

# ROUNDUP<sup>360</sup>

## Hip & Pelvis

### Goal-directed fluid therapy in hip fracture

#### x-ref Research, Trauma

■ Optimising care for patients with hip fractures has become big business, with improvements pushed forward by changes in care pathways to include comprehensive orthopaedic and geriatric medical reviews, in addition to lifestyle and risk factor modification. These efforts have resulted in reduced lengths of stay and lower mortality. Despite strides forwards in peri-operative care, there are few improvements that have resulted in genuinely improved outcomes. Although differences in anaesthetic modality (general vs block vs spinal) have been explored, and there have been no conclusive answers in terms of post-operative mortality or complications as to which modality is safer, there are few randomised studies investigating the potential for optimisation of intra-operative fluid management. Investigators from **Nottingham (UK)** set out to establish if the use of the LiDCO monitor could improve outcomes as part of a goal-directed fluid therapy regime and could be effective in decreasing complications and mortality.<sup>1</sup> The investigators conducted a blinded randomised controlled parallel group trial involving 130 patients. Patients were randomised to either standard care or intra-operative fluid management using pulse-control analysis cardiac monitoring. Outcomes were assessed as time to medical fitness for discharge and complication rates. The intervention

was achieved using pulsed boluses of Gelofusine to optimise stroke volume where the standard of care group received anaesthetist-directed fluid therapy. The study successfully recruited 130 patients and there was a non-significant difference in time to medical fitness for discharge (12.2 vs 13.1 days). There were no noticeable differences in complications, function or early mortality rates. The authors also updated a meta-analysis in light of their results which now included the results of 355 patients. There was a non-significant reduction in early mortality (RR 0.66) and in-hospital complications (RR 0.80). The current evidence base does not support the use of the LiDCO for goal-directed fluid resuscitation in hip fracture patients at the present time. However, the meta-analysis results are potentially encouraging regarding other secondary outcomes (mortality and complications) although of course more patients would be required to prove this one way or the other.

### Liberal blood transfusion no benefit in the longer term

#### x-ref Trauma, Research, Knee

■ The debate continues about the relative benefits or otherwise of transfusion in the post-operative period for arthroplasty patients. While there is little debate surrounding symptomatic or profoundly anaemic patients, there is a group in between who are moderately anaemic, but asymptomatic. Proponents of so-called 'liberal transfusion' strategies

would argue that transfusing these patients reduces cardiovascular stress, aids rehabilitation and may shorten overall length of stay. Clinicians favouring a restrictive transfusion policy would argue the counterpoint that the profound immunosuppressive effects of transfusion can result in higher infection rates and even in cancer recurrence. There is, however, a complete lack of high-quality evidence one way or the other. Researchers in **New Brunswick (USA)** have set out to plug this evidence gap with the publication of their high-quality randomised controlled trial (FOCUS) which aims to test these two competing strategies.<sup>2</sup> The research team designed a randomised controlled trial and recruited 2016 patients, all with hip fractures and cardiovascular compromise, to one of two strategies. Patients were either randomised to liberal transfusion and were transfused to maintain haemoglobin levels 100 g/L or higher, whilst the restrictive transfusion group received transfusion only when their haemoglobin fell below 80 g/L or they were symptomatic. Recruitment occurred in 47 centres across North America over a three-year period.<sup>2</sup> Primarily, outcomes were assessed as long-term survival with linkage to national death registries and analysis was performed on an intention-to-treat basis. At the final follow-up of 3.1 years there were no differences between the liberal and restrictive transfusion policies. There were 432 deaths in the liberal transfusion group and 409 in

the restrictive group, giving a hazard ratio of 1.09 (95% CI 0.95 to 1.25). It appears that in this fragile group of patients with high comorbidities there are no long-term sequelae of liberal transfusion policy, however, the other potential benefits of liberal transfusion were not evaluated.

### Repeated measures: increased accuracy or compounded errors?

#### x-ref Research

■ Almost every facet of research requires statistical estimations either of sample size, confidence limits or probabilities (such as significance testing which is based on probability theory). The accuracy and precision of measurements on which these estimates are made can have a profound impact on the eventual outcome. There is little in the way of research informing the effects of clinical measurements on statistical outcomes. In a fascinating study, researchers in **Dijon (France)** set out to establish the effects of aggregation repeated clinical measurements (in this case joint space width measurements calculated from plain radiographs).<sup>3</sup> Using data from a previously performed hip RCT they evaluated the effects of repeated measures on the smallest detectable difference (SDD) and sample size calculations. The study team undertook analysis of 50 radiographs with repeated readings performed by an experienced rheumatologist. The addition of repeated readings did not improve the inter-rater reliabilities (and one would not expect it to),

however, inclusion of repeated readings did improve SDD from 0.75 mm to 0.27 mm. The aggregation of readings in this study would have improved the SDD, and given more power to the study itself. Increasing accuracy of measurements with three consecutive paired measurements would have reduced the sample size calculation in this study from 6588 patients (with an SDD of 0.75 mm) to 377 patients (with an SDD of 0.45 mm). Perhaps the most interesting observation in this study is that further increasing the smallest detectable difference from 0.45 mm did not result in an automatic gain in terms of a smaller sample size requirement. Although the sensitivity improves in studies like this with a potentially limited treatment effect, the sample size actually increased again.

#### **Peri-acetabular osteotomy safer than perhaps thought?**

##### **x-ref Children's orthopaedics**

■ Peri-acetabular osteotomy (PAO) is a major procedure and is used in hip preserving surgery in the young adult. The surgery involves re-orientation of the acetabulum while preserving posterior column pelvic continuity. Like many major hip procedures there is both professional concern and literature to support the risks of major complications for this surgery. There is some evidence to suggest that higher volume surgeons suffer fewer complications, however, the exact interplay between complications and volume in PAOs has not been evaluated in an organised fashion. We were delighted when this study by an expert panel from **Royal Oak (USA)**, consisting of some of North America's leading hip preservation surgeons, crossed the desks at 360.<sup>4</sup> The paper reports the analysis of 205 consecutive unilateral PAOs, all with follow-up to at least a year. Remarkably, the authors report a major complication rate of just under 6% (n = 12 patients). Of these major complications, seven were evident at the ten-week visit, whereas five were apparent at the one-year

visit. However, there were no vascular injuries, permanent nerve palsies, intra-articular osteotomies and/or fractures, or acetabular osteonecrosis in this series of over 200 patients. Around 4% of patients required a second surgical intervention due to a complication, and these were mostly for migration of the osteotomy or infection. As would perhaps be expected, however, the most common low-grade complication was asymptomatic heterotopic ossification. This study suggests that PAO has come of age and is now a mature operation. When performed in experienced hands beyond the learning curve, the operation can be expected to be safe, with major complications occurring in only one in 20 patients.

#### **Obesity and peri-acetabular osteotomy: poor bedfellows**

##### **x-ref Children's orthopaedics**

■ There has been a flurry of interest in the hip literature in hip preserving surgery of late, and in particular there has been renewed interest in the Bernese peri-acetabular osteotomy (PAO) as described by Ganz. In the second paper concerning complications and PAO, surgeons from **Rochester (USA)**, in conjunction with other leading hip preservation surgeons in North America, have evaluated the patient factors that can be seen to be associated with a risk of post-operative complications.<sup>5</sup> In their retrospective study, the results of 280 patients including notes review, clinical and radiographic data to a mean follow-up of 48 months were analysed to establish any potential link between obesity and complications. In their series there were 65 patients (23.2%) who were obese and the authors undertook multivariate analysis to establish any risk factors that might

be associated with complications. The authors found that there was a 22% mean probability of a patient having a major complication after PAO if they were obese (compared with 3% for non-obese patients). Gender, age, smoking status, and pre-operative Tonnis grade were not significant risk factors when multivariate analysis was performed.

However, from an outcomes perspective, the authors established that there were no differences in the achieved radiographic correction between obese and non-obese patients. This study highlights the epidemic problem of obesity, and how it adversely impacts on

some outcomes, including those after PAO. While the longer-term results of surgery appear to be comparable with similar rates of correction, this comes at the potential cost of a higher complication rate in the obese population.

#### **Stress fracture in peri-acetabular osteotomy**

##### **x-ref Children's orthopaedics**

■ In the final paper in our trio of papers reporting complications following hip preservation surgery, researchers in **London (UK)** identify and evaluate the significance of stress fractures after a Ganz-type peri-acetabular osteotomy (PAO).<sup>6</sup> Their study reported the largest of these three series, consisting of 359 patients followed-up for an average of just over two years. The authors comment that although recognised as a complication (and previously reported at an incidence of around 3%), the natural history and incidence of stress fracture is not well described. In their series a radiographic stress fracture could be identified in 18.4% (n = 64) of patients, although this was often asymptomatic. The authors found

stress fractures were associated with increasing patient age (34 years vs 31 years) and higher levels of pre-operative deformity. The authors noted that stress fractures were associated with pubic nonunion (relative risk 11.8). Of note, however, 91% of stress fractures healed without additional intervention. As with all relatively rare operations, longer follow-up and larger numbers than the initial series are usually required to adequately quantify the incidence and effects of complications. In this large series, although stress fracture is alarmingly common with a 91% spontaneous resolution rate, it is certainly something to watch out for but the longer-term consequences remain to be seen.

#### **Infection and tantalum implants**

##### **x-ref Knee**

■ One of the potential prosthetic solutions to periprosthetic bone loss in patients undergoing major arthroplasty revision surgery is the use of tantalum augments. The application of new manufacture technologies to develop porous tantalum augments has allowed arthroplasty and tumour surgeons to tackle ever more challenging bone defects through prosthetic augmentation. A potential difficulty, however, is that of infection. Augments are almost impossible to remove with the bone literally growing through the prosthesis. Researchers in **Philadelphia (USA)** set out to establish what the risk of infection was in acetabular augmentation in revision hip surgery, with some surprising results.<sup>7</sup> They identified a cohort of 966 patients who had undergone revision hip surgery over a 13-year period and were able to report their follow-up to just over three years. Their cohort consisted of a mixture of titanium (n = 536) and tantalum (n = 454) acetabular components and the authors set out to establish the failure rate during their period of observation. While the overall subsequent failure rate was relatively low (at 7.7%), there was a surprising difference between the



two groups, with a 4.4% failure rate in the tantalum group and a 9.9% failure rate in the titanium group. Among the 144-patient subgroup of revision for infection, the failure rate was markedly different between the two components (3.1% tantalum vs 17.5% titanium). These results are remarkable – and on the face of it, very significant. However, as with many retrospective selected case series studies, it is perhaps worth injecting a slight note of caution. Even when adjustments are made for length of follow-up in heterogeneous samples like this, the results can be confusing. The use of multivariate analysis such as that used in this paper can account for confounders, however, it cannot ever take account of variable event rates with different follow-up lengths. We know that different failure modes following arthroplasty become apparent with different follow-up intervals, something not taken into consideration in this paper. This is unlikely to change the results wholesale but may well make the differences between the two prosthesis types less marked with a more uniform follow-up.

### Highly crosslinked polyethylene really does work

■ The use of highly crosslinked polyethylene (HXLPE) is now commonplace in a bid to reduce the incidence of wear and the subsequent need for revision surgery associated with component wear and aseptic loosening with conventional ultrahigh-molecular-weight polyethylene (UHMWPE). The evidence for this is essentially from either early clinical or simulator studies, all of which suggest there is a lower wear rate associated with the HXLPE. Surgeons from **Oxford (UK)** were awarded the John Charnley prize this year for their randomised controlled trial designed to tell once and for all *in vivo* if the use of HXLPE liners do indeed have lower long-term steady state wear characteristics than the UHMWPE alternatives.<sup>8</sup> They designed a prospective randomised double-blinded controlled trial to establish wear characteristics using RSA analysis as their primary outcome measure. The study team report the results of a randomised controlled trial of 54 patients randomised to either a UHMWPE or HXLPE liner

and the same cemented stem and uncemented acetabular component. Outcomes were assessed at ten years using an RSA system. By the ten-year follow-up point, the group were able to report significantly lower wear of the HXLPE liners (0.003 mm/year vs 0.030 mm/year). A similar result was seen with regard to volumetric wear (14 mm<sup>3</sup> vs 98 mm<sup>3</sup>). In what is a hugely important study, this arthroplasty research group in Oxford have proven conclusively that there is a lower rate of volumetric and linear wear associated with HXLPE liners. While there is more to wear than simply the amount of wear debris (the particular size and size profile may well matter more than the absolute volume), it is heartening to find that *in vivo* data match simulator data in a long-term randomised controlled trial.

### REFERENCES

1. Moppett IK, Rowlands M, Mannings A, et al. LiDCO-based fluid management in patients undergoing hip fracture surgery under spinal anaesthesia: a randomized trial and systematic review. *Br J Anaesth* 2015;114:444-459.
2. Carson JL, Sieber F, Cook DR, et al. Liberal

versus restrictive blood transfusion strategy: 3-year survival and cause of death results from the FOCUS randomised controlled trial. *Lancet* 2014;(Epub ahead of print)PMID:25499165.

3. Ornetti P, Gossec L, Laroche D, et al. Impact of repeated measures of joint space width on the sample size calculation: An application to hip osteoarthritis. *Joint Bone Spine* 2015;(Epub ahead of print)PMID:25575611.
4. Zaltz I, Baca G, Kim YJ, et al. Complications associated with the periacetabular osteotomy: a prospective multicenter study. *J Bone Joint Surg [Am]* 2014;96-A:1967-1974.
5. Novais EN, Potter GD, Clohisy JC, et al. Obesity is a major risk factor for the development of complications after peri-acetabular osteotomy. *Bone Joint J* 2015;97-B:29-34.
6. Malviya A, Dandachli W, Beech Z, Bankes MJ, Witt JD. The incidence of stress fracture following peri-acetabular osteotomy: an under-reported complication. *Bone Joint J* 2015;97-B:24-28.
7. Tokarski AT, Novack TA, Parvizi J. Is tantalum protective against infection in revision total hip arthroplasty? *Bone Joint J* 2015;97-B:45-49.
8. Glyn-Jones S, Thomas GE, Garfield-Roberts P, et al. The John Charnley Award: Highly Crosslinked Polyethylene in Total Hip Arthroplasty Decreases Long-term Wear: A Double-blind Randomized Trial. *Clin Orthop Relat Res* 2015;473:432-438.