at operation, and hence a delayed dural leak can be seen. In this study of 322 patients, the authors identified just three in whom a delayed dural leak had developed (a rate of 0.9%), and the diagnosis was reached a mean five months after the initial surgery. The typical symptom of this condition is delayed positional headaches in patients who underwent posterior spinal fusion. If the headaches persist, this should prompt a diagnostic workup consisting of a CT myelogram that can show the leak very precisely, along with a brain/cervical spine MRI that can show a Chiari I malformation. It seems likely to us here at *360* that, given the imprecise nature of the presenting symptoms, many of these complications probably go unrecognised. The authors agree that treatment consists, for the most part, of simply removing the malpositioned screw and closing the dural defect, usually providing full resolution of symptoms.

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Trauma

***X-ref** For other Roundups in this issue that cross-reference with Trauma see: Hip Roundup 2; Shoulder & Elbow Roundups 1, 2, 4, 5, 6 & 7; Research Roundup 3.*

Early outcomes of paediatric elbow dislocation: risk factors associated with morbidity

X-ref

■ Elbow dislocation is a rare and sometimes devastating injury in children. However, little is known about the risk factors for poor outcomes. These authors from **Boston, Massachusetts (USA)** describe their experience of the largest cohort we are aware of here at *360*, and report their review of 145 paediatric patients, all presenting with ulnohumeral elbow dislocations.[1] As with all large series of unusual and rare conditions, this is a retrospective series that is somewhat limited by the information contained in the medical notes, operative records, and imaging taken at the time. The mean age of the cohort was 11 and ranged from five years to 18 years. As perhaps would be expected, there was a high incidence of associated elbow fracture (at 80%), the most common of which was of the medial epicondyle (n = 60%). Around 60% of patients were treated operatively. Outcomes, as is almost ubiquitous in the paediatric population, were generally excellent, with a mean range of movement of -5° to > 126° at 14 weeks' follow-up. There were some children who lost terminal extension in this series and this was associated with multiple fractures, immobilisation and operative intervention. There was a generally moderate rate of complications, with 16% of patients requiring intervention for a complication, and this was associated with a poorer functional outcome. Although most patients suffering an elbow dislocation appear to have an acceptable result, this paper underlines the fact that it is a far from benign injury. Patients in whom complications are suffered, or those with multiple fractures or prolonged immobilisation, appear to have markedly compromised outcomes here.

InFix: what rod-to-bone distance is anatomically optimal?

■ These authors studied the now-fashionable InFix (Zimmer Biomet, Warsaw, Indiana) construct for pelvic stabilisation. Initially constructed from spinal pedicle screws and a contoured rod, the InFix has become a standard technique in treating patients with lateral compression fractures. The construct relies on two screws running across the pelvis from the anterior inferior iliac spine, secured with a long spinal rod to the other side. The construct is biomechanically disadvantaged by the lever arm of the pelvis, which is acting some distance from the rod and polyaxial screw head. This paper from **Zürich (Switzerland)** and **Graz (Austria)** sets out to identify the biomechanical ramifications of the rod-to-bone distance, and to determine whether there are any considerations for the vascular or neurological structures for any given position.[2] The study was a fairly simple one, in that the surgical team utilised ten soft-fixed cadavers and undertook InFix positioning using the standardised approach and equipment available in most Level 1 trauma centres. The authors constructed their InFix with three different rod:bone distances in order to establish what, if any, were the anatomical considerations of InFix positioning. The positioning of the InFix 1 cm from the bone resulted in widespread compression of anatomical structures within the groin, with the exception of the neurovascular bundle. Increasing the rod:bone distance to 2 cm had the desired effect of relieving the pressure on underlying anatomic structures. However, increasing the distance further to 3 cm had some undesirable effects. With a 3 cm rod:bone distance, deep hip flexion then introduces compression into a number of structures including the lateral femoral cutaneous nerve to the thigh. The more superficial the rod, the more likely the damage to the superficial nerves. At 3 cm rod:bone distance, the lateral femoral cutaneous nerve was injured 80% of the time and the anterior cutaneous branches of the femoral nerve was injured 35% of the time, both suddenly becoming structures at risk.

Hip fracture surgery within 24 hours reduces complications

X-ref

■ Despite our greatest efforts to prove that hip fractures do better with early surgery (and on the face of it this seems self-evident), the evidence doesn't support the most ardent of many trauma surgeons' beliefs. A number of registry and cohort studies have attempted to demonstrate that earlier surgery leads to lower death rates; nevertheless, in all major studies so far this has not been demonstrated to be the case. The most likely explanation for this is the confounder of delaying sicker patients for anaesthetic optimisation. The HipAttack study is still recruiting and will tell us one way or another what the benefits are of

early surgery in hip fracture patients using a randomised trial. These authors from **New York, New York (USA)** report on another large series that attempts to establish whether surgical timing affects outcomes in hip fracture surgery.[3] On this occasion, however, they focused on early surgery and whether it prevents complications. Their analysis included 26 051 patients, all aged 65 years or older, who underwent surgery for closed hip fractures between 2011 and 2014. The patient data were collected via the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP), and included episode details and complication details. The aim of the analysis was to characterise the effect of expeditious hip fracture surgery within 24 hours of admission on short-term post-operative outcomes in the form of complications and return to theatre. Of the more than 26 000 patients who were included in the study, just 23% (n = 5921) underwent surgery within 24 hours of admission. Using a propensity-adjusted multivariable logistic regression, the authors were able to demonstrate that surgery within 24 hours was independently associated with reduced risk of respiratory complications, including pneumonia, failure to extubate, or re-intubation (odds ratio (OR) 0.78), and extended length of stay (OR 0.84). The authors concluded that early surgery within 24 hours of admission is independently associated with fewer pulmonary complications, as well as shorter length of stay, in this large multicentre national sample.

Topical antibiotics in pelvic surgery? X-ref

■ Topical antibiotics (usually intra-wound vancomycin) have become more popular in recent years, spurred on by positive studies in spinal fixation. The concept of high-dose local prophylactic antibiotics to reduce post-operative infection rates is a sound one, lowering the risk of inducing resistance, and the systemic complications of antibiotic use (such as *Clostridium difficile* sepsis and toxic megacolon). In the pelvis, the prospect of infection is daunting as intra-pelvic sepsis can progress rapidly, and has a relatively high fatality rate. Surgeons in **Phoenix, Arizona (USA)** have reported their investigation, which was designed to establish whether topical vancomycin and tobramycin powder are able to reduce the incidence of surgical site infection following pelvic or acetabular fracture surgery.[4] The report is based on a retrospective cohort study of 140 patients (although 219 were screened for inclusion). The authors describe a comparative cohort series with 69 patients in the control group and 71 in the intervention group (who received intra-wound topical antibiotics). The reported overall infection rates in this study were rather high, with a 14.5% infection rate in the control group and 4.2% in the intervention group, a difference that was significant. There were no observed effects of systemic toxicity in the intervention group. The authors comment that this is a positive intervention study, although sensibly caution that "topical antibiotics possibly reduce the incidence of surgical site infection". The effect was not seen after adjusting for blood loss. For us here at *360*, this paper raises more questions than it answers. The overall infection rates in the study are rather high but there was an impressive effect of topic antibiotics, which disappeared when adjusting for blood loss.

Two screws better than one? Cephalomedullary nailing under the spotlight X-ref

■ This is a designer surgeon series from **Tampa, Florida (USA)** that asks whether two screws are better than one for proximal femoral fractures.[5] The implant in question is the InterTAN (Smith & Nephew, Memphis, Tennessee), a cephalomedullary nail with the advantages of providing two screws with fixed compression to substitute the traditional single sliding hip screw design. There are two potential advantages to this approach: one is the addition of the second screw and the potential additional rotational stability conferred; the other is the slightly separate issue of the 'fixed compression', which potentially allows compression to be applied as it would with a plate, fixed, and without the potential for overmedialisation. This is a retrospective comparative study comparing the Gamma 3 (single screw nail; Stryker, Kalamazoo, Michigan) with the InterTAN. The study represents a good number of fractures, with 413 patients treated with either a single screw (n = 130; 79 stable and 51 unstable) or a dual screw (n = 283; 155 stable and 128 unstable). In terms of avoiding varus collapse, there was a significant difference in rates of varus collapse and loss of femoral offset, with a 2.5-fold greater average rate of varus collapse and a twofold greater loss of femoral offset in the single screw than in the double screw construct. As would be expected, there were higher rates of varus collapse and loss of femoral neck offset in the unstable fracture group, but this was significantly less of a problem in the two-screw device. It certainly seems, from the results presented here, that the two-screw InterTAN does do what it was designed to do; with lower rates of varus collapse and loss of femoral neck offset, the InterTAN is clearly performing as intended. One can draw one's own conclusions as to the clinical relevance of these findings. Certainly, maintenance of reduction cannot be seen as anything other than a positive finding. However, in the complicated world of hip fracture, surrogate outcome measures do not always translate into positive clinical (and, in this case, functional) findings.

The extension-type tibial plateau fracture

■ There is an ongoing revolution in the understanding of, and treatment for, tibial plateau fractures. The authors of this study from **New York, New York (USA)** have turned their attention to the evaluation of the hypertension-type injury.[6] Typically, this is an impaction fracture of both anterior tibial plateaus, resulting in an unstable fracture that is very difficult to treat, with the femoral condyles applying a deforming force in hyperextension. Elevation of the joint line is particularly difficult as the anterior cortex is usually of poor quality and, as such, the plateau tends to sublux posteriorly and into hyperextension. This comparative cohort series compares these injuries with other significant bicondylar fractures. The paper reports the outcomes of 84 patients, all with bicondylar plateau fractures. Of these, 15 had the hyperextension variant, and 69 the more traditionally described varus:valgus variant. The authors describe the functional outcomes of both groups in terms of objective assessment of functional outcomes (range of movement, post-operative alignment) and outcome scores (Short Musculoskeletal Functional Assessment (SMFA), pain scores). In addition, the rates of infection and progression to post-traumatic osteoarthritis were reported. By one year following treatment, the authors report no differences in knee range of movement; however, the hyperextension cohort had, on average, a higher functional (SMFA) score, indicating poorer functional outcomes. This paper confirms what many have suspected: that the hyperextension type of tibial plateau fracture is associated with significant

loss of function in terms of patient-reported outcome measure (PROM) scores, despite surgery restoring and maintaining objective range of movement.

Vitamin D for fracture healing?

There is seemingly no end to the supply of papers that review the association between vitamin D deficiency and a variety of complications, including poorer outcomes in hip fracture surgery and nonunion rates. On the other hand, what we are short of is papers that suggest ways to deal with the problem. Our interest here at *360* was piqued by this paper from **Charlotte, North Carolina (USA)**, which seeks to establish whether the authors' proposed intervention of an early high-dose vitamin D supplement will have an effect on outcomes in patients with vitamin D deficiency and a long bone fracture.[7] We applaud this team for performing this study as a randomised controlled trial, given the difficulties of enrolling such patients. The team identified 113 patients with long bone fractures who were at risk of vitamin D deficiency. In all, 100 patients were either deficient or insufficient, and were then randomised to receive a single dose of vitamin D_3 orally (100 000 IU) within two weeks of injury (treatment group, n = 50) or a placebo (control group, n = 50). The study team recorded patient demographics, and fracture location and treatment, as well as their primary outcome measure of time to fracture union and secondary outcomes of complications. The bottom line is that there was no difference in nonunion rates between the two groups, with two patients (4%) having a nonunion in each group. In addition, there were no adverse events in response to supplementation. It is tempting to conclude from this report that vitamin D supplementation doesn't treat hypovitaminosis; however, perhaps a better take-home message is that the rate of nonunion is low, even in patients with profoundly low vitamin D levels.

Predicting tibial fracture union

The simple tibial fracture continues to vex even the most experienced of orthopaedic traumatologists. The tibia is unusual in that it is loaded almost exclusively in compression with an anatomical axis that aligns with the mechanical axis, thick compact cortices, and a poor soft-tissue envelope over one-third of the bone. Despite the best treatment, the tibia sometimes just doesn't heal. In a simple but important paper, researchers from the R Adams Cowley Shock Trauma Center in **Baltimore, Maryland (USA)** asked whether the likelihood of fracture healing can be predicted simply from information available at the time of fracture presentation.[8] Their paper collated data on 35 potential risk factors for nonunion in 382 patients, all of whom were treated for a mid-shaft tibial fracture with an intramedullary (IM) nail. The research team then undertook a bivariate and multivariate analysis to establish risk factors for union. Their sample was a representative one, with 56 patients going on to nonunion and 326 healing. The authors describe the nonunion risk determination (NURD) score based on seven factors, which were as follows: requirement for flap reconstruction; presence of compartment syndrome; presence of chronic medical conditions; open fracture; male gender; American Society of Anaesthesiologists (ASA) grade; and percentage of cortical contact. In addition to the above, the NURD score includes factors predictive of union, namely spiral fractures and low-energy injuries. Each is assigned a score, and the total NURD score was then calculated in terms of risk of nonunion. A NURD score of 0 to 5 had a 2% chance of nonunion; 6 to 8 had a 22% chance of nonunion; 9 to 11 had a 42% chance of nonunion; and > 12 had a 61% chance of nonunion. In this development cohort of patients, the NURD score performs well, and gives the surgeon and patient (and possibly negligence lawyer) something to think about. With a 20% rate of nonunion and some clearly defined risk factors for nonunion, we suspect that – if independently validated in a second cohort of patients – the NURD score is here to stay, and not just because of the catchy name!

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Oncology

Dedifferentiated chondrosarcoma: a survival analysis

The Surveillance, Epidemiology, and End Results (SEER) database has shed some significant light on a variety of relatively rare bone neoplasias over the past few years, and this paper from **Chicago, Illinois (USA)** is no different.[1] The authors are able to report on the survival estimates for dedifferentiated chondrosarcoma. This rare malignancy has a range of previously reported survival rates of around 5% to 25%. In the ten-year period of the study (2001 to 2011), centres forming part of the SEER database reported the outcomes of an impressive 159 dedifferentiated chondrosarcomas, and, consequently, a relatively accurate survival estimate with Kaplan–Meier survival analysis is the basis of this important study. The headline result is an 18% five-year overall survival and a 28% disease-specific survival. Unusually for such a rare tumour, there were enough patients here to make a rational attempt to identify covariates associated with survival. The authors established that patients with extremity tumours had a poorer prognosis than those with axial skeleton or chest wall tumours (hazard ratio (HR) 0.6). Patients with stage III+ disease (HR 2.51) and those