ROUNDUP360

Trauma

For other Roundups in this issue that cross-reference with Trauma see: Foot & Ankle Roundups 1, 2, 6 & 7; Wrist & Hand Roundup 7; Shoulder & Elbow Roundup 4; and Research Roundups 1, 2 & 6.

Reverse oblique fractures do better with a cephalomedullary device

For such a common injury, a surprising number of controversies remain surrounding the treatment of hip fractures. For a number of years one such controversy has been the selection of implant for treatment of the reverse oblique and transverse sub-trochanteric fracture. While on one side of the argument numerous biomechanical and modelling studies suggest a cephalomedullary device provides potentially better stability, on the other side there have been no clinical studies demonstrating this to be the case. Given the relatively low frequency of the reverse oblique fracture pattern (around 5% of all hip fractures), it is unsurprising that there has been, up to this point, little robust clinical data with enough patients included to draw conclusions about this group. The plucky Norwegians in **Bergen (Norway)**, however, have sprung yet again into action with an analysis from their inclusive national hip fracture registry. Noting that both the cephalomedullary nails and sliding hip screws are commonly used for AO type A3 fractures (transverse or reverse oblique), the researchers posed the question: does a sliding hip screw (SHS) or cephalomedullary device (IM) have a higher failure rate in AO type 3.A3 fractures? The study team were able to identify 2716 operations on patients meeting the inclusion criteria operated over a five-year period between 2005 and 2010. They also included (unusually for a registry study) patient reported outcomes (pain, satisfaction and quality of life scores). Re-operation rates were recorded and Kaplan-Meier analyses used to allow for loss to follow-up and different follow-up periods. Follow-up was undertaken at regular intervals until 36 months following surgery. Despite this being essentially a large cohort series, there were no differences in baseline characteristics (age, gender, ASA grade and EQ5D baseline). At one-year follow-up significantly higher re-operation rates (nearly double) were seen in the SHS group *versus* the IM group (6.4% *versus* 3.8%). These results were also reflected in higher pain scores and lower satisfaction scores in the SHS group. There were, however, no significant differences in EQ5D scores at one year following surgery.[1] There is now conclusive biomechanical and clinical data to suggest that selection of an SHS type device would risk an adverse outcome in patients who sustain a transverse sub-trochantic fracture or reverse obliquity. Given the results of this study, we would venture that patients should be offered operative intervention with an IM device when sustaining one of these injuries.

Locking screws confer no advantage in tibial plateau fractures

In the early days of modern fracture fixation, the 'AO rules' were quite clear and a simple step-by-step approach to fixing each fracture was widely accepted. In the case of a split depression fracture of the tibial plateau the 'standard recipe' was to elevate and graft the depressed fragment followed by a compression screw and a buttress plate with a raft of screws. With the development of newer locked screw fixation, things have become a little more fuzzy. The benefit of locked screws in providing a stable construct is beyond doubt. However, the role of compression and standard screws either through the plate or outside of the plate is more difficult to assess. Researchers from the Mayo Clinic, **Rochester (USA)** have taken this forward and designed a cadaveric study with the stated aims of "evaluating the relative stability yielded by screws placed above a lateral plate, as well as locking and non-locking screws placed through a plate in a split depression tibia plateau fracture model". The study team selected a cadaveric model of a split depressed lateral plateau fracture. Following generation of a standardised fracture pattern, the cadavers were randomised to one of three groups: 1. Raft of screws outside the plate, 2. Standard raft screws through the plate, and finally 3. Locking raft screws through the plate. Stability was assessed by measuring displacement of the depressed fracture fragments under cyclical load cycles up to 1600N. Interestingly, there were no significant differences between any of the groups with any measures tested. However, despite this lack of statistically significant difference, the authors do draw some conclusions. It is difficult for us to say, here at *360*, if these are valid or not; who knows if the lack of significance is due to a type II error (too small a sample size) or if indeed there are no significant differences. The authors conclude that there is no significant difference in resistance to displacement with locked *versus* non-locked screws, which their data would support. They also conclude that screws outside of the plate provide less stability than the 'through the plate' constructs.[2] Whilst this is in line with conventional wisdom, we are certainly a little worried here at *360* that this conclusion has been reached with only a 'trend'. It is certainly heartening to see that a raft of compression screws provides comparable stability to locking screws, as in many more complex fracture configurations compression screws are an important supplement to the buttress plate to achieve anatomical reduction.

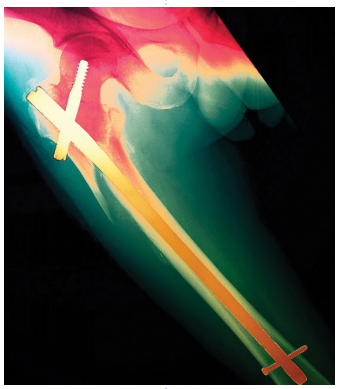
It's all about the radius of curvature

Treatment of extracapsular fractured neck of femur fractures is almost a matter of religion. Some surgical units zealously implant intramedullary nails, believing a smaller exposure and more favourable biomechanics are benefiting their patients more than those teams

using sliding hip screws for their ease of insertion and potential for lower post-operative complications. Much like opposing religious views, both camps interpret the evidence slightly differently; however, everyone is in agreement that fracture at the tip of the nail can be a problem. Periprosthetic fracture and anterior cortical perforation are problems that are exacerbated by ill-fitting nails. Researchers in **Fort Worth (USA)** have taken advantage of a change in implant usage in their institution to perform a retrospective comparative cohort study (Level III evidence) examining the implant positioning in hip fracture patients treated with either 150 cm or 200 cm radius of curvature nails. While retrospective and therefore not case-matched, the research team were able to recruit 58 patients with a single nailing system both before and after transition from a 200 cm (n = 26 patients) and 150 cm (n = 32) radius of curvature system. Patient records and radiographs were assessed for both primary and secondary outcomes. The investigators assessed the position in the AP plane of the nail tip as the primary outcome measure and complications including cortical abutment, perforation or periprosthetic fracture as secondary outcomes. The researchers identified that nails with the smaller radius of curvature were in general positioned significantly closer to the mid-axial line than those with a higher radius of curvature. There were three nails in the 200 cm radius of curvature group where the tip abutted the cortex (one associated with a fracture) as opposed to just one in the 150 cm cohort.[3] While this is a simple study with a simple design and methodology, it competently answers a simple question. Using a nail with identical geometry and instrumentation in 150 cm and 200 cm variants, the authors have competently demonstrated that better positioning in the elderly femur can be achieved with a smaller radius of curvature. Here at 360 this has, however, caused us to pause for thought. The increasing radius of curvature has occurred as these implants have been used more and more in the elderly population whose femoral geometry changes as part of the ageing and osteopenic process. With a small radius of curvature will the counter problem be seen in younger male patients with posterior cortical abutment and perforation? Time we guess will tell.

Radius of curvature revisited

In the second paper this month examining the effects of radius of curvature on percutaneous intramedullary nailing, researchers in **New York (USA)** report their experience with a new 'anatomically' designed long intramedullary nail. Although a less informative study design (retrospective case series – Level IV evidence), these researchers have been able to include a larger number of 271 patients in their paper. Sadly, only 212 of these patients (214 IM nails) were available for analysis due to incomplete radiological records. They used a 180 cm radius of curvature implant and achieved remarkably similar results with a perforation rate of < 0.5% and just over 15% of implants overly close to the anterior cortex.[4] Both papers highlight the risks of anterior cortical perforation, and although newer smaller radius of curvature nails are designed to reduce the problem, there are still risks of perforation. We can't help wondering if at least part of the problem isn't with the entry point: a combination of entry point and isthmic fit determines the position of the nail tip within the distal femur.



Radial head replacement in complex elbow reconstruction

Management of complex elbow instability with associated fracture can be one of the most challenging surgeries for any traumatologist to undertake. The radial head plays a role as a secondary stabiliser to valgus stress and becomes particularly important when either the anterior band of the medial collateral ligament is ruptured or the coranoid is fractured. This combination of injuries is classically seen in a forced valgus stress on a fully supinated forearm, causing a pilon of the radial head or capitellar fracture. Reconstruction of the radial head is essential in this circumstance, but there is considerable debate about when it is appropriate to reconstruct (risking considerable stiffness) and when appropriate to replace (risking elbow imbalance). While not pretending to answer all of these questions, a research team in **Tanta (Egypt)** has decided to share their results of using a modular anatomic radial head replacement combined with ligament repair and fracture fixation in these challenging situations. The study team were able to report the results of a cohort of 12 patients treated in this way. In this series all patients presented with traumatic elbow instability in combination with an unreconstructable Mason type III radial head fracture. Patients were followed-up post-operatively with radiographs and clinical scores (Mayo elbow performance score and DASH score) to a mean of 42 months.[5] The patients in this series did impressively well, with apparent complete restoration of stability in all patients and a reported similar range of movement between operated and non-operated side with all good or excellent results on the Mayo elbow performance score. This represents an excellent series of outcomes for what can be a difficult injury to treat, and we are impressed with the results this group have been able to achieve through the use of a modular prosthesis to allow for accurate restoration of the joint surface.

Stem cells in early fracture haematoma

It is widely accepted that early fracture haematoma plays an important role in fracture healing and has always been described as the 'first stage' in healing. Traditional wisdom describes a mêlée of inflammatory markers, chemokines and growth factors, but pays little attention to the potential function of stem cells, which have recently been demonstrated (as mesenchymal progenitor cells) to be present in the early haematoma. Researchers in **Kobe (Japan)** theorised that this supply of chondrogenic cells may play a key role in later endochondral ossification during haematoma organisation, and that preservation of these cells should contribute to fracture healing. To test this hypothesis, the research team set about designing an *in vitro* matrix study to establish whether haematoma-derived cells (HCs) could differentiate into hypertrophic chondrocytes and thereby function to cause calcification of the extracellular matrix *in vitro*. The research team obtained haematoma from four patients and cultured HCs over a five-week period, using rtPCR to establish gene expression levels of chondrogenic, hypertrophic, osteogenic, and angiogenic genes. The results are suggestive that haematoma cells can differentiate into chondrocytes and then function to calcify extracellular matrix. Serial gene expression profiles were also reflective of a stepwise discrete differentiation and then calcification activity of the stem cells. Once cartilage production had started, high levels of osteogenic and angiogenic gene expression were seen, particularly after hypertrophic induction which mimics the changes seen during fracture healing.[6] There is still much for us to understand about fracture healing, how it works and

why it sometimes doesn't. This paper makes a valid point: cells are required for healing. We did, however, find ourselves scratching our heads a little here. The authors have eloquently proven that mesenchymal stem cells in fracture haematoma have the ability in cell culture to make bone. This is in itself a novel, but not a groundbreaking, observation. Mesenchymal stem cells are known to be able to respond to the environment around them. What we really want to know is how do they respond to the microstrain environment, and is there anything special about the cells in the haematoma or will any stem cells do? We can't help thinking that the authors here have got a little carried away with the basic science and lost focus on the clinically relevant question. We have never seen a fracture fail to heal due to lack of haematoma.

Heterotrophic ossification in forearms

■ Heterotrophic ossification (HO) is a rare but potentially significant problem following fracture surgery. Little, however, is known about the prevalence or risk fractures in the forearm where HO can be a particular problem as the addition of fracture callus to the intimate relationship between the pronating radius and ulna can cause stiffness, pain and even neurological symptoms. A study team in **Rochester (USA)** set out to answer these questions, and to characterise the severity of any heterotrophic ossification seen in their series of fractures and fracture dislocations of the proximal radius and ulna. This retrospective study included 142 elbow fractures and associated dislocations treated over a four-year period and retrospective follow-up was sufficiently complete and available for 130 such injuries. The research team identified heterotopic bone in just over a third of cases (n = 47), significant enough to cause a restriction in range of movement half the time (20% of the total series). In 10% of cases (n = 13) this caused significant enough restriction to warrant further surgery. A number of factors were found to be associated with poorer outcomes; injury type (with subluxations, dislocations and open fractures associated with a higher risk of HO), and timing of surgery (severe chest injury and delayed surgery) had a profound effect on the likelihood of ectopic bone formation, and in the majority of cases this formed at detached soft-tissue structures surrounding fracture sites. Of those patients who developed HO, this was immature in 46% (n = 22), and mature in 54% (limited n = 18, extensive n = 5, synostosis n = 3).[7] This definitive series carefully characterises the risks for, and severity of, complications associated with fracture dislocations of the proximal forearm. We applaud the authors.

Boston in perspective

■ Finally this month we would encourage all our readers to read the two perspective articles (free full text access) published in the *New England Journal of Medicine*. Both are responses, in a general sense[8] and on a personal level,[9] to the services that medical response teams were able to provide in the wake of the marathon bombings in **Boston (USA)**. They look at the general preparedness of the medical services responding to the emergency and the difficulties that an individual practitioner (who is in fact very unlikely to be a traumatologist) faces at the scene. We found these both an interesting, sombering and thought provoking read.

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