

# ROUNDUP<sup>360</sup>

## Trauma

### Negative pressure wound therapy in open tibial fractures

■ Perhaps one of the most devastating injuries on the orthopaedic spectrum, the open tibial fracture is a highly significant injury. While many injuries heal without complication, for those patients who develop either compartment syndrome or infection, this can result in severe functional disability, many years of operating or even amputation. The long-term sequelae of these injuries are clearly dependent on a number of factors such as the pattern of injury, patient factors and contamination. However, although sometimes difficult to accept as surgeons, initial surgical treatment has a large effect on complications and eventual long-term outcomes. Inadequate debridement or inexpert surgery results in poorer outcomes and can predispose to infection. One area that has been of much interest, although there is yet to be a definitive answer on its utility, is that of negative pressure wound therapy (NPWT) in the treatment of these injuries. Although widely adopted, the evidence base for its use is far from conclusive. A review team in **Atlanta (USA)** set out to see precisely what the evidence was pertaining to the management of Grade IIIB open tibial fractures.<sup>1</sup> They conducted an extensive review and meta-analysis of papers reporting outcomes of open tibial fracture treated either with standard dressings or NPWT. The study team sought to establish whether NPWT had a beneficial effect

on infection rates, the safety of flap treatment after 72 hours, and crucially, whether its use was associated with a lower requirement for local or free flap treatment. Their study included extensive searching of six large databases where they were able to identify just a single randomised controlled trial and 12 retrospective studies that yielded useful data. The retrospective studies compared infection rates (four studies), extended use (ten studies) and effects on flap coverage with use beyond 72 hours (six studies). While the opportunities for meta-analysis were limited due to the usual problems of heterogeneity in the data, lack of randomised studies and reporting biases, there were decreased or equivalent infection rates seen in three of four studies, with a final study favouring standard dressings. The answer was slightly clearer with regard to use beyond 72 hours, with the vast majority of studies (n=8/10) reporting no increase in infection rates associated with negative pressure wound therapy beyond this time point. There were, however, wildly differing event rates reported, with infection rates varying from 0% to 57%. The review team addressed the question of requirement for flap rates using historical control data, and report decreases in the requirement for extensive soft-tissue reconstruction: from 60% to 13% when compared with historical controls. We would wholeheartedly agree here at 360, with the authors' conclusions that there is accumulating evidence that

the use of negative pressure wound therapy in open tibial fractures is potentially useful. The authors of this review address the three most clinically relevant questions. The WOLFF NIHR-funded, randomised controlled trial is actively recruiting at multiple centres in the UK at present and will likely report in around 18 months' time. This will definitively answer the questions surrounding infection rates, although more work is likely required to establish the effects on later flap treatment.

### Priority-driven approach to pelvic injuries

#### x-ref Research

■ The management of patients with high energy pelvic injuries can be very challenging and it can be difficult to make correct decisions surrounding resuscitation under pressure. Use of a simple priority-driven approach (as taught by the ATLS course) can simplify decision making, particularly for inexperienced or junior doctors under pressure. Researchers in **London (UK)** set out to establish the benefit of such a priority-driven approach using a simple ABC mnemonic in simulated patient scenarios. They performed a comparative cohort study in two groups undergoing pelvic training.<sup>2</sup> One group was taught the ABC aide memoire and the other was not. The research team directly compared the performance of the two groups of orthopaedic trainees, six weeks following a pelvic trauma teaching session. The teaching session itself was identical, but trainees were randomised into either a group

with an introduction to the ABC algorithm or not, prior to the pelvic specific trauma. Outcomes were assessed with three different scenarios and all 20 trainees undertook each scenario. There were no differences in baseline demographics between the two groups. However, there were significant differences in candidate performance between the two groups at six weeks. Those who were taught the ABC concept performed better in their assessment of coagulopathy, urological injury assessment, prioritisation and bowel injury/open fracture assessment. This simple priority-driven approach helped trainees significantly in their assessment and treatment of simulated pelvic injuries, and these benefits were seen to continue for six weeks following training. Human factors, problem solving and algorithms to provide appropriate decision making under pressure can have a big impact on patient care, and is an area that has been somewhat ignored in the past.

### Early surgery essential in hip fracture management

#### x-ref Hip

■ It has always been intuitively accepted that delay to surgery for hip fracture patients is essentially a bad thing; the difficulty has always been proving it. Although national guidance in many countries advocates early surgery for patients with hip fracture, there are few studies to support a specific time threshold, or that demonstrate a conclusive survival or complication benefit. Of course the major reason for this is

the confounding factor of selection bias – those most likely to receive early surgery are the fitter patients. High-quality observational data or, even better, a large randomised study, would be required to establish any potential benefit definitively. The **Peterborough Hip Fracture Unit (UK)** has kept observational records of their patients for some time, with many of them taking part in various randomised studies. The database now extends to over 6500 patients. Setting out to establish if early surgery, even when accounting for confounders, really does confer a survival benefit, these investigators designed a retrospective comparative cohort study.<sup>3</sup> Patients were divided into groups according to the time interval from admission to treatment. The study team adjusted for confounders using multivariate logistic regression analysis and assessed outcomes in terms of 30-day mortality to establish if a survival benefit is conferred with earlier surgery. In total they were able to analyse the outcomes of 6638 patients and adjusted for potential confounders using a multivariate binary logistic regression analysis. In their analysis, there were poorer outcomes for patients sustaining extra-capsular fractures, with worsening ASA score and increasing age. Conversely, patients with improved mobility, female gender and increasing mini-mental test scores had improved survival. Having adjusted for these confounders, there was still a marked survival benefit conveyed by earlier surgery. Patients undergoing surgery within the first 12 hours performed significantly better to those who waited longer than this. It is always difficult to understand the significance of ‘threshold’ analysis such as this, where large cohorts of patients are broken up into comparative groups, thus treating a continuous variable (time) as a discrete outcome. Whilst it is heartening to see that earlier surgery does improve outcome at 30 days, there are still some unanswered questions in our minds here at 360

HQ. Is this simply another form of reported selected bias? Whilst adjustment for comorbidities does help to correct for this, are the patients who were delayed those that needed medical interventions (such as those with pneumonia) and who were therefore bound to do worse in the first instance? An interesting paper, but we can’t help feeling there is still more work to be done.

### **Shear fractures to the posteromedial plateau** **x-ref Knee**

■ One of the fundamental changes to the management of trauma in recent years

has been the move towards operative fixation as the primary management strategy for posteromedial shear fractures of the tibial plateau.

The presence of such fractures to many surgeons now represents an absolute indication for fixation, often through a posteromedial approach that allows placement of a posterior or posteromedial plate. As with many sea changes in clinical practice, there is always the risk that the pendulum may swing too far. Does the medial tibial plateau really require operative fixation in every case? A study team in **New York (USA)** hypothesised that the stability of posteromedial shear fractures may not be that simple and designed a cadaveric model looking specifically at the stability of posteromedial fragments when treated non-operatively.<sup>4</sup> The experimental rig was set up to allow the investigators to apply an axial compression force alone or combined with either a posterior shear element, internal rotation torque element, or a varus moment. The investigators used the femurs of five fresh cadaveric knees, and the physiological loads were measured with a

Tekscan pressure mapping system. This allowed for contact pressure and area to be established between the femoral condyles, meniscus, and tibial plateau. Taking things one step further, the MicroScribe 3D digitizer was used to define the three-dimensional positions of the femur and tibia, giving a 3D map of joint position in combination with pressure readings. The investigators performed a 10 mm and then a 20 mm osteotomy with a saw at an angle of 30° in the axial plane and 75° in the sagittal plane of the tibial plateau to represent a typical posteromedial fracture fragment. The knees were



tested at a range of flexion angles (15°, 30°, 60°, 90°, 120°) and loading conditions (axial compression only, compression with shear force, torque, and varus moment). The research team employed distal displacement of the medial femoral condyle and the tibial fracture fragments as the primary outcome of their study.

With respect to smaller fractures (10 mm), the femoral condyle was not displaced up to 30° flexion, whilst with the 20 mm fracture there was progressive displacement associated with extension. The fragments themselves (as would be expected) continued to displace from 1.7 mm at 15° of flexion to maximum 10.2 mm with 90° flexion and varus bend. The authors clearly identified that, even at low degrees of knee flexion, the posteromedial fragment displaced, and the femoral condyle followed suit. This biomechanical study supports the change in recent years towards fixation of these fragments as the authors conclude that even under non-weight bearing precautions, with a mild degree of knee flexion, the posteromedial fragment of a tibial plateau fracture may

displace. The missing piece of the jigsaw is a clinical study to demonstrate improved clinical outcomes; displacement doesn’t always equal disability.

### **Fasciotomy closure under the spotlight**

■ Compartment syndrome is the most dreaded complication of fracture management, sometimes missed and, in the tibia, associated with dire consequences if fasciotomy is not performed in a timely manner. As such, a great deal of focus has been placed upon diagnosis and emergent treatment. There is, however, little in the way of research to support aftercare and many units and surgeons are still practising the same essentially unaltered treatment they have been using since the 1960s. One of the dilemmas in current surgical practice is the decision making surrounding closure and grafting of fasciotomy wounds. There is surprisingly little evidence to support decision making in a return to theatre, particularly prior to closure. How many times is it reasonable to return a patient to theatre prior to skin grafting? Colleagues in **Boston (USA)** set out to establish just how many times a patient with a fasciotomy should return to theatre prior to proceeding to skin grafting.<sup>5</sup> The study population consisted of a retrospective cohort of 104 adult patients with a fasciotomy closed either by delayed primary closure or split thickness skin grafting. Outcomes were assessed in terms of the proportion of patients in whom delayed primary closure (DPC) was successful. Although inherently biased, this is a fascinating question. The authors established that at first debridement, just 18% of patients were suitable for delayed primary closure, with 40% undergoing split skin grafting (SSG). The remaining 43 patients returned to theatre for a second debridement, of whom just three patients (7%) had a successful DPC. There were no patients who had sustained an open fracture who were closable by DPC. As would perhaps be expected,

patients undergoing first sitting SSC had a shorter hospital stay than those who required additional procedures (12 vs 17 days). In light of this series there is a good argument that early split thickness skin grafting may provide benefit to these patients – and certainly the ‘second trip’ to effect DPS being only 7% successful should clearly be avoided. It is, however, important to put these findings into context. There are patients with contaminated wounds or those not suitable for split skin grafting, and as such these patients will likely still require a subsequent return trip to theatre. Perhaps the most outstanding question to our minds, here at 360, is the utility of negative pressure dressings in these patients which may reduce the requirement for split skin grafting over traditional therapies. A comparative cohort or randomised controlled trial would, however, be needed to answer this question and no inferences on this subject can be drawn from this paper.

### Why do patients die from hip fracture?

#### x-ref Hip

■ It is a ‘universal truth’ in orthopaedic circles that hip fractures are associated with high mortality. Perhaps most memorably summed up by Sir Astley Cooper, “We enter life through the pelvis and leave through the hip”. Despite long recognition of mortality associated with hip fracture, and recent significant leaps in outcomes with the introduction of comprehensive care pathways, it has been some time since the causes of death associated with a hip fracture have been examined. In a retrospective cohort (database) study, authors from **Stoke-on-Trent (UK)** set out

to establish in contemporary practice exactly how patients die following hip fracture.<sup>6</sup> They examined a serial cohort of 4426 patients admitted over a seven-year period, all with a diagnosis of hip fracture. The authors sought to establish the incidence of mortality, associations with mortality and causes of death in this moderate-sized cohort. Their sample was representative of the typical hip fracture population with 26% male patients and a mean age of 82 years. They report an overall rise in incidence of fracture but decline in 30-day mortality (from 12.1% to 6.5%) throughout the period of the study, with three quarters of these being inpatient deaths. Factors associated with mortality in this cohort were male gender, increasing age and comorbidities. The subset of patients who had had a post-mortem (n = 220) recorded the most common causes of death to be respiratory tract infections (35%), ischaemic heart disease (21%) and cardiac failure (13%). While there is nothing groundbreaking or earth-shattering in these results, it is nice to see that mortality rates are falling across the Western world. The next step, perhaps, would be to provide higher levels of care and medical input for those patients at high risk of mortality.

### Acetabular fractures down the line

■ There are few large series describing the outcomes of acetabular fractures in the longer term, and many of these are historical, dating from before the use of more modern surgical approaches and certainly many before the routine use of CT scanning. A surgical team in **Uppsala (Sweden)** evaluated their own results in terms of functional outcome after surgically treated

acetabular fractures. Their carefully reported series of 112 patients are followed up to five years after surgery using radiography and patient-reported outcome measures.<sup>7</sup> Outcomes were assessed using the SF-36 score and pelvic discomfort index (PDI). The authors recorded a gamut of patient factors, injury factors and surgical factors in an attempt to establish what the factor predictors of outcome are. The study aimed to determine predictors of hip joint failure five years post-surgery, and the headline result is that this patient cohort did rather well with over three quarters of patients maintaining their native joint at five years. As would perhaps be expected, patients who managed to preserve their own joints had better outcomes at five years (SF-36 75 vs 48 points and PDI 28 vs 43 points). There were some associations identified with failure including femoral head impaction and an age of  $\geq 60$  years at the time of injury. Although the authors have suggested that patients with predictors of joint failure could benefit from treatment strategies other than ORIF, it is important to remember that patients treated with primary joint replacement for acetabular fractures (particularly in the elderly) are reported to have high complication rates and relatively poorer outcomes. It is high time a comparative series or prospective study of early fixation versus early arthroplasty was reported in elderly acetabular fractures as there are still a large number of unknowns in this population.

### Biomechanics of femoral neck fractures reviewed

#### x-ref Hip

■ And finally we would commend an excellent review from the

**Leeds (UK)** group examining the biomechanical rationale for, and evidence to support, different fixation strategies in patients sustaining femoral neck fractures.<sup>8</sup> The authors succinctly describe where we are with evidence for implant selection based on biomechanical studies – an excellent read for any surgeon regularly treating these patients.

### REFERENCES

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