ROUNDUP360

Trauma

For other Roundups in this issue that cross-reference with Trauma see: Foot & Ankle Roundups 2 and 4; Wrist & Hand Roundup 5; Shoulder & Elbow Roundup 8; Oncology Roundup 5; and Research Roundups 1, 3, 5 and 6.

Infection and temporising external fixation

■ All registrars and residents learn on their principle AO courses to apply external fixation to temporise an injury by bridging the zone of fixation as well as the zone of injury. While in an ideal world this would always occur, this is far from an ideal world, and often surgeons are left with no option other than to apply a fixator within the zone of fixation due to the anatomy of the fracture and patient. This can sometimes give the surgeon offering definitive fixation a tricky choice between overlapping the internal fixation with pin sites or using definitive external fixation. Which option is chosen often depends on judgement and experience more than evidence. Researchers in **Boston (USA)** have stepped up to offer some insight into the increased risks of infection associated with overlapping definitive fixation with temporising pin sites.[1] The authors used a comparative case series design to assess patients with bicondylar tibial plateau fractures and pilon fractures, all of whom were treated with a two-staged protocol of acute spanning external fixation and later definitive internal fixation. The study team were able to collate an impressive series of 182 patients treated in this manner (85 bicondylar tibial plateau fractures and 97 pilon fractures). They performed a thorough notes and radiographic review and reported infectious complications as their primary outcome measure. The series had relatively high infection rates of 14% (n = 25/182), all with deep infections. The 50 patients in whom plate fixation overlapped prior external fixation pin sites reported a 24% deep infection rate, compared with 10% of the 132 patients in whom the plate fixation did not overlap the external fixation pin sites. The authors concluded that placement of definitive plate fixation overlapping previous external fixator pin sites significantly increases the risk of deep infection. This paper highlights for us, here at *360*, how difficult it is to treat these severe injuries. Aside from proving the benefit of avoiding the zone of treatment with bridging fixation, this paper also highlights the high overall deep infection rates in these injuries.

Missing something? Vitamin C in distal radial fractures

x-ref Wrist & Hand

■ Here at *360* it was an eye-opener for us to read a randomised controlled trial from **Edinburgh (UK)** evaluating the potential benefits of vitamin C in treatment of distal radial fractures.[2] Although we were not aware of any units in which this represents standard of care, the authors make a compelling argument that vitamin C has been reported to reduce the prevalence of complex regional pain syndrome (CRPS) after a distal radial fracture, and may improve outcomes. The study team set up a randomised controlled trial and prospectively recruited 336 adult patients with an acute distal radial fracture to either receive 500 mg of vitamin C or a placebo daily for 50 days following injury. There was no significant difference at one year in the DASH score, other functional outcomes, the rate of CRPS, or osseous healing of non-displaced or displaced distal radial fractures treated with vitamin C compared with placebo. The study was powered for the DASH score at six weeks as the primary outcome measure, although patients were followed up for a year and a fairly complete set of secondary outcome measures including complication rates, strength, range of movement and CRPS scoring were also performed. Although there were some differences in the secondary outcome measures at six weeks (in favour of the placebo group), including strength, range of movement and the incidence of CRPS, these were not present at any other time point. The authors concluded that administration of vitamin C confers no benefit to patients with a displaced or non-displaced fracture of the distal aspect of the radius. The findings of this study do, however, contradict those of some prior studies which is discussed within the paper. One of those studies examined only patients treated non-operatively, potentially implying a less severe range of fractures than those in the present study and in yet another study of both operative and non-operatively treated patients, the diagnosis of CRPS was established on the basis of a telephone interview or inquiry letter. Clearly the methodology of this current paper is more robust, and so for the present time we can conclude that vitamin C probably adds little to the management of distal radial fractures.

Show, tell, learn

x-ref Research

■ Technical errors that occur during fracture surgery are a problem that many surgeons prefer not to discuss openly, yet they are usually considered preventable by good pre-operative planning and surgeon education. This is a thorny area to study as a surgeon's level of technical skill is an important part of their persona and it is often a challenge for individuals to candidly address technical errors. In a very interesting paper, surgeons in **Tel Aviv (Israel)** conducted a prospective study evaluating the impact of a structured, open review of all technical errors occurring over a four-month period.[3] The number of technical errors during a subsequent four-month period was then analysed and compared with the previous four-month period. The most common technical errors were: insufficient reduction, varus and valgus malalignment and prominent hardware. The study included the results of 761 patients, of whom 350 operations were included in the initial cohort, and 411 operations in the later cohort. All of the identified technical errors were discussed at

a combined teaching meeting with residents and consultants present using a very simple 'show, tell, learn' process. The authors reported that this simple intervention significantly reduced the total number of errors from 14.7% to 6.3% during the period of the study. In addition, classification of the severity of the technical errors was significantly reduced. Through this method, the authors showed that intra-operative technical errors can be significantly reduced by periodic performance evaluations in a seminar setting. Patient safety, including prevention of technical errors, has become an important initiative in healthcare systems worldwide. It is not clear to us here at *360* if is the Hawthorne effect or the intervention itself that improved the outcomes for these patients, but pragmatically, it doesn't seem to matter why the errors decreased, just that they did.

DRAFFT: Cheap and cheerful Kirschner wires win out

x-ref Wrist & Hand

■ One of the biggest about-turns in orthopaedic management may be about-turning again. Cynics would say that the industry-sponsored, almost total change to volar locking plates in the management of displaced wrist fractures is nearly complete. However, this change has not been supported by evidence. There have been a number of small randomised trials that have attempted to address this lack of evidence performed at single centres over the past few years, however, thus far there has not been a large multicentre randomised controlled trial. Clinical trialists from **Warwick (UK)**, taking a typically pragmatic approach to their study design, sought to establish the health economic and functional benefits of distal radial fractures treated with either K-wires or volar plating.[4] They excluded patients in whom a closed reduction could not be achieved, where the surgeon felt intra-articular reduction was required or those fractures with a proximal extension. The study was conducted in a group of 18 trauma centres and recruited 461 participants, each allocated to one method of fixation. Outcomes were assessed with a range of functional scores (DASH, PRWE) and quality-of-life analysis (EQ-5D), with the PRWE providing the primary outcome measure. Impressively, the study recruited acceptably, and complete outcome data were accessible in over 90% of patients. There were no clinically relevant differences in any outcome measure at any time point in this study, including the quality-of-life scores. Given that K-wire fixation is cheaper and easier to perform, we wonder here at *360* if this paper will start to swing the pendulum back the other way.

Femoral neck fractures not as stable as they might be

x-ref Hip & Pelvis

■ Despite the relatively common presentation of intracapsular neck of femur fractures, there is little consensus across the world as to how these injuries are best treated. There is, however, consensus that fixation of hip fractures carries lower morbidity and mortality, and for this reason in many centres around the world even elderly patients presenting with undisplaced intracapsular neck of femur fractures are treated with closed reduction and fixation. The long-term outcomes of these injuries have not been studied for some time, and reasoning that the longer-term outcomes of stable fractures may not be as good as previously thought, surgeons in **Burlington (USA)** undertook a retrospective review of 121 patients with stable intracapsular neck of femur fractures treated with cannulated screws.[5] The study was designed to establish the long-term outcomes of patients in terms of conversion to THR or revision surgery at around a year following injury. Not surprisingly for patients in this cohort with an average age of 80, there was a 40% mortality rate within the study period. The research team was able to report on the results of 121 fractures in 120 patients. All patients were treated with percutaneous cannulated screw fixation in an inverted triangle configuration. During the period of the study, 10% of patients underwent conversion to a THR at a mean of nine months following the index procedure. In addition to those patients who were revised to a THR, there were two patients who were treated for subsequent periprosthetic fracture to a cephalomedullary nail. The rates of complication in this elderly and frail group of patients are surprisingly high and while many readers will argue their own results are better than this (and indeed many of those in the literature are), this is an interesting paper that serves to highlight to us here at *360* that the complication rates and mortality in these hip fracture patterns widely thought of as 'benign' are not insignificant. This is an injury where more work certainly needs to be done.

Displaced sacral fractures give high morbidity and mortality

x-ref Spine

■ Isolated displaced sacral fractures are a rare and potentially highly disabling injury about which there is little long-term literature. Placed squarely between spinal surgery and pelvic surgery, this range of injuries includes everything from the minor sacral alar fractures to U and H sacral fracture dislocations. The more severe injuries are rarer and require operative intervention. There is, however, little in the way of long-term outcomes reported for patients with operatively treated displaced sacral fractures. Investigators from **Oslo (Norway)** have set out to establish the outcomes of these injuries in a ten-year follow-up of these injuries.[6] The study cohort consisted of 31 patients treated over a five-year period with displaced sacral fractures. Of these, an impressive 28 were available for a mean 10.7-year follow-up (all nine having also undergone an additional one-year follow-up). The study was designed to establish the functional outcomes of displaced sacral fractures using the SF-36 and VAS pain scores as primary outcome measures. Additional outcomes included bowel and bladder function, neurologic deficits and sexual activities. These were then compared with normalised data for the Norwegian population. The study team did not identify any differences in the outcomes between the one-year and ten-year follow-up in this cohort, however, the outcomes did appear to be mostly determined by the level of post-operative pain. Poor pain scores were significantly correlated with impairment of physical, bodily pain, general health and emotional scores on the SF-36. These scores were also significantly poorer across the study cohort when compared with Norwegian norms. Sexual, emotional and bowel and bladder functions were all related, and patients who performed poorly in these outcome measures had poor overall results. This paper serves to underline the poor overall functional status of patients with sacral fractures requiring open reduction and internal fixation. Patients had a sustained and significant deficit in the SF-36 overall, and in a large number of subdomains.

Sanders and calcaneal fractures: a 20-year experience

x-ref Foot & Ankle

Roy Sanders is a name synonymous with calcaneal fractures. His CT-based classification is used for the classification of calcaneal fractures and to make decisions about treatment and prognostication across the world. Although initially validated more than ten years ago, the value of the Sanders classification as a long-term prognosticator is not actually known. This month we were delighted to see the 20-year follow-up of Dr Sanders' original paper from **Tampa (USA)** with the aim of determining the long-term (10 to 20 year) outcomes of patients treated with open reduction and internal fixation of Sanders type II and III fractures.[7] The study was designed as a report of long-term comparative cohorts with the intention of determining the prognostic value of the Sanders classification. Over the ten-year study period there were 638 fractures treated, of which 208 met the inclusion criteria for the study and all were treated with a lateral approach and ORIF with plate and screws. Post-operatively, reduction was assessed with CT scanning and plain radiographs and functional outcomes were assessed using both general quality-of-life measures (SF-36) and domain-specific scores (AOFAS hindfoot score, Maryland Foot Score and the Ankle Osteoarthritis Score) to assess long-term functional outcomes. In addition, the authors reported complications and further surgery and defined the requirement for a subsequent subtalar arthrodesis as a treatment failure. By the final study of the 208 initial patients, just over 50% were available for follow-up (n = 108/208). Follow-up was achieved to a minimum of ten years (and a mean of 15.2). As would be expected, the Sanders II group was larger than the Sanders III group (n = 70 vs 38) and the authors classified their post-operative reduction as anatomic in 95% of patients based on post-operative CT scans. In terms of longer-term complications, there were three late losses of reduction, seven cases of sural nerve complications and an 11% apical wound breakdown rate. A single patient had deep infection, although nearly a third of patients developed subtalar arthritis requiring subsequent fusion, representing a long-term failure rate of 29% in this series. In terms of the value of prognostication of the Sanders classification, there were marked differences in failure rates between the two groups, with a relative risk of 3.9 for fusion (47% vs 19%). In those who did not undergo fusion for failure, the functional outcomes were good, with an AOFAS score of 75, VAS pain score of 1.75 and SF-36 physical component scores within the normal range for the US population.

Bleeding and pelvic fractures: is it arterial?

Pelvic fractures are one of the few diagnoses in orthopaedics that can sometimes constitute a life threatening emergency. The bleeding from a severe pelvic fracture can be torrential and potentially fatal. The nature of trauma of this type is that finding the source of bleeding can be difficult, and with around a third of trauma deaths from haemorrhage due to pelvic bleeding, there may not be time to deliberate. Most major trauma centres have mature and carefully developed protocols for managing the bleeding pelvis which are designed to maximise the patient's chances of survival. The difficulties all these protocols face is that arterial bleeding is best managed with interventional radiology, whereas bleeding from fracture ends or venous bleeding is better managed in other ways (either with stabilisation, a binder or packing). Surgeons in **Newcastle (Australia)** have conducted one of the few prospective studies aimed at helping to pick out those patients who have sustained an arterial injury associated with their pelvic fracture.[8] This prospective cohort study reported a three-year period of consecutive pelvic fractures occurring in 143 patients, of whom just 10% (n = 15 patients) had sustained an arterial bleed. Patients were managed using both ATLS principles and institutional guidelines and the data collated included demographics, injury mechanisms, patients' vital signs and details of their accidents and associated injuries. The study team initially identified potential predictors of arterial haemorrhage using standard statistical testing and then used a decision tree analysis to establish the best possible predictors of arterial injury. The basic univariate analysis established that patients tended to be older, hypotensive, more severely injured and acidotic. Unsurprisingly, patients were also likely to require transfusions in the resuscitation room. While there was no single factor that was successfully able to predict haemorrhage from arterial bleeding in the pelvis, the useful predictors in this study were an increased base deficit (< 6 mmol/l), requirement for transfusion in ED and a systolic BP of < 104 mm Hg. While this paper promised much with a large series of patients, all of them with pelvic fractures, it fails to deliver a clear message, other than that haemodynamically unstable patients are more likely to have ongoing haemorrhage. The message is simply that sicker patients are more likely to be bleeding.

Optimising timing for acetabular fractures

Operative fixation of acetabular fractures can be complex and there is a general view that these should be done expediently (but not urgently) to minimise complications and the difficulty of surgery. The BOAST guidelines in the UK recommend surgery within five days of injury, although the evidence for this guideline is a little thin on the ground. Researchers from **Cincinnati (USA)** set out to establish what the optimum timing of acetabular fixation might be.[9] Their study used the results of 288 patients studied in a retrospective manner with the outcomes of blood loss and operative time to establish if indeed surgery becomes more difficult with increasing preoperative delay. The research team divided this large group of patients into early and late fixations, and limited the included fracture patterns to posterior wall, associated both columns and anterior column hemi-transverse. Data on operative approach, timing, blood loss and hospital length of stay were collated from the patient records and used as surrogate outcome measures for operative difficulty. Analysis was undertaken by timing of surgery (early being less than 48 hours) as well as stratification by approach and fracture pattern. In terms of the approaches and types of fracture, the research team identified that estimated blood loss was reduced (800 mls vs 400mls), operative time was reduced (270 vs 154 mls) and length of hospital stay was reduced (11 vs 7 days), with the anterior approaches (associated both columns and anterior column posterior hemi-transverse) performing more poorly than the Kocher-Langenbeck approaches. In terms of timings of surgery, there were no differences between the two groups for posterior wall fractures in terms of blood loss (400 mls vs 400 mls) or operative times (150 mins vs 156 mins). There was a similar finding in the anterior approach group with no differences between early and late fixation in terms of blood loss (725 mls vs 800 mls) or operative time (258 mins vs 272 mins).

Tibial plateau fractures: the transfibular approach

x-ref Knee

The more modern approaches to treating fractures of the tibial plateau recognise the importance of treating posterior shear fractures of both the medial and lateral plateau. They are not treated well by traditional anterior approaches and gaining purchase with fine wire frames is unlikely to be achievable as the safe corridors around the knee do not allow passage of fine

wires across the posterior portion of the knee. It has become commonplace for patients to be treated for posteromedial fractures with a medial approach. However, there is disagreement among experts as to how best to manage posterolateral fractures. The surgical team in **Chongqing (China)** presenting this study are proponents of fixation with a fibular osteotomy for posterior-lateral fibular fractures to provide access to the posterolateral corner without endangering the neurovascular structures around the knee.[10] The team present their retrospective case review of 32 patients who underwent fixation of a posterolateral tibial plateau fracture over a four-year period with outcomes assessed using radiographic and functional outcomes (Rasmussen score). Outcomes were available to a mean of 18 months, with the majority of patients achieving an excellent functional outcome. The mean Rasmussen score was 24.8 post-operatively, with 19 achieving excellent results (> 27 points), 11 good results (20 to 26 points) and two a fair result (10 to 19 points). Impressively in this series of over 30 patients, there were no reports of infections, loosening or implant fracture. There were no cases of nonunion, deformity or fracture slippage, and just a single patient suffered from a common peroneal nerve injury that spontaneously recovered after two months of conservative treatment. This series proves the point that these fractures can be treated with a posterolateral approach including fibular osteotomy with acceptable short-term results. The low rate of common peroneal nerve palsies seen in this series is encouraging.

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