ROUNDUP360

Hip & Pelvis

X-ref *For other Roundups in this issue that cross-reference with Hip & Pelvis see: Foot & Ankle Roundup 6; Trauma Roundups 2, 6 & 9; Children's orthopaedics Roundup 3; Research Roundups 3 & 6.*

Outcomes and complications in African American and white patients after total joint arthroplasty X-ref

■ This fairly large retrospective study from **Annapolis, Maryland (USA)** deals with the slightly politically charged issue of outcomes and race.[1] The study looks at a variety of outcome and complication measures in patients who have undergone either total hip arthroplasty (THA) or total knee arthroplasty (TKA), and compares them between white and African American (AA) subgroups. Over a five-year period between 2013 and 2017, a total of 7335 THA and TKA arthroplasty procedures were undertaken in their institution, and this cohort formed the basis for the study population. Once ethnic groups other than white and AA were excluded, this left a total of 7208 patients (2596 hips, 4612 knees). In total, 6182 white and 1026 AA patients were included. A combination of chi-squared tests, *t*-tests, and analysis of variance (ANOVA) were used to compare the various potential outcomes between the groups, with multiple logistic regression used to single out the various factors contributing to these differences and to eliminate confounding. The key finding was that AA patients had longer hospital stays: significantly so for knees, and approaching significance for hips. Overall, AA patients were statistically twice as likely to require reoperation for all causes. Patients experiencing septic complications were over three times as likely to be AA than white, and the mean age in the AA cohort was over three years younger than in the white cohort. These differences also extended to discharge destinations, with AA patients undergoing THA being significantly more likely than their white counterparts to be discharged to a nursing facility rather than their own homes. These differences were still seen once various other confounders such as socioeconomic and insurance status, medical comorbidities, and so on had been accounted for. The authors conclude that there are multifactorial ways (such as body mass index (BMI) and health status) in which ethnicity is likely to influence these outcomes, and such modifiable risk factors can be optimized to reduce the disparity. The authors also suggest, although they do not claim that their study evidences this, that other issues such as bias, institutional discrimination, and community factors may also contribute to their findings. While the authors do not make firm suggestions on how to address these differences, they correctly state that we are all responsible for attempting to do so.

Hip arthroscopy following contralateral total hip arthroplasty

■ This study from **Phoenix, Arizona (USA)** is based on a retrospective review of prospectively recorded data.[2] The authors report the results of two centres, both of which prospectively collect data on patients undergoing hip arthroscopy. The authors reviewed their data for all 2089 patients treated with hip arthroscopies between 2008 and 2015. From this large series, they identified a sub-cohort of just 12 patients meeting stringent inclusion criteria; these included Tönnis grade 0 or 1, labral pathology, greater than two-year follow-up, completion of patient-reported outcome measures (PROMs), and, most importantly, previous contralateral total hip arthroplasty (THA). It is these 12 patients that form the basis of this report. Exclusion criteria were then also applied (previous surgery, acetabular dysplasia), leaving a total of nine patients. A 3:1 matched cohort (27 patients) was then established, in whom analysis demonstrated no statistical difference in intraoperative findings at arthroscopy with respect to, among others, labral tear type, treatment undertaken, and articular cartilage appearance. Although four of the 27 control cases underwent revision arthroscopy (at a mean of 15 months postoperatively), compared with no repeat arthroscopies in the contralateral previous THA cohort, the rate of conversion to THA (at an average of 35.8 months following arthroscopy) was significantly higher in the contralateral previous THA group than the controls (67% *vs* 15%; p = 0.006). The authors correctly acknowledge a number of study limitations, such as the retrospective design and the fact that only 0.67% of all patients undergoing hip arthroscopy during the study period had undergone previous contralateral THA, rendering this a very small cohort. Nevertheless, they postulate some interesting possible explanations for their finding, in particular the fact that patients who have undergone previous THA may be more aware of the potential symptomatic benefits than those who have not, and thus perhaps have a lower threshold for wishing to undergo the same to their contralateral hip if arthroscopy does not give them the improvement they are hoping for. The authors also note that patients undergoing conversion to THA had relatively high-grade chondral injury at arthroscopy, potentially more so than suggested by preoperative imaging. Overall, however, the simple take-home message – that arthroscopy should not be offered to patients who have already had the opposite hip replaced – is undoubtedly backed up by the data from this paper, and should be noted by the wider hip community.

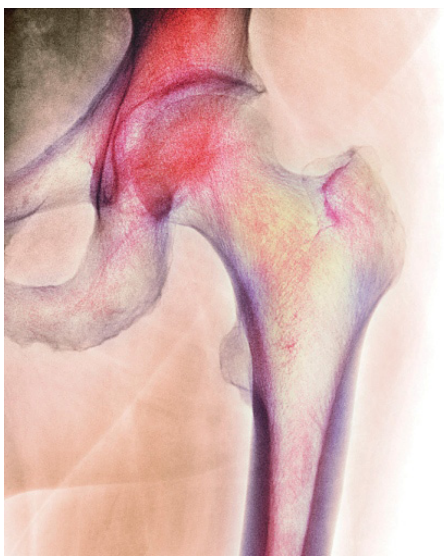
Incision VAC after revision arthroplasty: a randomized controlled trial X-ref

■ This paper from **Cleveland, Ohio (USA)** is another looking at hips and knees, this time in the revision arthroplasty context.[3] The authors report a prospective randomized controlled trial (RCT) comparing closed-incision negative-pressure wound therapy (ciNPWT) *versus* silver-impregnated Aquacel. Patients had to present with at least one risk factor for infection (high body mass index (BMI), anticoagulant treatment, vascular disease, diabetes, smoking, malignancy, HIV, liver or renal disease, or

inflammatory arthropathy) and be undergoing revision arthroplasty to be included. Of the 854 consecutive potential participants screened for inclusion, there were 160 participants included in the study. The authors enrolled 80 patients into each group, allocated evenly to standard dressing (40 hips, 40 knees) or ciNPWT (38 hips, 41 knees plus one lost to follow-up). There were no statistical differences between the groups in terms of basic patient demographics, indication for surgery, procedure undertaken, and American Society of Anethesiologists (ASA). The outcome measures reported here were: any wound complication (defined as active drainage requiring dressing change), cellulitis, blistering, haematoma, skin necrosis, abscess, surgical site infection (SSI), wound dehiscence, or prosthetic joint infection (PJI). These were assessed at 2, 4, and 12 weeks postoperatively. All-cause readmission and unplanned reoperation were also included as adverse outcomes. The authors report that at both four- and 12-week follow-up, wound complication rates were higher in the control group than in the ciNPWT cohort (17.5% *vs* 5.4% at two weeks; 23.8% *vs* 10.1% at 12 weeks) and both of these findings were statistically significant. There were seven PJIs in the control arm *versus* two in the ciNPWT group; and all-cause reoperation was statistically more likely without ciNPWT than with ciNPWT (16.4% *vs* 2.8% at 12 weeks). There are a number of obvious weaknesses in this study, which are acknowledged in its discussion section. There was variation in the duration of ciNPWT application in the treatment group, operative technique heterogeneity between different participating surgeons, and a mixture of hip and knee revisions despite the different event rates in hip and knee arthroplasty. Nevertheless, the use of fairly comprehensive inclusion criteria makes this a very relevant paper to the cohort of patients undergoing revision joint arthroplasty who are at particular risk of postoperative wound complications. The prospective RCT design of this study certainly strengthens the data output significantly, which in turn strongly supports the conclusion that ciMPWT should be seriously considered in patients who are at above-average risk of wound complications after revision hip or knee arthroplasty. A definitive large trial is clearly indicated here.

The centre gap: a radiological predictor in DDH

■ It is well known that developmental dysplasia of the hip (DDH) is a risk factor for the development of hip osteoarthritis (OA), but it is also widely acknowledged that significant variation is seen between patients with similar grades of severity of DDH radiologically, in terms of progression in the longer term. Any means of increasing the accuracy by which this can be predicted has the potential to be extremely useful in guiding patient selection for hip preservation surgery earlier in life. This study from **Shizuoka (Japan)** focuses on the measurement of a new proposed radiological parameter, the centre gap.[4] The authors have neatly designed their study to answer three distinct questions. First, what is the probability of OA progression or symptom development in the asymptomatic contralateral hip of patients with DDH undergoing unilateral joint-preserving surgery? Second, is the measured centre gap associated with OA progression or symptom development in these hips? Finally, is the centre gap measurement correlated with previous radiological parameters? The study is designed around a retrospective data set, obtained from a database containing 297 patients who had undergone unilateral eccentric rotational acetabular osteotomy between 1989 and 1999. A cohort of 155 patients was identified, aged under 55 years with a dysplastic contralateral hip classified as Tönnis grade 0, asymptomatic at the time of the acetabular osteotomy, and in whom no previous surgical intervention had been undertaken. Once exclusions were made for those lost to follow-up or with incomplete medical records/radiographs, 88 patients remained for analysis in the study. Mean follow-up for the purposes of this study was an impressive 20 years (10 to 27). Anteroposterior (AP) pelvic radiographs were obtained at the time of the initial osteotomy and annually thereafter, recording Tönnis grade, as well as previously established radiological parameters (centre-edge angle, head extrusion index, head sphericity, depth:width index, and minimum joint space width). The authors also measured their proposed new parameter, the centre gap. This is measured by drawing a number of lines around the acetabulum, from which seven points along the acetabular roof are then plotted, and a further seven along the femoral head. These lines are then used to construct a femoral 'circle' and acetabular 'circle'; the measured distance between the centres of these two circles is the 'centre gap'. Overall, the study found that no patients progressed towards radiologically diagnosed OA (defined as Tönnis grade 2 or higher) in the non-operated hip over the first ten years, but that rates were 7% and 13% at 15 and 20 years, respectively. The key finding here was that the centre gap was an independent risk factor for radiological progression of OA in the contralateral non-operated hip at a mean follow-up of 20 years. In combination with the femoral head extrusion index, these two measures together had, respectively, a sensitivity, specificity, and positive predictive value of 77%, 76%, and 36% for OA progression. The centre gap was not found to correlate with any of the other pre-established radiological measurements. The authors acknowledge that the retrospective design potentially detracts from the strength of their data set, and also recognize that their study population of Japanese subjects may not demonstrate either clinical natural disease history or radiological findings that are directly analogous to those seen in other races. Nevertheless, the authors propose that the combination of the femoral head extrusion index and centre gap is useful in predicting the natural course of the asymptomatic hip in this patient cohort. Given the increasing successes of hip preservation techniques, any means of improving the accuracy of patient selection is to be welcomed. Further work assessing this new parameter would certainly seem advisable. In the meantime, the wider hip surgery community should certainly take note of this paper and its findings, as it is our view that this measurement is a potentially important addition to the existing armamentarium in this field.



Porous tantalum: as stable as we thought?

■ Trabecular tantalum acetabular revision shells have increasingly become the 'go-to' prosthesis in revision hip surgery. Their ease of implantation and promise of longevity have made them especially beloved of the modern hip surgeon in the context of cases with significant acetabular defects. This study from **Adelaide (Australia)** focuses on the use of radiostereometric analysis (RSA) to measure the migration of such porous tantalum components in cases with Paprosky type 3 defects (global erosion of the acetabulum with attenuation or destruction of all supporting structures and greater than 2 cm of hip centre migration).[5] The paper draws on a single centre (two-surgeon) prospective cohort of all acetabular revisions using this

prosthesis from 2003 onwards. At the time of revision surgery, all patients had 12 × 1 mm tantalum beads inserted into the surrounding pelvic bone to allow subsequent RSA of acetabular component migration. All patients with Paprosky type 3 defects were initially included in the present study (81 hips in 78 patients in the original data set). After exclusions for death, loss to follow-up, re-revision, or inadequate visibility of the beads, 55 remained for the final RSA (28 with type 3A, 27 with type 3B) and form the basis of this report. Although this may seem like rather low numbers for a RSA study, given the submillimetre accuracy, it is actually a reasonable number to look for migration. All patients had anteroposterior (AP) and lateral radiographs at three days, three months, six months, and one, two, and three years postoperatively, then biennially thereafter. Uniplanar RSA was used to assess acetabular component migration. The authors defined acceptable translation as less than 1 mm within two years. Indications of radiological loosening included, over 3 mm of proximal translation, 5° of sagittal rotation, or a continuous radiolucent line. Key findings of the study were: five components re-revised for loosening; three revisions for recurrent dislocation; one debridement and bearing exchange for infection; and seven components found to have more than 1 mm possible translation within two years, five of which were associated with significant pain, so were re-revised. The other two migrated within the first two years, but remain relatively unchanged thereafter. Unsurprisingly, there was a trend of higher migration rates for type 3B defects *versus* type 3A, and for patients with pelvic discontinuity. Inferior acetabular screws were associated with a statistically significantly lower proximal migration, and no components with screws migrated more than 1 mm. The main learning points from this study are that the majority of tantalum components implanted resulted in favourable clinical outcomes, even in the long term, and that this can be achieved in this challenging subgroup within the revision hip context. Furthermore, the use of inferior screws is shown to be associated with significantly better outcomes.

Extended oral antibiotic prophylaxis: a good option in the high-risk

■ Prosthetic joint infection (PJI) is a significant complication following primary joint arthroplasty, and, in part due to the increased number of arthroplasties performed, is on the increase. Not only is this a significant burden for the patient to bear, but it also puts a significant stress on the increasingly pressured financial resources of the health economy. Clearly prevention is better than cure, and considerable efforts have been made to adopt measures to reduce the risk of PJI. As the authors of this paper from **Indianapolis, Indiana (USA)** identify, it is often easier to control for the environmental factors and less easy to control for the host factors.[6] Patients who are being considered for joint arthroplasty are increasingly obese, less active, and have a number of additional comorbidities such as diabetes and kidney disease. The authors of this study attempted to evaluate if there were any benefits to extending the standard oral antibiotic prophylaxis for total joint arthroplasty (TJA) in higher-risk patients. This was conducted in addition to the standard perioperative infection control practices at the authors' institution, which included nasal screening and decolonization, preoperative skin cleansing, glycaemic control, a minimum of three months between an intra-articular steroid injection and surgery, and intravenous antibiotics within an hour of the commencement of surgery. Additional intraoperative measures included the use of laminar airflow, alcohol and chlorhexidine-based skin preparation, skin sealant and drapes, a dilute Betadine (povidone-iodine) soak prior to closure, and maintaining the patient's temperature throughout the procedure. The standard time for intravenous antibiotics to be administered postoperatively was 24 hours. Allogeneic blood transfusions were not used. Patients were identified preoperatively as at high risk of postoperative PJI according to the following criteria: body mass index (BMI) > 35 kg/m², diabetes mellitus, active tobacco smoker, chronic kidney disease, autoimmune disease, and nasal colonization of methicillin-resistant *Staphylococcus aureus* (MRSA) or methicillin-sensitive *Staphylococcus aureus* (MSSA). Those patients identified as high risk were given a standardized prophylactic oral antibiotic protocol for a minimum of seven days after discharge. The patients were divided into three groups: group A consisted of patients who were not at increased risk of PJI and were not given the extended course of antibiotics; group B consisted of patients who were at increased risk for PJI but were not given extended oral antibiotic prophylaxis; and group C consisted of patients who were at increased risk for PJI and were given extended oral antibiotic prophylaxis as described above. A total of 2181 primary joint arthroplasties were included in this study. The 90-day infection rate following total knee arthroplasty (TKA) was 1%. The highest rate of PJI was in group B (2.1%), followed by group C (0.4%), and then group A (0.3%). The 90-day infection rate after total hip arthroplasty (THA) was 2.2%. Again, the highest PJI rate was group B of 4.3%, then 1.5% for group A, and 1.1% for group C. Following TKA, male patients were 7.2 times more likely than female patients to develop a PJI and patients in group B were 4.9 times more likely to develop PJI than those in group C. Following THA, patients in group B were four times more likely to develop PJI compared with group C. Extended antibiotic prophylaxis following THA resulted in significantly reduced rates of PJI in patients with one or more risk factors (1.1% *vs* 4.3%) and those with two or more risk factors (0.8% *vs* 7.6%). This was also observed following TKA with one or more risk factors (0.5% *vs* 2.1%). The message of this paper conflicts with the guidelines issued by the International Consensus on Periprosthetic Joint Infection and the 2017 Centres for Disease Control and Prevention (CDC), which strongly recommended that postoperative antibiotics should not be administered for more than 24 hours after surgery. While this paper should not be dismissed out of hand, there has to be some danger in the widespread use of a prolonged course of postoperative antibiotics following TJA. The results presented in this paper are impressive, but surely this potential benefit would be negated should we see an acceleration in the development of multiple-antibiotic-resistant organisms. Other studies have shown that optimization of modifiable risk factors such as HbA1c, BMI, and albumin can have a significant benefit in the reduction of postoperative PJI. Prevention has to be the way forward, but before we consider the 'easier' option of widespread use of extended antibiotic prophylaxis, there has to be a greater focus on the modifiable risk factors prior to surgery.

Do we need a robot to place hip components?

■ Outcomes following total hip arthroplasty (THA) continue to improve. One of the essential components to help achieve to a successful THA is accurate implant positioning. There have been many studies confirming that, whatever the experience of the surgeon, there is still a risk of component malpositioning. Malpositioned components can result in instability and dislocation, leg-length discrepancy, impingement, accelerated wear, and component loosening. Despite placement of the acetabular component in the 'safe zone' as described by Lewinnek, dislocations can still occur. Increasingly, it is felt that stability can be better achieved by measuring the combined femoral anteversion and acetabular version. This is no easy task and, due to the difficult nature of the procedure, there has been increased interest in the development of sophisticated navigation devices to aid the surgeon intraoperatively. In robotic-assisted hip arthroplasty, a robotic arm aims to assist in the reaming and siting of the acetabular and femoral component using a CT-based

navigation system. This enables the surgeon to restore the centre of hip rotation and position the acetabular component according to a pre-determined CT-based preoperative plan. To date, there has been no *in vivo* assessment evaluating the accuracy of this technology, and the authors of this interesting study from **New York, New York (USA)** aimed to address this.[7] A total of 20 patients with a mean age of 60.8 years and a mean body mass index of 26.6 kg/m² underwent robotic-assisted THA using the MAKO surgical navigation system (Stryker Inc., Fort Lauderdale, Florida). All patients had a posterolateral approach. The surgeons aimed to place the acetabular component between 35º and 45º of abduction and between 10º and 26º of anteversion depending on patient anatomy. The femoral version did vary, but with the aim that the combined version (femoral and acetabular) would be between 25º and 45º. The preoperative plan was made using preoperative CT scans and robotic-assisted templating software. Following surgery, CT scans were obtained on all patients at six weeks after surgery. An independent evaluator then performed a postoperative assessment measuring component orientation. The mean intraoperative acetabular component inclination angle was 40.4º, which was similar to the mean postoperative CT-based measurement of 40.12º, with good statistical correlation. The mean percentage error between intraoperative inclination measurements and postoperative CT measurements was 1.6%. In addition, all patients had a measured postoperative acetabular component inclination within 5º of the postoperative CT measurements. There were similar outcomes for the acetabular version, with a significant correlation between intraoperative acetabular component version and postoperative CT measurements. The mean percentage error was 0.8% and all components were within 5º of the postoperative CT measurement. Similar outcomes were seen with restoration of the hip centre of rotation (within 2 mm of planned placement) and femoral anteversion (percentage error was 0.7%). The mean intraoperative combined version measured with the robotic system was 32.5º, which was not statistically different from the mean combined version of 32.6º, as measured on the postoperative CT scan. Leg length and offset were also accurately reproduced by the navigation system. This is the first study to confirm that robotic-assisted surgery is reliable and impressively accurate in achieving the preoperative plan designed by the surgeon, and that it can accurately restore offset and leg length. While there are still no long-term data assessing the clinical impact of this technology, it is clear that robotic-assisted surgery is accurate, and that this study supports its increasing popularity among arthroplasty surgeons.

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