

X-ref For other Roundups in this issue that cross-reference with Trauma see: *Hip & Pelvis Roundups 1, 3 & 4; Foot & Ankle Roundups 1, 2 & 3; Wrist & Hand Roundups 1 & 3; Shoulder & Elbow Roundup 8; Children's orthopaedics Roundup 5; Research Roundup 2.*

Hip fractures and postoperative weight-bearing restrictions **X-ref**

■ It has now long been held that early mobilization following hip fracture fixation is essential to reduce the risks from venous thromboembolism, pneumonia, urinary tract infections, and pressure ulcers. Restricting an elderly patient's weight-bearing status may lead to a period of immobilization with bed rest, which is associated with poor function at two months and also has a deleterious effect on patients' six-month survival. Weight-bearing restrictions for patients with lower limb fractures have been advocated due to fear that this will put the fracture fixation at risk if the osteosynthesis construct is loaded too early. However, these precautions are subjective. With the increasing incidence of lower limb fractures due to the ageing population, a comprehensive understanding of postoperative mobilization in the elderly patient is essential. This study from **Munich (Germany)** reported the ability of younger patients (18 to 40 years) treated with ankle fractures *versus* elderly patients (≥ 75 years) treated for a hip fracture (trochanteric hip fracture treated with an intramedullary nail device) to protect their weight-bearing.¹ Patients were instructed to comply with a partial weight-bearing (≤ 20 kg) protocol of the affected limb; a physiotherapy session gait analysis with weight-bearing analysis was performed when the patient was asked to walk a distance of 40 metres. From the gait analysis, it was apparent that none of the patients in

the elderly test group was able to perform partial weight-bearing for the full distance; 69% of the patients reviewed exceeded the specified load by more than two-fold. In the younger patient group, 56% of the patients were able to meet the partial load requirement and a further 22% exceeded the partial load only slightly (< 24 kg). Reduced mobility in the elderly is a significant problem, both for the patient and society as a whole, as it can significantly affect quality of life and lead to loss of independence, requiring additional social care input. There is now a considerable body of evidence supporting early mobilization in elderly patients to reduce the risk of medical complications, increase muscle bulk, and provide an improved feeling of well-being. It has been relatively common practice for surgeons to recommend 'partial weight-bearing' following hip fracture fixation. This has been thought to be far better than 'bed rest', although it is apparent from this study, and others, that 'partial weight-bearing' doesn't really exist in the elderly. Whilst revision surgery is to be avoided, as it is associated with poor outcomes, this should not be at the expense of allowing patients to fully weight-bear. The message here is that, whatever is done for a hip fracture, patients should be able to fully weight-bear at the end of it all.

Acetabular fracture surgery: mind the step **X-ref**

■ The authors of this study from **New York, New York (USA)** examined the relationship between articular gap or step displacement and hip survivorship following open reduction internal fixation (ORIF) of an acetabular fracture, as well as determining the independent association between these factors and conversion to total hip arthroplasty (THA).² The hip itself is a very constrained, congruent joint and the

prevailing principle is that in acetabular fracture surgery, 'anatomical' is a binary concept. These authors have taken a slightly different approach. They have evaluated the evidence for mal-reduction and outcomes, and their paper makes for interesting reading. The article itself is a report of 227 patients with acetabular fractures, a follow-up of two or more years, and a postoperative CT scan available following acetabular fracture ORIF. The authors investigated the quality of reduction; residual gap and step displacement were measured using a standard CT-based method, with the assessors blinded to the patient's outcome. Overall, 24.2% of the patients (55/227) eventually underwent a conversion to THA within the observational period of the study, at a mean follow-up of 8.7 years. The critical CT cut-off value for prediction of eventual THA conversion was 5 mm for residual gap and 1 mm for step displacement. The overall hip survivorship at ten years was 82.0% for patients with a gap of < 5 mm compared with 56.5% for patients with a gap of ≥ 5 mm. Hip survivorship was 80.0% for patients with a step of < 1 mm *versus* 65.5% for patients with a step of ≥ 1 mm. The investigators found that a gap of ≥ 5 mm and an age of ≥ 50 years were independently associated with conversion to total hip arthroplasty. Whilst both residual gap and step displacement are related to long-term hip survivorship, step displacement of only 1 mm is tolerated less than gap displacements of up to 5 mm. It seems that the hip doesn't mind the gap as much as it minds the step.

Early reoperation after operative treatment of acetabular fractures

■ In the second paper on acetabular fractures in this issue of 360, a group from **Baltimore, Maryland (USA)** have turned their attention to the risk factors for early reoperation.³

Rather than focusing on the quality of reduction and the longer-term risk of conversion to a total hip arthroplasty (THA), this paper deals with the causes of early secondary intervention. In one of the largest series of its kind, comprising 791 patients with displaced acetabular fractures, the authors examined risk factors that might be associated with early reoperation following operative fixation of the acetabulum. For the purposes of their study, they defined early reintervention as further operation occurring within three months, with the intention of capturing early infections, metalwork failure, and early conversion to THA. In their series, 7% of patients ($n=56$) underwent debridement and washout of an acutely infected fixation or wound complications. Risk factors for this complication, in this series, included length of stay in the intensive care unit, having had a pelvic embolization, increased operative time, and time delay between injury and surgical fixation. Whilst some of these factors are self-evident or have been previously identified, supporting these previous findings in a large series is important. Some risk factors are clearly modifiable, such as operative time and timings to surgery, whilst others, such as pelvic embolization, may not be. The message should perhaps be that patients who are likely to have a prolonged stay in the intensive care unit, and who have required pelvic embolization, should be emergently operated on by an experienced, high-volume acetabular surgeon in order to minimize complications. Of the 8% of patients ($n=62$) who underwent early revision surgery, the majority were revised to an arthroplasty ($n=45$), whilst ten patients underwent early revision fixation for loss of reduction and six patients underwent removal of metalwork for likely joint penetration. Revision was more likely with hip dislocation,

articular comminution, femoral head or neck fracture, and advancing age.

Quantitative histology and fracture-related infection

X-ref

■ The treatment of fracture nonunion is a complex and often tertiary referral problem. Whilst there are many reasons why a fracture might not heal, infection is in the forefront of every specialist surgeon's mind when evaluating the patient with a nonunion. There are some cases in which the presence of infection is obvious – such as the presence of 'halos' around the screws on radiographs. However, in most cases, the diagnosis is trickier than this, with patients sometimes heading for surgery without infection entirely excluded. The question of how best to investigate and include/exclude infection, either intraoperatively or during the perioperative period, then still remains. It is commonplace for surgeons to send cultures, and these have been supplemented with the use of quantitative polymerase chain reaction (qPCR) in recent years to detect bacterial ribosomal DNA. An additional investigation that has been gaining some traction recently is the use of quantitative histology. There is little evidence for or against this investigation, and the diagnostic accuracy is far from known. We were delighted to come across this multi-centre study originating in **Oxford (UK)**, which aims to describe the role of quantitative histological analysis in the diagnosis of fracture-related infection.⁴ The study centres on the results of over 150 patients, all with surgically treated nonunions. In this retrospective analysis, the authors collated the clinical features, microbiology culture results, and histological analysis of all 156 surgically treated nonunions with the aim of stratifying the risks of associated infection based on the results. Within their cohort, they had 64 patients with confirmed infections (defined as pus, sinus, and bacterial growth in two or more samples), 26 possibly infected nonunions (single



culture positive and no confirmatory criteria), and 66 simple 'aseptic' nonunions. In addition to the microbiology and clinical results, the most interesting part of this study is the inclusion of quantitative histology with neutrophil polymorph counts per high-power field (NPs/HPF). The authors established that histology can be used in a bimodal fashion as a diagnostic test for fracture-related infections. The presence of more than five NPs/HPF had a positive predictive value for infected nonunion of 100%, whilst the complete absence of any NPs is almost always indicative of an aseptic nonunion (positive predictive value of 98%). Histology is available in every hospital undertaking surgery, and this is a simple microscopy technique that can be used to either 'rule in' or 'rule out' infection relatively easily. It would seem a simple thing for centres not yet using quantitative histology to start adding it to their battery of tests undertaken at the time of surgery.

Single- versus double-column fixation in transverse fractures of the acetabulum

■ There are precious few randomized trials in trauma, let alone in rarer diagnoses such as acetabular fractures. Whilst there are some obvious methodological problems with this study from **Cairo (Egypt)**, which involves just 30 patients and is therefore clearly underpowered, it is notable for its inclusion only of patients with a double-column acetabular fracture.⁵ These patients were randomized

to receive either a single-column fixation (posterior) or a posterior column plating with an additional anterior column screw. The authors aimed to establish which approach was superior in the treatment of patients with a transverse fracture of the acetabulum, either with or without a posterior wall element. Outcomes were assessed using the Matta radiological criteria, roof arc angle, and femoral head offset. The patients had a variable follow-up period, with a mean follow-up of 19 months (minimum 12 months). In terms of initial treatment, the authors identified no differences in the quality of postoperative reduction, blood loss, and hospital stay. They were unable to establish any differences in functional scores (Merle d'Aubigné–Postel score). However, there was a difference in operative timing, as would be expected, with the double-column fixation group taking significantly longer on average (130 minutes vs 104 minutes). Despite the robust radiological outcome measures, there were no differences seen in terms of loss of reduction observed in the two groups. This trial is worthy of mention, given the difficulties in achieving such a study in a rare diagnosis, as well as the logistical issues associated with recruiting and randomizing patients to a complex intervention. Nevertheless, here at 360, we can't help but view this trial as a pilot study demonstrating that this can be achieved. Not every transverse fracture is suitable for an anterior column screw, and nor is every fracture suitable for posterior fixation alone. The small numbers of patients reported here essentially make any 'negative' finding irrelevant, as the effect size it is powered to detect is extremely large and it is unlikely that any differences will be seen, clinically relevant or otherwise.

Treatment of type B and C pelvic fractures

■ The method of treatment for unstable pelvic fractures that involve the obturator ring is still very much

a matter for debate. In the absence of any robust trial data, large case series have become the mainstay of research to underpin clinical decision making. However, there are now some large trauma registries that include high-quality information on patient diagnoses, allowing certain inferences to be drawn from their results. We were delighted to see this article from **Freiburg (Germany)** that reports on the outcomes of type B and type C pelvic fractures.⁶ The authors compared patients undergoing conservative management and surgical treatment, including posterior stabilization alone with isolated posterior osteosynthesis, anterior fixation, and combined fixation. The series consisted of 3739 fractures, including 2394 conservatively managed patients and 1345 patients who underwent surgical treatment. The authors undertook an evaluation of outcomes, including adjustment for recorded confounders. According to their analysis, operative stabilization reduced mortality by 36% but doubled the observed incidence of complications. Interestingly, there were no differences in mortality and the incidence of neurological deficits at discharge between isolated posterior or combined anteroposterior fixation. However, the odds of surgical and general complications were over twice as high in the group with the more extensive surgery. This observational series confirms the benefits of what has become standard practice in the majority of centres, in terms of open reduction and internal fixation of patients with unstable pelvic fractures. The assessment of complications is useful in that it addresses the question of risks and benefits in those patients with stable injuries, who would run the risk of a significant increase in major complications if surgery were undertaken for social or convenience reasons.

Plasma during air medical transport

■ There have been great strides made over the last 40 years in improving outcomes for the severely

injured, thanks in part to the rationalization of trauma services, addition of transfer protocols, formal recognition of levels of trauma care, and nationalized and regionalized models of care. The prospects for the average trauma victim injured and managed within a modern trauma network are many times better than they would have been in previous decades, and are also better than they would be outside of a formalized trauma network. The formalization of these networks and coordination between Helimed and trauma centres have also allowed for changes in front-line care. One of these changes, pre-hospital plasma resuscitation, is the focus of this randomized trial led by researchers in **Pittsburgh, Pennsylvania (USA)**.⁷ The authors trialled their standard resuscitation protocol against the addition of pre-hospital administration of thawed plasma. This was a safety-and-efficacy trial that included injured patients who were at risk of haemorrhagic shock. The trial reports on the outcomes of 501 patients, of whom 230 patients received plasma and 271 received standard care. The primary outcome was mortality at 30 days, as the trial was designed to assess the effects of early plasma administration on downstream haemorrhage. In terms of the primary outcome measure, there was a superior rate of survival in the plasma group (33.0% vs 23.2% in the standard-care group); this was also seen in the nine pre-specified subgroups. When explored with Kaplan–Meier analysis, the treatment effect appeared to begin at three hours post-injury, and was maintained until the 30-day follow-up. In

terms of possible explanations for the observed effect, there was a lower average prothrombin-time ratio (1.2 vs 1.3) in the intervention group. There are no significant differences in the other common causes of death or expected serious adverse events with regard to multi-organ failure, acute lung injury and acute respiratory distress syndrome, nosocomial infections, or allergic or transfusion-related reactions. Quicker blood products in haemorrhagic shock leads to reduced mortality. Whilst there are some potential difficulties with access and logistics here, early access to blood ambulances or helicopters would seem to be a sensible approach where possible. The study was funded by the military, which makes it clear where one application of this protocol will be.

Discharged but not dissatisfied: the Edinburgh Trauma Triage Clinic

■ In state-funded systems and those with bundled payments, there is an incentive to reduce the number of patients moving through clinics, whilst in other systems there may be incentive to keep the number of patients high for funding reasons. In some parts of the world, telemedicine, Skype consultations, and other types of ‘virtual’ clinic have become very fashionable, whereas in others, triage approaches have become very common. In one of the few papers looking at these changes in detail, the **Edinburgh (UK)** trauma service report on how their changes in protocol were effective in streamlining the clinic experience for their patients.⁸ The Edinburgh

approach involves the implementation of consultant-led ‘virtual’ triage of referrals combined with the direct discharge of minor fractures from the Emergency Department. The authors then compared the patient outcomes for simple fractures of the radial head, little finger metacarpal, and fifth metatarsal before and after the implementation of the Edinburgh Trauma Triage Clinic (TTC). The authors report on a consecutive series of 628 patients, all of whom had sustained these simple upper limb injuries over a one-year period. Two patients were subsequently excluded due to death and incarceration, respectively. During the study period, there were 337 patients in the pre-TTC group and 289 in the post-TTC group. This paper reports on the clinical scores in terms of Disabilities of the Arm, Shoulder and Hand Score (QuickDASH) or Foot and Ankle Disability Index (FADI), EuroQoL-5D (EQ-5D), visual analogue scale (VAS) pain score, satisfaction rates, and return to work/sport at six months post-injury. The patients were not directly seen; however, their electronic records were evaluated at three years post-injury in an attempt to exclude late complication. A cost analysis was performed. Overall, patient-reported outcomes were equivalent between the two groups, although at three years, the pre-TTC group required a total of 496 fracture clinic appointments compared with 61 in the post-TTC group. Mean cost per patient was nearly four times less after the commencement of the TTC. There is certainly some food for thought here, and appropriate use of expensive resources (such as

face-to-face fracture clinic time) is clearly important. It is worth noting that the system reported on here is an enhanced triage rather than a ‘telephone clinic’ approach, and that data related to the former should not be used to support the implementation of the latter.

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Oncology

Limb-sparing resection in pelvic sarcoma: where are we?

■ The treatment of pelvic sarcoma is one of the most difficult in the

orthopaedic oncology world. In other areas of oncology, the development of limb-sparing techniques with megaprosthesis, vascularized autograft, or allograft has

transformed the functional outcomes with similar overall and disease-free survival rates to amputation. However, it is not entirely clear where the orthopaedic literature stands

regarding treatment of pelvic sarcoma and the role, if there is any, of limb-sparing surgery. This systematic review from **Nashville, Tennessee (USA)** sets out to establish more