

modified Kocher criteria to determine the utility of the variables in excluding a septic knee. The authors were able to include 104 patients in this series. Children with a septic knee presented with a mean age of eight years and 69% were culture positive for septic arthritis. The prevalence of positive variables included a CRP > 20mg/l in 75% of patients, fever in 65%, and non-weight-bearing in 64%, ESR > 40mm/hr in 60%, and serum WBC > 12,000cells/mm<sup>3</sup> in 49%. Based on Kocher's original criteria, three positive factors gave a sensitivity of 84% in the hip, compared to 48% in the current cohort. The addition of CRP to produce the modified criteria meant that three positive factors in the current cohort gave a sensitivity of 71% compared with 79% in the hip. This is still obviously a relatively poor screening test and notably a markedly poorer diagnostic performance than using the same criteria for hip septic arthritis. It is clear that in the case of suspected septic arthritis of the knee other markers or thresholds are required. Unfortunately, this paper makes no firm suggestions on what these should be, save only to say that the practice of extrapolating the Kocher criteria from the hip to the knee joint is inappropriate.

### Management of paediatric humeral shaft fractures and associated nerve palsy **X-ref**

In less common paediatric injuries where the literature is sparse, usual practice is often extrapolated from the adult literature. This is certainly the case for paediatric humeral fractures

associated with radial nerve palsy; the fractures themselves are relatively rare (comprising up to 3% of paediatric fractures) and there is no literature on the frequency of associated nerve palsy, which in the adult population occurs in 10% of fractures. This group from the Mayo Clinic **Rochester, Minnesota (USA)** conducted a retrospective review of all traumatic paediatric humeral shaft fractures presenting to their institution over a 20-year period to 2006. In this time 80 appropriate patients were identified, with a mean age at presentation of ten years, and two thirds were males. Mean follow up was 24 months and 5% of fractures were subsequently attributed to nonaccidental injury. Five patients presented with some degree of nerve injury, all of which were closed injuries and four of these (5% overall) had a radial nerve injury. Of these nerve injuries, two were treated with closed reduction and flexible intramedullary nailing without nerve exploration and two were managed nonoperatively. Unsurprisingly, nerve injuries were associated with greater fracture translation at a mean of 2 cm versus 1.1 cm. Full recovery was noted in all nerve injuries at a mean of 154 days, and the mean time to onset of recovery was 41 days. The ulnar and median nerve injuries recovered sooner, with an onset of recovery within 4 days of injury. The overall incidence of humeral shaft fractures in this series was 18% of humeral injuries which is higher than reported previously in the literature. Overall, the majority of fractures treated nonoperatively healed with no issues, but where required, surgical fixation was safe with few complications. All

nerve palsies recovered within five months with no nerve exploration required.

### REFERENCES

- Masrouha KZ, Moses MJ, Sala DA, Litrenta J, Lehman WB, Chu A.** The Validity of Patient-reported Outcome Measurement Information System (PROMIS) Parent Proxy Instruments to Assess Function in Children With Talipes Equinovarus. *J Pediatr Orthop.* 2019;39(10):e787-e790.
- Hines AC, Neal DC, Beckwith T, Jo C, Kim HKW.** A comparison of Pavlik harness treatment regimens for dislocated but reducible (Ortolani+) hips in infantile developmental dysplasia of the hip. *J Pediatr Orthop.* 2019;39(10):505-509.
- Liu YH, Xu HW, Li YQ, et al.** Effect of abduction on avascular necrosis of the femoral epiphysis in patients with late-detected developmental dysplasia of the hip treated by closed reduction: a MRI study of 59 hips. *J Child Orthop.* 2019;13(5):438-444.
- DeFrancesco CJ, Storey EP, Flynn JM, Ganley TJ.** Pediatric ACL reconstruction and return to the operating room: revision is less than half of the story. *J Pediatr Orthop.* 2019;39(10):516-520.
- Choudhry DK, Brenn BR, Sacks K, Shah S.** Evaluation of gabapentin and clonidine use in children following spinal fusion surgery for idiopathic scoliosis: a retrospective review. *J Pediatr Orthop.* 2019;39(9):e687-e693.
- Dibello D, Odoni L, Pederiva F, Di Carlo V.** MRI in Postreduction Evaluation of Developmental Dysplasia of the Hip: our Experience. *J Pediatr Orthop.* 2019;39(9):449-452.
- Obey MR, Minaie A, Schipper JA, Hosseinzadeh P.** Pediatric Septic Arthritis of the Knee: Predictors of Septic Hip Do Not Apply. *J Pediatr Orthop.* 2019;39(10):e769-e772.
- O'Shaughnessy MA, Parry JA, Liu H, Stans AA, Larson AN, Milbrandt TA.** Management of paediatric humeral shaft fractures and associated nerve palsy. *J Child Orthop.* 2019;13(5):508-515.

## Research

**X-ref** For other Roundups in this issue that cross-reference with Research see: **Hip & Pelvis Roundups 3, 4 & 5; Foot & Ankle Roundup 1; Spine Roundup 3; Children's Orthopaedics Roundup 1.**

### Novel MRI-based score for assessment of bone density in operative spine patients **X-ref**

Adequate bone density is key in achieving good clinical outcomes after spinal surgery and helps to prevent instrumentation failure or adjacent level fractures. A significant proportion of patients due to have spine surgery may not have had a bone density assessment in their preoperative work-up, and this study from

**Baltimore, Maryland (USA)** investigates a novel approach to determining bone density.<sup>1</sup> As all patients preoperatively for spinal surgery have an MRI, these authors investigated a bone density score that can be calculated from a preoperative scan and whether this correlates with a standard DEXA assessment. This novel technique recorded the vertebral bone quality score (VBQ) which measured the average signal intensity within the L1-L4 lumbar vertebral bodies and divided this score by the signal intensity of the CSF on a T1 sagittal MRI score. This score was then correlated with the T-score from the patient's hip and femoral neck. The authors excluded the lumbar T-score due to the risk of an artificially elevated bone density due to

arthritis within the lumbar spine. There are, of course, some limitations to this method as it relies on identical MRI sequence capture, and there is some significant variation between scanners and departments. The take home message of this study was that the VBQ score was found to have a statistically significant correlation with the T-score found at the femoral neck ( $p < 0.001$ ) and the hip ( $p < 0.001$ ). This study has limitations including small patient numbers, not all patients having T1 imaging, and a bias that patients with severe osteoporosis may not have been included in this study as it seems likely that they would not have been listed for spine surgery. Nonetheless, if in the future a routine MRI can provide quick bone density

estimations, this would be of immense value to the clinician.

### Prediction of autograft hamstring size for anterior cruciate ligament reconstruction using MRI **X-ref**

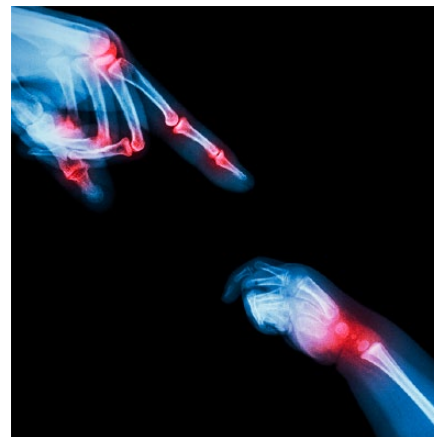
Anterior cruciate ligament (ACL) reconstruction makes use of a selection of autografts in an attempt to recreate the injured structure. There are significant variations in techniques, graft sizes, and potential sources for autografts. One of the more commonly used grafts is hamstring harvested at the time of reconstruction, though when the graft diameter is lower than 8 mm, the risk of subsequent rupture climbs. In order to preoperatively identify if the hamstring graft is worth taking or if a suitable donor should be sought elsewhere, a team from **Roanoke, Virginia (USA)** have used the MRI scans which are routinely taken in work up prior to surgery to preoperatively assess the calibre of the hamstring tendon.<sup>2</sup> Using preoperative MRI images from 68 patients who underwent ACL reconstruction over a three-year period, the team compared the preoperative graft diameter with that found intraoperatively. Patients undergoing revision surgery, multiligament reconstruction, and those with previous hamstring injury were excluded from the study. The group found that the correlation between preoperative hamstring calibre correlated well, but not excellently, with that found and recorded intraoperatively. The measurements that demonstrated the strongest correlation with graft size were the semitendinosus at the medial femoral condyle, the semitendinosus and gracilis combined at the medial femoral condyle, and the mean semitendinosus and gracilis diameters. An 8 mm hamstring autograft required a mean semitendinosus plus gracilis areas of at least 17.5 mm<sup>2</sup> in this study. These findings may, in certain circumstances, improve the workflow in ACL reconstruction, and may reduce morbidity from hamstring harvest where the graft is inadequate. This may be of clinical relevance to assist orthopaedic surgeons in graft selection and surgical planning. Clearly it is not possible to be completely reliant on the preoperative MRI scan. However, the authors set out a useful framework with which to approach the use of routinely collated preoperative MRI scan data in surgical planning for ACL reconstruction.

### Antibiotic cement in total knee arthroplasty

While the value of antibiotic loaded cement is widely accepted, the evidence if evaluated lags somewhat behind. There are some registry studies from Scandinavian nations and use of antibiotic loaded cement seems to make sense. This paper, originating from authors in the **UK**, utilizes the data from the National Joint Registry (NJR) of England and Wales for all primary cemented total knee arthroplasties (TKAs) between March 2003 and July 2016 to evaluate the use of antibiotic-loaded bone cement (ALBC) in a large population of TKA patients.<sup>3</sup> The authors were able to include the registry data for 731,214 TKAs. There was major disparity in group sizes due to national practice in the UK. As such, 15,295 (2.1%) were implanted with plain cement and 715,919 (97.9%) with ALBC. Overall, there were 13,391 linked revisions, of which 2,391 were performed for infection. The authors undertook an adjusted analysis and established that after adjusting for other variables, ALBC had a significantly lower risk of revision for any cause (hazard ratio = 0.85). While a simple message, this paper highlights the importance of standardizing practice in areas such as this, where the use of antibiotic cement is not ubiquitous; however, the authors here have established conclusively that the use of antibiotic cement does reduce infection and revisions. The effect observed was still seen when controlling for surgeon and unit effect.

### Plasma viscosity and prosthetic joint infection **X-ref**

Diagnosing prosthetic joint infection (PJI) is a challenge in many cases. Rafts of diagnostic criteria and investigations have been implemented over the years, including biomarkers (serum and local), imaging and even clinical criteria. As yet, nobody has established a 'gold standard' test and even consensus groups find it difficult to agree what the best diagnostic criteria for PJI are. This article from **Exeter (UK)** set out to evaluate the value of plasma viscosity (PV) in diagnosing this complication.<sup>4</sup> There is certainly some food for thought in this diagnostic investigation. The group identified 310 patients, all of whom were revised for a painful total knee arthroplasty (TKA), and divided them into infected and non-infected groups based on the



current best standard, the Musculoskeletal Infection Society criteria. In all, 102 patients were defined as being infected and the remainder as aseptic. The group established that there was a strong correlation between plasma viscosity (PV) and both erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) in this cohort. The criteria defined here was non-inferiority of PV compared to ESR, and combining the results of a CRP  $\geq$  13.5 mg/l with a PV  $\geq$  1.81 mPas gave the highest specificity of 98%. A short and pragmatic study, the results show that combining PV with CRP would be useful in diagnosing PJI, particularly in light of the fact that PV is not affected by haematocrit or drugs, and is readily available in all labs.

### General anaesthesia or awake-regional anaesthesia in infancy (GAS): an international, multicentre, randomized controlled equivalence trial **X-ref**

The effects of general anaesthesia on the immature brain are unknown, and those operating on children are often asked by parents whether anaesthesia is damaging to the child. This is not without good reason as there have been several studies in rat models that suggest anaesthetic agents negatively affect neurodevelopment through a neural toxicity mechanism. Several large cohort studies have suggested that anaesthesia in humans may have similar neurotoxic effects but these studies have confounding factors, not least because infants requiring anaesthesia are likely to have other issues which will impact on subsequent brain development such as chronic health problems and congenital abnormalities. Building on the previously published

two-year results to now give the five-year results, this randomized control trial from the **UK** and **The Netherlands** is the first of its kind comparing babies aged under 60 weeks to those of postmenstrual age born after 26 weeks gestation undergoing inguinal hernia repair, either under a spinal anaesthetic or a general anaesthetic.<sup>5</sup> The subsequent neurodevelopmental assessments were undertaken by assessor blinded to the anaesthetic type. The team found that in the 722 patients included in the trial, an anaesthetic of just below one hour does not affect neurodevelopment at five years of age, though this should be tempered with the fact that children were largely male and undergoing only inguinal hernia repair. This study provides some reassurance to paediatric surgeons when performing elective procedures on small children.

### In vivo measurement of thumb joint reaction forces during smartphone manipulation: a biomechanical analysis **X-ref**

Smartphones are one of the major technological leaps of the last 15 years, and as a result their use is pervasive in every society. The use of hand-held devices probably marks the biggest change in lifestyle since the invention of the computer with much work, social, and leisure activities now being undertaken in palm-sized devices. The concerns surrounding fertility, radiation, and phone use have hit the popular press; however, it is somewhat surprising that there has been little discussion of the potential hand and finger implications for this new way of working and communicating. Of course, with every new technology comes adverse effects, and in this interesting and fun article, a team from **Seoul (South Korea)** look at the axial joint reaction forces the thumb torques performing typical smartphone tasks.<sup>6</sup> The forces and torques applied across the thumb were contrasted to comparable activities when a keyboard or a pen is used. The study was designed to evaluate axial joint reaction forces (AJRFs) and thumb torques when using palm devices and compare these to more traditional keyboards and mouse use. The authors recruited 19 healthy volunteers and evaluated them performing a battery of typical smart phone tasks, including tapping, tap game, and swiping. Force and torque were directly measured and the motions of each joint using surface markers and motion capture

systems. This data was then combined to calculate AJRFs and torques. The results were compared to representative activities such as computer keyboard typing and handwriting. The authors found that AJRFs and torques were significantly higher during tap gaming activities then during simple tapping subtasks. When compared to computer keyboard typing, the joint forces and torque at the carpometacarpal joint with smartphone tapping was 3- and 1.4-times larger, respectively. The authors wonder if the increased use of smartphones will lead to increase wear and tear leading to arthritis or repetitive stress injury to thumbs. This is certainly a useful observation and should probably be taken into account when considering design of smart devices.

### Does PRP have a role in the nonoperative management of UCL injuries? **X-ref**

The use of biologic therapy in orthopaedic surgery remains a controversial and active area of research. There has been recent literature supporting the use of platelet-rich plasma (PRP) in the nonoperative treatment of elbow ulnar collateral ligament (UCL) injuries, but there have been no controlled investigations of the effectiveness of PRP in treating UCL injuries in professional baseball players. 'Pitchers elbow' is a particular problem in baseball players and a range of treatments from splints to injections to operations are in common use. In this study out of **Naperville, Illinois (USA)**, the authors performed a retrospective trial using the Major League Baseball (MLB) Health and Injury Tracking System to identify 544 players who underwent nonoperative treatment of UCL injuries from 2011 to 2015.<sup>7</sup> Within this cohort, the 133 patients who received PRP injections prior starting their nonoperative treatment were compared to the 411 who did not. A matched analysis (by age, position, side, and league status) of player outcomes and Kaplan-Meier survival curves demonstrated that nonoperative treatment had an overall 54% return to play (RTP). Players undergoing PRP injection as part of their treatment showed significant delay in return to throwing and RTP, and interestingly minor league professional baseball level pitchers who did not receive PRP had significantly faster RTP and throwing than those who received PRP. No differences were observed in the survival analysis, and PRP use, magnetic

resonance imaging (MRI) grading and tear location were not predictive of RTP or need for surgery. In this retrospective investigation, the use of PRP did not decrease the return throwing or play for baseball players, and as a result questions the utility of this treatment.

### Does biologic augmentation improve ACL reconstruction in young patients?

In another investigation of the effects of platelet rich plasma (PRP), this time with the addition of a collagen carrier, a team from **Ohio (USA)** have examined outcomes after anterior cruciate ligament (ACL) reconstruction with this augmentation.<sup>8</sup> The group identified and retrospectively investigated a cohort of patients at minimum follow-up of 24 months after treatment with hamstring autograft ACL reconstruction accompanied by augmentation with PRP and collagen membrane. In all, 151 knees were evaluated with an average age of 16 years and average follow-up of 52 months. Subjective outcome scores were excellent, and KT-1000 side-to-side differences averaged 1.2 mm. The average time to completion of physical therapy was 22 weeks, and 92% of patients returned to pre-injury level of sports with only 5% requiring revision surgery. While these results are impressive on their own, they are in keeping with the literature for standard ACL reconstruction without biologic augmentation and the lack of a comparative cohort limits the application of these findings significantly. The authors' conclusions are not supported, and there remains significant controversy regarding the effectiveness of PRP to improve patient outcomes.

#### REFERENCES

1. **Ehresman J, Pennington Z, Schilling A, et al.** Novel MRI-based score for assessment of bone density in operative spine patients. *Spine J.* 2019;51529-9430(19):31064-2; Epub ahead of print.
2. **Hollnagel K, Johnson BM, Whitmer KK, Hanna A, Miller TK.** Prediction of autograft hamstring size for anterior cruciate ligament reconstruction using MRI. *Clin Orthop Relat Res.* 2019;477(12):2677-2684.
3. **Jameson SS, Asaad A, Diament M, et al.** Antibiotic-loaded bone cement is associated with a lower risk of revision following primary cemented total knee arthroplasty: an analysis of 731,214 cases using National Joint Registry data. *Bone Joint J.* 2019;101-B(11):1331-1347.
4. **Bajada S, Yoong AWH, Hourigan P, Koopmans PC, Phillips JRA, Toms AD.** Plasma viscosity has a role in the diagnosis of prosthetic joint infection after total knee arthroplasty. *J Arthroplasty.* 2019;34(12):3035-3039.

5. **McCann ME, de Graaff JC, Dorris L, et al; GAS Consortium.** Neurodevelopmental outcome at 5 years of age after general anaesthesia or awake-regional anaesthesia in infancy (GAS): an international, multicentre, randomised, controlled equivalence trial. *Lancet*. 2019;393(10172):664-677.

6. **Kim W, Kim Y, Park HS.** In vivo measurement of thumb joint reaction forces during smartphone manipulation: a biomechanical analysis. *J Orthop Res*. 2019;37(11):2437-2444.

7. **Chauhan A, McQueen P, Chalmers PN, et al.** Nonoperative treatment of elbow ulnar collateral ligament injuries with and without

platelet-rich plasma in professional baseball players: a comparative and matched cohort analysis. *Am J Sports Med*. 2019;47(13):3107-3119.

8. **Berdis AS, Veale K, Fleissner PR Jr.** Outcomes of anterior cruciate ligament reconstruction using biologic augmentation in patients 21 years of age and younger. *Arthroscopy*. 2019;35(11):3107-3113.