ROUNDUP360

Hip & Pelvis

X-ref *For other Roundups in this issue that cross-reference with Hip & Pelvis see: Trauma Roundups 3 & 7; Research Roundups 2 & 4.*

Dual-mobility components in revision total hip arthroplasty

At the recent American Academy of Orthopaedic Surgeons meeting, there was much coverage of the increasing use of dual-mobility (DM) acetabular components in high-risk primary and revision arthroplasty to reduce the risk of dislocation. This paper from **Cleveland, Ohio (USA)** represents the most up-to-date review of the current literature and is a worthwhile read.[1] Dislocation following total hip arthroplasty (THA) is a common cause for revision surgery, and post-revision dislocation rates as high as 30% have been reported. A number of options to reduce the risk of dislocation are available to the revision hip surgeon, including the use of large femoral heads, constrained liners, and DM components. Early clinical reports have been encouraging for the DM component, which has led to its enthusiastic adoption across the hip community. In essence, the DM implant results in a larger head-to-neck ratio, which results in an increased jump distance with a reduced risk of dislocation. However, new procedures always bring new complications, and the DM is not without its own particular risks, including excessive wear of the polyethylene acetabular liner, higher risk of aseptic loosening, and intraprosthetic dislocation (IPD, i.e. the head disengaging from the polyethylene acetabular liner). This review was based on the results of 693 revision THAs with DM acetabular components in 691 patients, reported across nine studies. The surgical approaches used in these studies included posterolateral, direct lateral, and a combination of approaches, with some studies not specifying what approach was used, which is a little perplexing. Revisions involving cementing DM implants to a well fixed acetabular shell were excluded. The pooled aseptic survivorship was 97.7% and the pooled all-cause survivorship was 94.5% over a weighted mean follow-up of 31 months (10 to 48). In addition, three of the studies reviewed included a comparison with fixed-bearing acetabular components, and DM demonstrated significantly higher all-cause and aseptic survivorship. The pooled dislocation rate was 2.2% (15/693 hips), with six treated with a closed reduction and nine requiring a further revision. IPD occurred in just two hips (0.2%) and both required revision. A meta-analysis comparing DM with fixed bearings revealed that DM had a lower dislocation rate. The most common complication was prosthetic joint infection (PJI) at 3.3%. The prevalence of aseptic loosening was 0.7%, and the overall complication rate for DM was 7.4%, compared with 10.4% for the fixed-bearing group. Clinical outcomes were also encouraging, with a mean improvement in the Harris Hip score of 34, with two out of three studies reporting a statistically significant improvement in the Harris Hip Score. Other clinical outcome scores quoted in other studies, including the 12-Item Short-Form Health Survey (SF-12) mental and physical components, also reported similar improvements. From this review of the current literature, it would appear that the newer generation of DM components have overcome the concerns of excessive wear of the acetabular liner, of increased risk of aseptic loosening, and of the risk of IPD. There is good evidence that DM can reduce the risk of dislocation when compared with fixed-bearing revisions, and that it has a lower risk of complication. However, as the authors highlight, there is a need for a prospective, randomized controlled trial comparing DM with fixed-bearing implants. Ideally, this would include a cost analysis, as the DM implants are significantly more expensive.

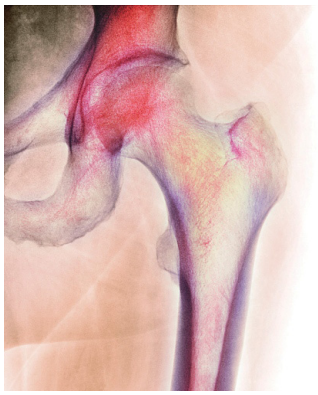
Trabecular metal and risks of revision in the National Joint Registry

Due to an ageing population and an increasing number of patients having total hip arthroplasties (THA), the number of revision operations is increasing. Trabecular metal (TM) implants have been with us for a while, and tantalum-coated implants in particular have become increasingly the 'go to' implant in revision acetabular surgery. Tantalum trabecular metal has a number of advantages, including a high porosity, a high coefficient of friction, a similar modulus of elasticity as cancellous bone, and an increased potential for osseointegration and increased strength of fixation compared with other implants. There have been a number of encouraging studies to date reporting the benefits of TM; however, these have often been single centre cohorts with no comparator group, and are often based purely around acetabular revision. The authors of this retrospective study from **Oxford (UK)** used National Joint Registry (NJR) data to compare the re-revision rates for all causes, aseptic loosening, and infection between TM- and non-TM-coated acetabular components in the revision setting.[2] The internal geometry between the TM and non-TM acetabular components were the same. The only difference between the two components was the coating. The authors used propensity-score matching to allow a more accurate assessment of the effect of the acetabular component coating on the risk of re-revision surgery. From a total of 11 988 revision THAs, the authors identified a final matched cohort of 3862 cases, with 1931 hips in both the TM group (1707 TM Modular and 224 Continuum components) and the non-TM group (1717 Trilogy and 214 Trilogy IT implants). There were a total of 285 hips (7.4%) that underwent an all-cause re-revision operation of any component at a mean follow-up of 2.3 years (1 day to 9.5 years). There were 758 deaths (19.6%) and the mean follow-up for the remaining 2819 hips not undergoing re-revision was 6.1 years (1 to 12.7). The six-year cumulative rate of survival, free from all-cause acetabular re-revision, was 97.2% for revision THA in which TM coatings were used *versus* 96.9% for

revision THA with non-TM coatings. The TM coatings had a 9% reduced relative risk of all-cause acetabular re-revision compared with non-TM-coated implants; however, this difference was not significant. The six-year cumulative implant re-revision free survival for aseptic loosening was 98.8% in the TM group compared with 99.1% in the non-TM group. The cumulative re-revision rate for infection was also similar between the two groups, as was the re-revision rate of revisions initially performed for infection. This is the largest study of its type to assess the outcomes of TM implants used in revision THA against a matched control group with acetabular components made by the same implant manufacturer. The outcomes for TM and non-TM components were very similar. The potential benefits of TM-coated implants identified in previous studies was not reproduced in this study. This is perhaps due to the follow-up period being only six years, and it may be that a difference between the two groups becomes evident with longer follow-up. The authors also highlight a major flaw in this study, in that the severity of the acetabular bone loss was not identified, as this is not recorded on the NJR registry. It is possible that TM-coated implants were used in patients with more severe acetabular defects and the non-TM-coated implants were reserved for the less severe defects. This could clearly have a significant impact on the studies' findings and also highlights the difficulty of using NJR data. In summary, while the outcomes were very encouraging for TM implants, further evidence is needed, especially as TM-coated implants can be up to 30% more expensive than non-TM-coated implants.

Repeat two-stage exchange arthroplasty for prosthetic hip re-infection

■ Prosthetic joint infection (PJI) is a devastating complication for patients and surgeons alike. With the risk of recurrence of infection reported at



being between 6% and 26% of cases following two-stage revision total hip arthroplasty (THA) even this gold standard is not perfect, and there is not much research to base treatment decisions on when a two-stage revision fails. Options in the case of recurrence include debridement and implant retention with a further course of antibiotics, repeat revision THA (one or two stages), chronic suppression with antibiotics, or, in the worst case scenario, either excision arthroplasty or amputation. This is the most recent study from the Mayo Clinic in **Rochester, Minnesota (USA)** that sets out to examine and report the outcomes of repeat two-stage revision THA, as well as aiming to determine the usefulness of the McPherson staging system in predicting clinical success following a repeat two-stage revision.[3] The McPherson staging system categorizes patients with PJI by infection type, host status, and local soft-tissue status. In common with many reports of re-revision for infection, this paper is based on a small number of 19 patients with a failed two-stage revision. The mean age of the patients was 60 years (30 to 85), and all of whom underwent a repeat two-stage revision THA for PJI with a mean follow-up of 5.4 years (0.8 to 10.8). Successful eradication of infection was assumed if no further operation was needed for PJI. Interestingly, chronic antibiotic suppression was used prophylactically in 13 patients (68%), although the authors did not consider this a failure. At the time of the first stage, a static antibiotic spacer was used in 12 hips, an articulating spacer was used in six hips, and one hip was left without a spacer. The antibiotic spacers used a standardized protocol of 3 g vancomycin and 3.6 g gentamicin per batch of cement. In most cases, the organisms identified as the cause of the PJI were Gram-positive and in eight cases, a new organism was cultured either on its own or in combination with those previously cultured. The interval between the first and second stages was 22 weeks (7 to 81), depending on the patient's comorbidities and the surgeon's preference, with an average of six weeks' antibiotics between stages (6 to 12). At the second stage, intraoperative samples were taken for a frozen section procedure and three to five deep tissue samples were taken for microbiology. Two patients unexpectedly had positive samples for infection and were subsequently treated with chronic antibiotic suppression postoperatively. Of the 19 patients, 14 underwent reoperation, including four who had debridement with implant retention, six who underwent revision, and four who had resection arthroplasty. There was a two-year implant survival of 74% and a five-year survival of 45%, with the endpoint being revision. Eight patients had revisions for failure to control infection, four hips had conversion to dual mobility/constrained acetabular liner for hip instability, one hip required revision to a total femoral arthroplasty for aseptic loosening, and one hip required revision to a custom Triflange implant for aseptic acetabular loosening. At the time of final follow-up, 14 patients (74%) required a walking stick or frame and two (11%) were wheelchair-bound. This paper makes for difficult reading. While the treatment of an original PJI is challenging, the outcomes for a repeat two-stage revision are pretty bleak. This is even when you consider that the patients included in the study were the 'good' candidates for a repeat two-stage revision, suggesting that the results could have been even worse. In contrast to the overall rate of infection-free implant survival, which is reported to be over 90% following two-stage revision for an original infection, this series reports 45% survival at five years for a repeat two-stage revision. Patients clearly need to be carefully counselled about the high rate of failure should they find themselves in this position. The authors add that, when it comes to options following re-infection, an honest discussion needs to be had with patients who have significant medical and limb compromise, as further attempts to eradicate infection with a two-stage revision are unlikely to work. Salvage procedures such as joint excision may be a pragmatic option. It is clear that these complex patients need to be managed in an appropriate tertiary referral centre with an established practice in managing PJI, and with the involvement of an experienced multidisciplinary team.

Reverse hybrid total hip arthroplasty

■ A reverse hybrid total hip arthroplasty (THA) is rarely performed, representing just 2.5% of all THAs recorded by the National Joint Registry (NJR) for England and Wales, and with a similar picture presented by other registries across the world. The authors of this study from **Leeds (UK)** extol the virtues of a cemented acetabular component and a cementless femoral stem.[4] They suggest that cemented all-polyethylene acetabular components have excellent rates of long-term survival, are inexpensive, allow local antibiotic delivery in the cement, and provide a reliable method of fixing the acetebular component to osteoporotic or pathological bone. The argument goes that a cementless stem allows for a shorter operating time, avoids the risk of bone cement implantation syndrome, and has proven long-term survival in young patients. Given the evidence of low rates of revision for a reverse hybrid THA, the authors set out to review the effect of age, gender, femoral head size, and surgeon grade

on implant survival in this retrospective study of 1082 cases. A reverse hybrid THA was performed in patients with a mean age of 69.2 years (21 to 94) and with a mean follow-up of 8.2 years (5 to 11.3). All patients had a Corail cementless femoral stem with either an Elite, ultra-high molecular weight polyethylene (UHMWPE) or a Marathon, cross-linked polyethylene (XLPE) flanged acetabular component (all manufactured by DePuy Synthes). Ten-year survival was reported at 97.2%, with revision for any reason as the endpoint. The commonest indication for revision was dislocation (1.1%), followed by infection (0.4%), postoperative femoral periprosthetic fracture (0.3%), leg-length discrepancy (0.1%), and femoral perforation (0.1%). None of the acetabular components required revision for aseptic loosening, whereas four femoral stems had aseptic loosening and were revised at a mean follow-up of 2.5 years. Three of these stems were collared and migrated into a varus position. There was no difference in overall survival according to age, gender, head size, or surgeon grade for stem revision for aseptic loosening. However, patients under 60 years were more likely to undergo stem revision for aseptic loosening than patients over the age of 60 years. Radiological analysis was available for 1050 THAs at a mean follow-up of 6.6 years. Overall, radiolucent lines were present in 118 hips, 82 on the acetabular side and 36 on the femoral side. This study is worthy of comment as it represents the largest consecutive series of reverse hybrid THA at medium-term follow-up, and presents some very good outcomes irrespective of age, gender, femoral head size, and grade of surgeon. There was evidence of radiolucent lines around the acetabular component in 7.6% of hips, but only those associated with infection showed evidence of progression. The authors attributed their excellent results to high-volume surgery, robust training in the surgical technique, advances in the manufacturing of polyethylene, changes in implant design, and the use of modern-generation cementing techniques in the case of the acetabular component. It is interesting to note that uncemented acetabular components currently represent 62.5% of all THAs recorded on the NJR, despite their increased expense and little evidence that they have superior outcomes compared with cemented acetabular components in the long term. While there was no late aseptic femoral stem failures, there were some early stem failures, which the authors put down to undersizing of the femur resulting in failure of osseointegration. Dislocation was the most common complication in this series, although none occurred in patients with femoral head sizes greater than 32 mm. This led to the authors recommending the use of 32 mm heads based on registry data, in order to increase hip stability and reduce the risk of revision for dislocation. To date, there has not been shown to be an increase in wear or osteolysis when using a 32 mm head as opposed to a 28 mm when using crosslinked polyethylene. On the basis of their findings, the authors were able to recommend a reverse hybrid THA as an alternative to the more conventional combinations of implant fixation in THA. However, they emphasized the importance of meticulous surgical technique regarding the cementing of the acetabular component and sizing of the femoral stem. This can help to avoid metaphyseal/diaphyseal mismatch, which may result in oversizing or undersizing and lead to early failure or complications.

The effect of preoperative administration of intravenous tranexamic acid during revision hip arthroplasty: a retrospective study

By now, most arthroplasty surgeons are using tranexamic acid (TXA) in all primary and revision arthroplasty cases, and previous issues of *360* are replete with articles concerning the use of tranexamic acid in almost every single surgical indication. Although these papers come in various shapes and sizes in terms of research question, methodology, and sample size, they all unerringly come to the same conclusion: TXA reduces intraoperative and perioperative blood loss. Despite the relative wealth of articles surrounding TXA use, the overwhelming majority concern primary joint arthroplasty, and there is relatively little published work concerning revision surgery. The authors of this paper from **Toronto (Canada)** have contributed much to the debate by publishing their own large series of patients undergoing revision total hip arthroplasty (THA), and the results make for encouraging reading.[5] Although retrospective, this series of just over a 1000 cases undertaken over an eight-year period included 634 patients suitable for inclusion in the study, of whom 232 had tranexamic acid and 402 did not. The authors subdivided the cohort into four subgroups depending on components exchanged (both, stem, acetabulum, or liner exchanges). Outcomes were assessed as blood loss and transfusion requirements. The authors report that in all subgroups and in the whole study population, there was a significant reduction in blood loss when TXA was administered. As would be expected when the complexity of surgery was taken into account, the decrease in estimated intraoperative blood loss was greatest when a complete revision was undertaken (845 ml *vs* 1095 ml), and this was mirrored in the postoperative drop in haemoglobin. In all groups, perioperative blood transfusion was reduced in all revisions treated with tranexamic acid, although the magnitude of this difference varied with the complexity of surgery. Patients undergoing revision of both components (1.79 units *vs* 3.33 units) benefitted more from TXA than those undergoing femoral revision (0.97 units *vs* 2.25 units), acetabular revision (0.73 units *vs* 1.72 units), or head and liner exchange (0.15 units *vs* 0.89 units). This study demonstrated that TXA is also effective in revision THA cases for all case complexities (polyethylene exchange, femoral component, acetabular component, and both components). Thus, TXA should be utilized as standard of care in all revision hip arthroplasty cases when possible, in order to decrease blood loss and transfusion rates.

Blood glucose and infection

There has been much focus on haemoglobin A1C (HbA1C) and postoperative complications in recent years, although most of the literature is published in anaesthetic journals. It appears that there is little in the way of consensus in the literature surrounding the benefits or otherwise of using perioperative HbA1C to stratify risks of complications, with as many answers to the value as there are papers. The majority of meta-analyses on the topic are similarly unclear. However, it is evident that diabetes itself is associated with poorer postoperative outcomes in almost any surgical intervention one chooses to name, and almost any outcome measure. A group in **Philadelphia, Pennsylvania (USA)** have set out to establish the value of postoperative glucose levels.[6] With the hypothesis that failure of glucose control when physiologically stressed may explain the variation in outcomes seen between diabetics and non-diabetic patients, the authors of this series of nearly 25 000 patients undergoing arthroplasty have explored any association very thoroughly. The authors examined the association between the immediate postoperative blood glucose levels and the incidence of prosthetic joint infection. They then went on to perform a fairly comprehensive multivariable analysis on any apparently relevant covariates. Their follow-up was to a year for over 13 000 participants. The take-home message from this study was that the rate of prosthetic joint infection increased linearly when immediate postoperative blood glucose levels exceeded ⩾ 115 mg/dl.

The more refined multivariable analysis revealed that blood glucose levels were still significantly associated with prosthetic joint infection even when potential confounders were taken into account. Overall, the prosthetic joint infection rate was 1.59%, which equated to 2.39% in diabetics *versus* 1.46% in non-diabetics. While the diabetic thresholds for safe surgery in terms of HbA1C and serum glucose levels are still very much debated, most surgeons do not look closely at perioperative glucose levels. Since increased glucose levels can predispose patients to infection, this study very much holds together. The finding that 137 mg/dl was the 'threshold' for postoperative infection risk highlights the importance of emphasis on prosthetic joint infection.

Depression and patient-reported outcome measures in arthroplasty X-ref

■ In the day and age of 'payment by results' and surgeon-specific outcomes, what our patients think of our interventions has become arguably more important than what we ourselves think about how successful our treatments are. Generally speaking, it is felt that patient-reported outcomes (PROMs) are more objective and more suitable to determine outcomes than surgeon-reported measures. A research team in **Farmington, Connecticut (USA)** have undertaken a large study using their own institutional database of patients who had undergone a joint arthroplasty. In this series, patients were included who had a minimum of a year's follow-up and had available Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and 12-Item Short-Form Health Survey (SF-12) scores. The authors used the answers to their SF-12 mental component score (SF-12MC) to stratify patients by the presence of depression on their preoperative baseline scores and compared them with scores at four and 12 months postoperatively. The authors established that patients with depression but a healthy SF-12MC reported outcomes that were similar to the non-depressed group. However, patients with an overall poor mental health baseline score reported poor overall scores. As we are using more and more PROMs, we are coming to understand their strengths and limitations a little more. It is clear that, as well as performance of the surgeon, surgery, and hospital experience, patient factors are at play when a PROM is administered. Understanding these is essential, as we put our trust more and more in PROMs to evaluate our interventions. It certainly seems sensible to assess specific PROMs in combination with a mental health baseline questionnaire.

REFERENCES

1. Levin JM, Sultan AA, O'Donnell JA, et al. Modern dual-mobility cups in revision total hip arthroplasty: a systematic review and meta-analysis. *J Arthroplasty* 2018. Epub ahead of print (PMID: 30195654).

2. Matharu GS, Judge A, Murray DW, Pandit HG. Trabecular metal versus non-trabecular metal acetabular components and the risk of re-revision following revision total hip arthroplasty: a propensity score-matched study from the National Joint Registry for England and Wales. *J Bone Joint Surg [Am]* 2018;100-A:1132-1140.

3. Brown TS, Fehring KA, Ollivier M, et al. Repeat two-stage exchange arthroplasty for prosthetic hip re-infection. *Bone Joint J* 2018;100-B:1157-1161.

4. Jain S, Magra M, Dube B, et al. Reverse hybrid total hip arthroplasty. *Bone Joint J* 2018;100-B:1010-1017.

5. Peck J, Kepecs DM, Mei B, et al. The effect of preoperative administration of intravenous tranexamic acid during revision hip arthroplasty: a retrospective study. *J Bone Joint Surg [Am]* 2018;100-A:1509-1516.

6. Kheir MM, Tan TL, Kheir M, Maltenfort MG, Chen AF. Postoperative blood glucose levels predict infection after total joint arthroplasty. *J Bone Joint Surg [Am]* 2018;100-A:1423-1431.

7. Halawi MJ, Cote MP, Singh H, et al. The effect of depression on patient-reported outcomes after total joint arthroplasty is modulated by baseline mental health: a registry study. *J Bone Joint Surg [Am]* 2018;100-A:1735-1741.

Knee

***X-ref** For other Roundups in this issue that cross-reference with Knee see: Hip & Pelvis Roundup 7; Children's orthopaedics Roundup 6; Research Roundup 2.*

Persistent opioid use can signify mischief

■ Chronic opioid use has been identified as a risk factor associated with poor postoperative outcomes following total knee arthroplasty (TKA). Despite the widely reported relative success of TKA in providing pain relief and improvements to quality of life, postoperative opioid use continues to be a challenge to surgeons and patients alike. There has been much focus in the United States on what is being termed 'the opioid epidemic', with widespread opioid-seeking behaviour a concern among surgeons. However, opioid use is not always dependence-driven, and some consider opioid use as a surrogate for pain, providing early identification of a patient at risk for revision. In this paper from **Adelaide (Australia)**, the authors set out to evaluate the risk of one-year and five-year revision, as well as investigating whether they are associated with prolonged use of opioids in the year following TKA.[1] Using a single joint arthroplasty registry from one integrated healthcare system that covers over ten million patients, the authors identified 24 105 TKAs undertaken between 2008 and 2011. Cumulative daily amount of oral and transdermal opioids (oral morphine equivalents; OMEs) was calculated over a 360-day period following surgery. The postoperative period was divided into four 90-day periods for further analysis. The primary endpoint for the purposes of this study was registry-recorded aseptic revision surgery at one and five years postoperatively. In total, 155 TKAs (0.6%) were revised within one year of surgery and 377 TKAs (1.6%) were revised within five years. In the first 90 days following surgery, over 93% of all patients utilized opioid medications. There was only a slight increase in opioid use at any time in the 360 postoperative days between those revised within one year (95.5%) and those not revised (93.6%). From 90 days postoperatively onwards, patients taking opioids were consistently at a higher risk of five-year revision than those not taking any opioids. There also appeared to be a dose-response association between total opioid use and revision. In this paper, medium-high OME (210 mg to 539 mg) and high OME (≥ 540 mg) were associated with a 432% and 606% increased risk of revision, respectively. Although not specifically highlighted in this manuscript, 59.7% of non-revised patients were preoperative opioid users (defined by any opioid use within the year prior to surgery), while 71.6% of those revised within one year were preoperative opioid users. This study highlights the importance of both patient selection and monitoring postoperative opioid use, particularly beyond the 90-day postoperative mark.

Cementless TKA is OK in osteonecrosis

■ Interest in uncemented total knee arthroplasty (TKA) designs has grown considerably in recent years. The proposed benefits of using cementless TKA designs include: shorter operating time,