ROUNDUP360

Hip & Pelvis

X-ref ***For other Roundups in this issue that cross-reference with Hip & Pelvis see: Knee Roundup 1; Trauma Roundup 3; Children's orthopaedics Roundup 4; Research Roundups 2 & 5.***

Trends in hip bearing surface

In recent years, there has been increasing debate regarding the choice of bearing surface in total hip arthroplasty (THA). Traditionally, a metal head on a conventional polyethylene liner (MoP) was the default bearing, but there were some concerns about the polyethylene wear and long-term osteolysis. This spawned the development of alternative bearings, such as metal-on-metal (MoM) and ceramic-on-ceramic (CoC), as well as the refinement of MoP with highly cross-linked polyethylene liners, with either a ceramic or metal femoral head. In the current financial climate, our choice of bearing is coming under increasing scrutiny, and rightly so. This commendable study from **Iowa City, Iowa (USA)** looks at the current trends in the choice of bearings in THA and focuses particularly on the impact of issues related to MoM bearings, the perceived success of highly cross-linked polyethylene, and implant cost.[1] Between 2007 and 2015, the authors reviewed the implant choices made in a total of 28 504 primary THAs with a male:female split of 59:41. There were gender differences apparent in bearing choices: in the females, 16.3% received a MoM bearing; 47.6% metal-on-polyethylene (MoP); 32.6% ceramic-on-polyethylene (CoP); and 3.5% received a CoC bearing. This was compared with 18.1% of the males receiving a MoM bearing, 44% for MoP, 34.2% for CoP and 3.7% for CoC. There were also differences, as would be expected, in the median age for each bearing as follows: 65 to 70 for MoM; 70 to 74 for MoP; 65 to 69 for CoP; and 70 to 74 for CoC. There was a significant increase in the use of CoP from 6.4% in 2007 to 52% in 2015, which mirrored a decline in the use of MoP. There was also a decrease in the use of CoC and MoM over the same period. The decrease in the use of MoP appeared to be a recent phenomenon, decreasing from its peak use in 2012 at 53.6% to 39.8% in 2015. Patients over 65 years of age are more likely to receive a MoP bearing as opposed to any other bearing combination. Although this was an American study, there were some interesting observations that would be globally applicable. Age was an independent predictor of bearing choice, as was a patient's private health insurance status. Gender was not found to be a significant factor. The changes in choice of bearing, particularly in the last five years, have been quite dramatic, with a shift away from MoM and MoP bearings to CoP. The most likely reasons for this shift include the adverse tissue reactions reported in the case of MoM, as well as the positive mid-term results of highly cross-linked polyethylene. The move away from metal heads to ceramic, combined with a polyethylene acetabular liner, could be due to the concerns of corrosion at the head-neck junction seen with metal heads. In addition, the implant breakages experienced with the earlier generation of ceramic heads appear to have been reduced significantly with more modern designs. Is the real choice of bearing in THA between CoP and MoP? The most significant factors that appear to influence this choice are age and whether the patient has private health insurance. The authors suggest that, with increasing reports of corrosion at the metal head-neck junction, a CoP bearing combination should be the choice in all patients, regardless of age or cost.

Total hip arthroplasty after fixation of minimally displaced femoral neck fractures X-ref

The population is ageing and the prevalence of fragility fractures continues to increase. The standard of care for patients with a valgus-impacted or minimally displaced fractured neck of femur is *in situ* fixation with either three cancellous screws or a sliding hip screw. Most fractures managed this way heal fully and the patients return to their pre-fracture state; however, around 10% require further surgery due to nonunion, avascular necrosis (AVN), or degenerative changes. The solution for most of these patients is a total hip arthroplasty (THA). While there have been many studies analysing the conversion of failed open reduction and internal fixation of a displaced fractured neck of femur, none have looked at the conversion of failed *in situ* fixation of a minimally displaced fracture. This retrospective study of 62 patients from **Rochester, Minnesota (USA)** reports the outcomes of those aged over 65 years with a minimally displaced fracture treated initially with *in situ* fixation and who subsequently required conversion to a THA.[2] Follow-up was 5.5 years and, during this period, a total of 13 patients were treated with a hip hemiarthroplasty as they were deemed to be too high a risk for THA, and a total of 44 patients were reported with two years of clinical follow-up. The most common indication for conversion to a THA was osteonecrosis of the femoral head (44%), followed by post-traumatic degenerative changes (35%), and nonunion (21%). Patients had the screws removed at the time of the THA and screw tracks were filled with autogenous bone graft. Two patients died within 90 days of the surgery, two patients sustained an intra-operative periprosthetic fracture, and there were two post-operative dislocations that were both treated with closed reduction. Four patients developed wound healing or infection problems that required further surgery. Although survivorship analysis was excellent, with 97% free of any surgery at five years, and the mean clinical improvement was significant, there is a burden of complications that is higher than one would expect in a primary hip series. However, this is notably better than most series of THAs performed after failed fixation of displaced fractured neck of femur. The authors made no apology for the fact that higher-risk patients in their study had a hip hemiarthroplasty as opposed to a THA and suggested that this emphasised good patient selection.

The authors highlighted some useful intra-operative tips such as dislocation of the hip with the metalwork *in situ* in order to reduce the torque on the femur through stress risers associated with the screw tracks. Although there is no evidence for bone grafting the screw tracks, the authors felt that this was good practice in their experience. In addition, where possible, the authors elected to use larger head sizes and suggested that this may also contribute to their low dislocation rate.

Surgical correction of cam deformity and degenerative process within the hip joint

X-ref

■ There has been a rapid expansion in the field of hip preservation surgery in the last ten years and, with it, an ever-increasing range of interventions that can be performed, many of them without any long-term evidence for efficacy, particularly in the field of hip arthroscopy. This has attracted some scepticism, particularly when it has been observed that not all cam deformities are symptomatic and not all develop into arthritis. This excellent paper from **Ottawa (Canada)** attempts to identify some objective evidence that surgical correction of a cam deformity can have a positive impact on the degenerative process in patients with symptomatic cam deformity.[3] This prospective study includes ten patients with cam-femoroacetabular impingement (cam-FAI) who underwent hip preservation surgery including arthroscopy, surgical dislocation, and a mini-arthrotomy. The mean follow-up was 24.5 months. The authors report significant clinical improvement in terms of pain, activities of daily living, sports, and recreational activities over the two years of the study. Additionally, the cartilage and subchondral bone of the hip was assessed using quantitative CT and T1r MRI biomarkers. Although this was a small sample, the authors did observe a decrease in the bone mineral density, suggesting restoration of normal joint mechanics as well as a decrease in T1r values post-operatively. The decrease in T1r values, the authors argue, represents an improvement in the proteoglycan content that could possibly reflect 'healthier' articular cartilage. The authors used the posterosuperior quadrant as an internal reference and were able to show that the T1r values appeared to stabilise in the anterosuperior quadrant post-operatively. This *in vivo* evidence suggests that there was a local process responsible for mechanical overload as opposed to a systemic factor driving the degenerative process of FAI. Change in T1r values appeared to correlate with the clinical improvement noted on the functional scores post-operatively, again with the caveat that this is just ten patients in the report. The reduction in bone mineral density (BMD) in the anterosuperior quadrant was an interesting observation noted post-operatively. As the authors suggest, the increase in BMD in the anterosuperior rim is thought to be due to the early degenerative change but also to the repetitive impact of a cam against the acetabulum. The reduction in the BMD post-operatively would therefore suggest that the abnormal mechanical load had been addressed by the surgical correction. One can only speculate as to whether patients with asymptomatic cams also have an increased BMD in the anterosuperior rim. However, previous studies have suggested that there is a strong correlation between the severity of the cam deformity and the acetabular BMD. Changes in the BMD and proteoglycan content appeared to occur in the same regions of interest, which may further suggest the role of increased BMD (subchondral bone 'stiffening') and cartilage degeneration. Perhaps the increase in BMD relates to the altered biomechanics and the body's attempt to protect the hip from the high compression load applied by the impingement. This is an extremely thought-provoking study that highlights some of the huge advances in articular cartilage imaging in the last few years, and suggests some possible objective evidence on how hip preservation surgery can improve hip biomechanics. There must be some caution exercised in interpreting data on such a small sample size; however, to recruit widespread support for hip preservation surgery, it is this type of objective evidence, along with a durable post-operative clinical improvement, that is needed.

How many cultures to diagnose total hip and knee arthroplasty infections?

■ This is a great paper for all those involved in the diagnosis of infection in the periprosthetic joint. The authors from **Philadelphia, Pennsylvania (USA)** set out to establish how many specimens are required to rule out, or rule in, deep tissue infection effectively.[4] The difficulty, of course, is that as the number of cultures increases, although the sensitivity also increases, so too does the false positive rate. These authors based their paper on 113 consecutive cases of infected total hip and knee arthroplasties. The revisions were known to be infected, and the cultures undertaken at the time of revision surgery form the basis of this report. Overall, 85% of patients (n = 63/74) had a positive culture from samples taken at the time of surgery. The odds of a positive culture from fluid were 75% while the odds of tissue cultures yielding a positive result were 67%. The authors identified the optimal number of cultures needed to yield a positive result as four (but still with limited specificity = 0.61 and sensitivity = 0.63). Increasing the number of samples would increase sensitivity but at the cost of reduced specificity.

Physical activity and the development of cam morphology

■ The exact nature of cam morphology is a puzzle. We all understand from recent papers that cam morphology can be both symptomatic and asymptomatic. Although it is possible to correct with surgical debridement, the long-term benefits (or otherwise) of surgical correction are still poorly understood, as are the causes of cam morphology. Why do some patients have it and others not? Is it genetic or environmental? These authors from **Oxford (UK)** ask whether individuals who participate in intense physical activity in adolescence are predisposed to cam deformity.[5] Their cross-sectional study of 103 male nine- to 18-year-olds, all recruited from a football club academy, aims to assess just this question. The authors undertook a range of assessments including 3-Tesla MRI scans of both hips. The football academy cohort were compared with a control cohort of 107 who did not undertake any regular high-intensity sport. In the sports cohort, the typical findings were of soft-tissue hypertrophy seen in subjects of around ten years of age and located at the femoral head-neck junction. This preceded osseous cam morphology and was seen most commonly at the one o'clock position. Perhaps most convincingly, the authors were able to identify differences in maximum alpha angles depending on the sporting level of the cohort. When comparisons were made between the football academy cohort and with individuals who play no regular sport, alpha angles were 4.0° higher. When compared with those playing at a national or international level, alpha angles jumped to 7.7° higher. There is never likely to be a firm answer to the question of

whether sport causes the cam, which in turn causes arthritis. What is clear from this cohort study, though, is that there is definitely an association between level of sporting activity and the likelihood and size of cam lesion formation. In addition, there is a described evolution in patients in whom a cam lesion is forming, with soft-tissue hypertrophy in the first instance. Both of these observations would support the assertion that heavy activity levels in adolescence are associated with cam lesion formation.

Diagnosis of femoroacetabular impingement and labral tears

Among those who are interested in early adult hip pathology, there has been a longstanding debate about the best way to diagnose both femoroacetabular impingement (FAI) and labral tears. The authors of this systematic review and meta-analysis from **Copenhagen (Denmark)** have set out to establish the state of play of the imaging techniques in diagnosis of both FAI and labral pathology.[6] The authors conducted their review in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure high quality with both search strategy and reporting of the review. The authors searched MEDLINE, CINAHL and EMBASE for reports of diagnostic accuracy in hip joint pathology. The studies were then assessed using the Quality of Diagnostic Accuracy Studies (QUADAS) tool and meta-analysis was undertaken using a random effects model. The study team identified 25 patients with a relatively low risk of bias. The authors' first, and probably most important, finding was that there was a high chance of detecting pathology (pre-test probability) for both FAI (74%) and labral tear (81%). This somewhat limits the applicability of the results as, with such a skewed population, establishing the diagnostic value of each test is difficult. The authors here have commented that, in this setting, positive imaging findings increased the probability that a labral tear existed by a minimal to small degree with MRI, magnetic resonance angiogram (MRA) and ultrasound, but by a moderate degree with computed tomography angiography (CTA). With regard to negative imaging findings, the probability that a labral tear existed was only reduced by a minimal degree with MRI and ultrasound, although by a moderate degree with MRA and CTA. Clearly, imaging does not yet have a gold standard. As these authors point out, the studies that exist on diagnostic accuracy are flawed in that study populations all have a high pre-test probability of having the condition. That said, MRA or CTA are apparently preferable to their non-contrast equivalents.

Five-year follow-up of metal-on-metal *versus* ceramic-on-metal

There is precious little randomised data about metal-on-metal (MoM) bearings, and even less presenting serum metal ion levels. We take our hats off to surgeons in **Christchurch (New Zealand)** who are persevering with the reporting of their randomised controlled trial, which compares MoM and ceramic-on-metal (CoM) bearings.[7] Although initially instigated, presumably, to establish the value of CoM bearings, this pairing has for the most part been entirely ceased in clinical use due to high failure rates. In this five-year report of previously reported data, the authors are able to give contemporary follow-up on 67 of the 83 patients originally recruited. This particular manuscript, however, focuses on the recorded serum cobalt (Co) and chromium (Cr) levels. The authors have established that, in both groups, the cobalt and chromium levels are significantly raised above baseline. Those patients with a MoM articulation had elevated levels of both Co (2.93 µg/l) and Cr (1.85 µg/l) that were higher than in the CoM cohort (Co, 1.16 µg/l; Cr, 1.05 µg/l). The authors note that both of the bearing combinations have been withdrawn. However, they make the valid point that continuing to follow them up (especially in the setting of a lower than expected revision rate in this series) will likely yield valuable information on the best form of clinical surveillance for those patients who did have a CoM articulation.

Posterior bony impingement following arthroplasty

Hip stability is determined by a combination of various well described factors, including implant design, component positioning, implant sizes, and soft-tissue tension. Dislocations can happen due to a variety of underlying aetiologies, some of which are avoidable and some of which are not. There are, however, technical errors and implant design errors that result in bony impingement and subsequent recurrent dislocations following total hip arthroplasty (THA) – a disaster for the patient and surgeon alike. Given the relative frequency of dislocation and the consequences of a dislocating hip, it is surprising how little is written about it and about how best to avoid dislocations. We were delighted to see this paper from **Hiroshima (Japan)**, where the study team aimed to evaluate patients radiologically, and to identify the potential of posterior bony impingement using CT simulations.[8] The authors used virtual CT data from 112 patients, all of whom underwent THA to establish if there were any associations between radiological characteristics and posterior bony impingement. In addition, the simulation was used to establish the range of external rotation, pelvic tilt, and neck/shaft angle. In patients in whom bony impingement was seen, rather than implant impingement, the virtual CT scans demonstrated a lower range of external rotation and a shorter ischiofemoral length. When the effects of pelvic tilt, neck/shaft angle, and femoral offset were taken into account, the authors were able to offer some significant insights into the factors that result in bony impingement. Posterior bony impingement after THA is more likely in patients with a wider ischium and a narrow ischiofemoral space. A high femoral offset and posterior pelvic tilt are also risk factors for this type of impingement.

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