatment options for tibial eminence avulsion tends to nudge towards operative interventions, as the increasing use of MRI scanning suggests that there are few truly undisplaced fractures. Some are advocates of arthroscopic reduction and internal fixation (ARIF), arguing that this reduces the incidence of subsequent arthrofibrosis, while others are proponents of open reduction and internal fixation (ORIF), arguing that superior reduction and fixation offsets any potential issues with surgical insult. Surgeons in **Auckland (New Zealand)** set out to establish which chain of thought was correct with their rather small study of 13 patients undergoing ORIF, and 18 patients undergoing ARIF.⁷ On the surface, the two groups appeared to be demographically similar with no real differences in sex, age, fracture type or fixation mode. However, the ARIF group waited significantly longer for their surgery, had longer tourniquet times, and the arthrofibrosis rate was significantly higher ($n = 6$ of 18 vs 1 of 15). For reasons that escape the statistical boffins at 360 HQ, the authors undertook a multivariate analysis and claim that the key to

success is early, quick surgery and that ARIF itself may actually be a confounder. It is almost impossible to reliably make that sort of conclusion with a small group and multiple factors; however it certainly seems that if patients do require fixation of a tibial eminence fracture, in these patients at least, the use of open surgery is more reliable.

REFERENCES

1. **Werner BC, Yang S, Looney AM, Gwathmey FW Jr.** Trends in pediatric and adolescent anterior cruciate ligament injury and reconstruction. *J Pediatr Orthop* 2016;36:447-452.
2. **Kruppa CG, Khoraity JD, Sietsema DL, et al.** Pediatric pelvic ring injuries: How benign are they? *Injury* 2016 [Epub ahead of print] PMID: 27451290.
3. **DiFazio R, Shore B, Vessey JA, Miller PE, Snyder BD.** Effect of hip reconstructive surgery

on health-related quality of life of non-ambulatory children with cerebral palsy. *J Bone Joint Surg [Am]* 2016;98-A:1190-1198.

4. **Upasani VV, Bomar JD, Matheny TH, et al.** Evaluation of brace treatment for infant hip dislocation in a prospective cohort: defining the success rate and variables associated with failure. *J Bone Joint Surg [Am]* 2016;98-A:1215-1221.

5. **Novais EN, Sink EL, Kestel LA, et al.** Is assessment of femoral head perfusion during

modified Dunn for unstable slipped capital femoral epiphysis an accurate indicator of osteonecrosis? *Clin Orthop Relat Res* 2016;474:1837-1844.

6. **Novais EN, Kestel LA, Carry PM, Meyers ML.** Higher Pavlik harness treatment failure is seen in Graf type IV Ortolani-positive hips in males. *Clin Orthop Relat Res* 2016;474:1847-1854.

7. **Watts CD, Larson AN, Milbrandt TA.** Open versus arthroscopic reduction for tibial eminence fracture fixation in children. *J Pediatr Orthop* 2016;36:437-439.

Research

X-ref For other Roundups in this issue that cross-reference with **Research see: Hip & Pelvis Roundup 4; Shoulder & Elbow Roundups 5 & 6; Spine Roundup 4; Trauma Roundup 5.**

In-theatre diagnostic tests for periprosthetic infection X-ref

■ There has been a lot of industry-driven pressure towards the use of expensive assays, and one in particular, anti-defensin alpha-1, to establish the presence or absence of infection intra-operatively during joint revision surgery. Despite the tantalising nature of a bedside instant diagnostic test, uptake has been far from 100% — in part due to the limited (and mostly commercially sponsored) research on its use and partly due to the competing test leukocyte esterase, which is essentially just a standard ‘cheap-as-chips’ urine dipstick. Recognising the current dichotomy in practice, a review team in **Bristol (UK)** have undertaken a well conceived systematic review and meta-analysis to enlighten us all as to what exactly the evidence is for each approach.¹ The study team’s stated aim in the abstract of their paper was to “synthesize the evidence on the accuracy of the alpha-defensin immunoassay and leukocyte esterase colorimetric strip test for the diagnosis of PJI compared with the Musculoskeletal Infection Society diagnostic criteria”. Their extremely extensive literature review yielded just 11 studies evaluating the accuracy of one or more of these two diagnostic tests. The study team undertook a

data-pooling approach to evaluate the sensitivity, specificity and receiver-operator characteristic (ROC) curve for both diagnostic tools. In short, there was no statistically discernible difference between the two, both showing superb sensitivity and specificity with a ROC area under the curve of 0.99 for the alpha-defensin assay and 0.97 for the leukocyte esterase dipsticks. Both were equally impressive from a diagnostic accuracy perspective, however, given the massive cost difference, the feeling around the editorial desks at *360 HQ* is that — for the moment at least — the leukocyte esterase tests win out drastically on cost savings alone. This meta-analysis suggests that using a simple urine dipstick is equally as accurate and is a fraction of the cost.

Orthopaedic replicas X-ref

■ I would strongly recommend all orthopaedic surgeons with an interest in arthroplasty to read this annotation from **London (UK)**, published in a recent issue of *The Bone & Joint Journal*.² Excellent outcomes with long-term follow-up continue to be reported in the literature for lower limb arthroplasty. Not only can patients expect a successful outcome in terms of pain relief and function, but the results are also durable in the long term. It is also widely reported that with an ageing population, the demand for lower limb arthroplasty is expected to rise. Increasingly, the cost of performing a total hip or knee arthroplasty has come under close scrutiny with

efforts to reduce patients’ length of stay in hospital and increase theatre productivity. An additional focus has been on the cost of the implants we use, particularly with a number of the well-established implants coming off patent. Are these implants, however, really ‘good enough’? The two most publicised disasters in orthopaedic arthroplasty implants is the Capital Hip System (3M; St Paul, Minnesota) — a copy of the Charnley — and the articular surface replacement (ASR), a copy of the Birmingham hip. Neither of these lightly modified implants appeared terribly different even to the educated consumer, however, both were significant disasters. The authors of this important article highlight the difficulty in identifying the true costs of manufacturing an implant due to the lack of transparency. Estimates have suggested that the actual manufacturing of the implant represents approximately 30% of the final cost, while the sales and marketing represent 40%. Similar to the drug industry, as patents expire, generic ‘copies’ of well established implants are starting to appear on the market. However, there is very little regulation of how these copies are manufactured, nor how they are monitored once they are on the market. We would thoroughly commend this annotation to *360* readers.

How long do hands stay ‘scrubbed’?

■ There is plenty of evidence that longer operations have a higher infection rate. There are a number

of possible reasons for this — clearly the longer the operation, the higher the risk of inadvertent contamination or seeding of an open wound with bacteria. There is also the likelihood that longer operations are more complex, or the operating surgeon less experienced, or sometimes both. An interesting potential contributing factor to this phenomenon is investigated by a study team based in **San Diego, California (USA)**. These investigators hypothesised that the surgical scrub becomes less effective the longer the time interval between scrubbing and the operation, and, as such, surgeons may then end up with contaminated hands.³ The study team undertook a prospective clinical study with 20 cases, all spinal procedures, each the first case of the day and all lasting longer than three hours. In all cases, the surgical team scrubbed with chlorhexidine gluconate 1% solution and ethyl alcohol 61% prior to the procedure. Cases were excluded if glove changing occurred or post-scrubbing cultures were positive. The study team undertook swabs and culture to calculate the colony-forming units (CFU) per ml when the swab tips were mixed with 5 ml pre-buffered saline. The swabs were undertaken pre-scrub, post-scrub and immediately post-surgery. Perhaps unsurprisingly, the main finding of this study was that with gloved hands there was a recolonisation effect, with more CFUs cultured with each unit time. Analysis with receiver-operating