

ROUNDUP³⁶⁰

Trauma

For other Roundups in this issue that cross-reference with Trauma see: Hip & Pelvis Roundup 6; Foot & Ankle Roundups 1, 2, 5, 6, 7 and 8; Shoulder & Elbow Roundup 7; and Research Roundups 1 and 8.

Proximal humeral fractures in children do not need surgery x-ref Children's orthopaedics

■ Proximal humeral physeal fractures (PHPF) are relatively rare injuries in the paediatric population and when they do occur it is rarely with large displacement. In the face of a paucity of scientific literature to inform treatment choices, this treatment decision has often been undertaken primarily based on surgeon preference. A research team in **Denver (USA)** conducted this study with the aim of comparing operative and non-operative treatment outcomes in skeletally immature patients with displaced proximal humeral physeal fractures (Neer-Horwitz (NH) grade III or IV).¹ The team undertook a retrospective notes review on a nine-year series of patients with a displaced proximal humeral physeal fracture. Eligible patients were invited to complete a phone survey and outcomes were assessed using the Quick DASH score. As would be expected, there were a range of operative and non-operative treatments employed and a propensity score matching method was used to accurately match patients. Matching was performed for age at injury and fracture classification. The study population consisted of 70 patients with a NH III or IV

fracture, of whom 32 completed the outcomes assessment portion of the study. At the time of follow-up, the research team found no difference in return to pre-injury activities or cosmetic appearance scores between the two groups. However, a less than desirable treatment outcome was seen in four out of 23 (17.4%) patients managed non-operatively, and Quick DASH scores were 1.9 points higher in this group. Further subgroup analysis of the non-operative cases showed that for every one year increase in age at initial injury, the odds of having a "less than desirable outcome" increased by a factor of 3.81 (95% CI 1.31 to 21.0). The authors of this study concluded that in a matched cohort of patients, there was no difference in the rate of return to activity, complications, or cosmetic satisfaction with this injury. Although functional outcomes were not significantly different, they tended to be poorer amongst patients who underwent non-operative treatment, particularly in older patients. It certainly seems to us, here at 360, that in light of this study open reduction should be considered with a lower threshold in older adolescent patients with a displaced proximal humeral fracture.

Quadrilateral surface plates in transverse acetabular fractures

■ The outcomes for acetabular fractures are well known to be dependent on the quality of reduction which determines the incidence of post-traumatic arthritis and hip functional

outcome scores in both the short and longer term. The transverse fracture pattern is a particular challenge both in terms of reduction and fixation given the orientation of the fracture lines. Almost universally transverse acetabular fractures are displaced and as such the recommended treatment is open reduction and internal fixation the world over. There are several construct options available to the acetabular surgeon for managing transverse acetabular fractures, including the use of a combination of column plates and lag screws. Recently, the use of quadrilateral surface buttress plates has become increasingly popular, however, biomechanical data regarding the relative stabilising effects of these various fixation strategies are not yet available. In a comprehensive study from the trauma group in **Tampa (USA)**, the biomechanical properties of different acetabular fixation strategies were tested.² The authors used saw bone models with a standardised transverse transtectal acetabular fracture to test the stability of the most commonly used fracture stabilisation constructs: 1) anterior column plate and posterior column lag screw, 2) posterior column plate and anterior column lag screw, 3) anterior and posterior column lag screws only, 4) infrapectineal plate and anterior column plate, and 5) suprapectineal plate alone. Cyclical loading in a biomechanical testing lab of 35 hemi-pelvises was undertaken up to 1500 cycles to 2.5 x body weight and from this construct stiffness was

calculated. In addition, maximal failure loads were also tested. After 1500 cycles, both types of quadrilateral plates tested were significantly stiffer than the posterior column buttress plate with supplemental lag screw fixation (311 ± 99 N/mm), however, there was no difference between the infrapectineal (568 N/mm) and suprapectineal group (602 N/mm). When loaded to failure, the infrapectineal group had the highest load to failure which was significantly better than for the other groups. The authors concluded that, in this biomechanical study using synthetic hemi-pelvises at least, quadrilateral surface buttress plating spanning the posterior and anterior columns is superior to traditional forms of fixation at resisting motion at the fracture site and in resisting medial subluxation. This is, of course, only part of the picture. While this study validates the use of such plates, there are many other considerations in fracture surgery, including obtaining reduction and the potential difficulties associated with insertion of metalwork through any specific approach. The surgical tactic and construct used should be tailored to the patient and surgeon, however, the quadrilateral plate is at least as good an option when suitable.

Sleep deprivation associated with poor outcomes in trauma x-ref Research

■ Any clinician who has a regular fracture commitment is used to offering advice to patients about the

best way to sleep with a fractured shoulder or clavicle, a very common problem. Pain has been frequently associated with sleep deprivation in orthopaedic patients and it is reasonable to suggest that this might result in poor sleep quality and cognition, shortened sleep duration, and an increase in the likelihood of work-related errors. A study team in **New York (USA)** set out to add some evidence to what is a very poorly investigated area. The study was set up to evaluate the rates of sleep disturbance, its risk factors, and longitudinal change following four different orthopaedic traumatic injuries.³ The study used prospectively collected data in regard to patients' functional status. Each patient completed validated questionnaires following orthopaedic injuries. A total of 1095 patients were included in the study: 111 proximal humerus, 440 distal radius, 109 tibial plateau and 435 ankle fractures. Patient-reported sleep disturbance or deprivation was compared with the overall functional and emotional status and assessments were undertaken at three, six, and 12 months following fracture. Surprisingly, there were still significant rates of sleep difficulty reported by three months' follow-up in patients with proximal humerus (41% of patients), wrist (25%), tibial plateau (36%) and ankle (19%) fractures. By the final follow-up point, less than 20% of patients with all fracture types were still reporting difficulty sleeping. A range of mental wellbeing scores recorded at one year, including the Mental Health category of the SF-36 and the Emotional category of the Short Musculoskeletal Function Assessment, were reported as independent predictors of poor sleep, while their respective physical function categories were not. The authors concluded that poor sleep was independently associated with poor emotional status, although they were not found to be associated with poor functional outcomes at 12 months following treatment. The authors conclude that

in the later stages of fracture healing, the mental health status of patients with sleeping difficulty should be carefully assessed in order to provide the best possible outcomes. It is of course important to remember that, as with many studies designed in a similar manner, this study simply shows association, not causation.

Bipolar hemiarthroplasty confers no benefit

x-ref Hip

■ Femoral neck fractures are one of the most common fractures in the elderly, and carry with them some of the highest rates of mortality and morbidity of any injury (or indeed any other diagnosis). There has been a renewed interest in the choice of implant for these fractures, with a number of randomised controlled trials showing a benefit of total hip replacement over traditional hemiarthroplasties, even with newer prostheses. However, there has not been the same resurgence of interest in bipolar hemiarthroplasty, which remains controversial, with some arguing it offers many of the advantages of a total hip replacement without the added complications, while others are in complete disagreement, arguing there is no benefit. The aim of this recent study from **Tampere (Finland)** was to compare outcomes in a cohort of elderly patients with a displaced femoral neck fracture treated either with a cemented, modular unipolar or bipolar prosthesis with the same femoral component.⁴ They designed a prospective, randomised controlled trial including patients aged > 65 years with displaced intracapsular femoral neck fractures. Outcomes assessed were implant survival, functional status and mortality rates at two months, and one, three and five years. The study team recruited



a total of 175 patients who were randomised to either a unipolar (n = 88) or bipolar (n = 87) hemiarthroplasty. Survival analysis was conducted using Kaplan–Meier curves. At the time of final follow-up, the unipolar group had a significantly higher dislocation rate but no difference in the incidence of revision for recurrent dislocations. The unipolar prosthesis survival was 98% and the bipolar group was 97%. There were also no differences

in mortality rates, ambulatory status or early radiological acetabular erosion between the two groups. It certainly seems from this series that there are very few differences between any of the reported outcome meas-

ures in these two groups, and given the added financial costs associated with bipolar prostheses, there are few benefits to be seen in this study from this prosthesis.

Skeletal traction: cutting edge?

■ Pre-operative fracture stabilisation was shown to be a life-saving measure by Hugh Owen Thomas during the First World War where his introduction to the trenches of the Thomas Splint reduced mortality from a femoral fracture from around 80% to less than 8%. Traction and fracture immobilisation still forms a critical part of early resuscitation of patients with long bone fractures. Femoral skeletal traction, skin traction and splints all remain in common use as a method of pre-operative fracture stabilisation and pain control. Distal femoral traction pins are in common use throughout the world to treat patients with femoral shaft, acetabular, and unstable pelvic fractures, however, skeletal traction is invasive and poses risks to neurovascular structures, infection and stiffness

around the knee. Clinicians in **Saint Louis (USA)** commonly use both long-leg splints and skeletal traction and they designed a prospective study to determine if, in femoral or pelvic fracture patients, there was an advantage to either method in terms of pain relief and long-term sequelae.⁵ Their cohort study was based on an attending-specific protocol with some patients receiving the splint and some traction. Outcomes were assessed with Lysholm Knee Scores (to assess pre-injury knee pain and at three and six months), along with a visual analogue score for pain. In what must be one of the largest studies assessing pre-operative fracture immobilisation of recent times, the authors managed to include a total of 120 patients, the majority of whom had sustained a femoral shaft fracture (n = 71, 59%). The mean cohort age was 39.7 years (18.1 to 89.5) and there was a disproportionate split between the groups, with a third of patients (n = 35) immobilised with a long-leg splint and the remainder (n = 85, 71%) immobilised with skeletal traction by a distal femoral pin. A six-month follow-up was completed by 84 patients (70%), and at this final follow-up Lysholm scores had decreased by around 9.3 points evenly across the entire cohort, with no significant difference between the groups. At the time of injury and immobilisation, VAS pain scores were significantly lower in the traction group (1.9 points lower) and there were no complications associated with insertion of the skeletal traction pin. The authors conclude that insertion of distal femoral traction pins did not result in knee dysfunction and provided patients with acute pain relief, with no identifiable morbidity at six months compared with a long-leg splint. Perhaps the oldest treatment methods remain the best in some circumstances?

Forefoot fractures not so innocent

x-ref Foot & Ankle

■ Midfoot fractures are complex injuries with diverse fracture patterns and varied treatment options. They

are usually the result of high-energy trauma or a direct crush of the foot (with the associated severe soft-tissue injury), and frequently lead to severe functional impairment and a decreased quality of life. Despite this diverse range of injuries, there are few comparative series in the literature comparing functional outcomes and specifically the clinical and functional outcomes of Chopart, Lisfranc and multiple metatarsal shaft fractures. In particular the outcomes of multiple metatarsal fractures are poorly described. Investigators in **Münster (Germany)** undertook a retrospective case series with the aim of establishing the mid-term outcomes of patients with either a Chopart, Lisfranc or multiple metatarsal shaft fractures.⁶ Patients were included who presented at a level 1 trauma centre, and were treated with a variety of operative modalities, including open or closed reduction and internal fixation with screws, K-wires, plates, external fixation or a combination of different techniques. Outcomes were assessed with a combination of pain and functional outcomes (using the two components of the American Orthopaedic Foot and Ankle Society (AOFAS) Midfoot Score and the Maryland Foot Score). Further computational assessments included 3D gait analysis, pedobarographic analysis, and plain radiography. Some additional assessments specifically undertaken for this study included an unusual measure of activity with a step counting accelerometer. The research team improved the value of the research by introducing a normal age-matched control group. Sadly, they were unable to assemble a particularly large study group, with a total of 24 participants in the study, with a mean age of 44 years (16 to 72). The group was divided into 12 patients with multiple metatarsal shaft fractures, six Chopart, and six Lisfranc fracture dislocations. Treatments were heterogeneous, making for a difficult-to-interpret combination of injuries and treatments included in this paper.

The authors did, however, venture some analysis, and comparison of pedobarographic analysis between the injured and normal foot demonstrated reduced contact times of the total foot (763.9 ms vs 789.5 ms), the forefoot (643.6 ms vs 672.5 ms), and the hallux (359.6 ms vs 460.5 ms) for the injured foot compared with the contralateral foot. There was, however, no statistical difference in outcomes between the injury subgroups. The patients achieved an overall median SF-36 score of 64, AOFAS-Midfoot Score of 64, and Maryland Foot Score of 73, all of which are suggestive of a poor restoration of foot function. Although in such small numbers subgroup analysis is essentially meaningless, the authors established that multiple metatarsal shaft fractures had a lower walking speed and cadence than the comparators. The authors advise that one should not underestimate the severity of multiple metatarsal shaft fractures, as well as Chopart and Lisfranc fracture dislocations. The authors somewhat undermine the usefulness of their study by attempting to draw too many conclusions and perform subgroup analysis on what is a small and heterogeneous group of patients. In doing this, they detract from what is a key message of this paper – mid- and forefoot injuries are significant and they can lead to ongoing problems.

Telemedicine in trauma?

x-ref Research

■ Central to the orthopaedic surgeon's patient-centred approach has been the provision of face-to-face consultations in order to underpin the combined decision making process. The changes in Western world affluence and the perpetual search for 'value' in health care has moved the focus a little from a 'patient-centred' approach towards a more 'value-centred' approach in many of the world's major healthcare economies. The challenge for physicians is to lower costs and resource use without eroding quality of care or patient satisfaction. A commonly sighted

potential 'corner cutter' is the follow-up clinic. Can patient follow-ups be undertaken in a telemedicine manner? Clinicians in a busy major trauma centre in **Nashville (USA)** designed a randomised controlled pilot study with the intention of establishing what patient satisfaction levels were with a 'telemedicine' follow-up clinic for fracture patients.⁷ This pilot study reports the results of 24 patients who were randomised to either face-to-face or telemedicine follow-up clinics. The results of 17 patients: eight telemedicine and nine face-to-face, were included in the analysis. Of the patients in the telemedicine group, two failed to adhere to the study protocol, one withdrew due to technical difficulties and one sustained an open fracture during the follow-up period. In the control (face-to-face) group, three were withdrawn due to protocol violations. The protocol required four follow-up appointments during a six-month period. There were no reported differences between assessed satisfaction rates between the two groups. Although there was a lower satisfaction rate in the telemedicine group (89% vs 100%), three quarters still agreed to have further telemedicine follow-ups. On the plus side, none of the telemedicine group required time off work and the appointments took significantly less time to achieve. How patients are followed-up after attendance at medical services is facing increasing scrutiny. Minimising follow-up visits keeps costs down and managers happy, however, it may erode patient satisfaction. Novel technologies such as telemedicine are likely to play a greater role in patient follow-up as time goes on, and as a profession we should take the best solutions available to provide high quality care while keeping costs down.

Ketamine infusion for orthopaedic injuries

■ Ketamine is a drug with, at best, a chequered history. A popular drug of abuse and with questionable efficacy as an anaesthetic agent, it

had fallen out of favour with many anaesthetic and emergency room doctors. Recent research has, however, demonstrated ketamine to have a morphine sparing effect following injury, and as such researchers in **Lille (France)** set out to investigate the potential benefits of ketamine infusion following orthopaedic trauma in the pre-hospital environment.⁸ Amazingly, these researchers have managed to design and complete a randomised controlled trial in the pre-hospital environment, a feat in itself. This represents one of a very small number of randomised pre-hospital trials – simply completing such an ambitious study deserves commendation. The study protocol was a blinded randomised controlled trial to compare the effects of a continuous ketamine or saline infusion. The primary outcome measure was the cumulative morphine requirements to control severe acute pain. In this single-blind clinical study, patients with an isolated orthopaedic injury were included and following a small bolus dose, patients then received either a continuous infusion of ketamine (0.2 mg·kg⁻¹·h⁻¹) or saline of the same volume. Secondary outcomes of pain perception were evaluated with the visual analogue scale in the 66 patients successfully enrolled into the study. There were no differences in the total morphine dose administered with continuous ketamine infusion and a similar mean duration of care. There were also no differences in analgesia efficacy between the two intervention groups. This ambitious study has quite clearly demonstrated that there is no benefit of a continuous ketamine infusion from an analgesic point of view following orthopaedic trauma injuries in the pre-hospital setting.

Improved functional outcomes seen with trauma networks

■ Despite large investment in trauma networks worldwide and some compelling evidence surrounding survival on a national scale, there is little evidence quantifying the

benefit of these centralised trauma services during their inception. Researchers in **Coventry (UK)** sought to establish a comparative study evaluating the outcomes of a centralised regional trauma network following inception.⁹ Their study was designed to evaluate trends in admissions, case mix, and outcomes of injured patients in four hospitals that became major trauma centres in March 2012 as part of the UK-wide major trauma network. Consecutive patients all presenting with major trauma were identified from the TARN national UK trauma registry, both before and after the inception of the trauma networks. This comparative cohort study evaluated the differences in case mix, demand on hospital resources, and outcomes prior to and following the 'switch on' of their respective regional trauma networks. Across the four centres, patient volume increased around 200% (442 to 1326), as did the number of operations by around

250% (n = 349 to 1231). As would be expected, the use of ITU beds rose 233%, as did the total number of bed days by 188%. Slightly counterintuitively, the median injury severity score actually fell (from 16 to 14) which is probably reflective of a more rounded case mix. Prior to the designation of major trauma centres, the very severely injured were transferred to large centres for neurosurgical, cardiothoracic and specialist orthopaedic input where, following the network's designation, all patients fulfilling the triage criteria were transferred. This paper paints an encouraging picture of improving outcomes with falling mortality (although not yet significantly so) and improved clinical outcomes at discharge. It does appear that centralising services has improved outcomes in the shorter term. We would encourage the authors to repeat their study to quantify the learning curve as greater numbers of presenting patients should result

in greater depth of experience and improved outcomes.

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