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,

preservation of bone stock, ease of revision, and avoidance of cement-related complications (i.e. third body wear). Many are sceptical that press-fit uncemented fixation may be inadequate when compared with the historically successful and dependable cemented designs, which are known to provide a durable and stable reconstruction able to withstand the high stresses endured by the joint. The success of uncemented femoral components has been difficult to replicate in the knee, probably due to the purely metaphyseal and 'resurfacing' nature of the implants. However, the development of new porous biomaterials, improvements in component designs, instrumentation, and operative technique all lend themselves to reinvestigating cementless designs that may offer increased longevity, particularly when used in younger patients. Concerns, however, still remain, especially in patients in whom osseointegration may be impaired, such as those with osteonecrosis. Authors from **Cleveland, Ohio (USA)** retrospectively evaluated 46 patients who underwent 49 primary cementless posterior-stabilized TKAs for osteonecrosis between 2008 and 2014.[2] All TKAs were performed using one cementless knee system manufactured by Stryker Orthopaedics. Range of movement, Knee Society pain and function scores, complications, and radiographs were evaluated as outcome measures postoperatively at four to six weeks, three months, one year, and yearly thereafter (with a mean follow-up of 44 months). At final follow-up, the authors reported a mean Knee Society pain score of 93 points, while the function score was on average slightly lower, at 84 points. The patients achieved a good average range of movement from 2° extension to 124° flexion. Aseptic implant survivorship was impressive at 97.9%, and an all-cause implant survivorship was reported at 95.9%. Two TKAs required revision: one case of methicillin-resistant *Staphylococcus aureus* (MRSA) prosthetic joint infection requiring a two-staged revision, and a single case of aseptic tibial baseplate loosening. In addition to the two revisions, one patient developed wound necrosis three weeks postoperatively. Aside from the two patients who underwent revision, there were no other cases showing any radiological abnormalities related to the prostheses at final follow-up. Despite the small sample size and very short-term follow-up reported in this study, the results appear to generally be quite promising. Even in a population of osteonecrotic knees, which potentially have single or multiple foci of subchondral dead bone undermining the osseointegration capacity, all-cause survival was 95.9% at a mean follow-up of 44 months. It is imperative that these patients, and all others receiving cementless TKAs, continue to be followed long-term to determine the safety and efficacy of these designs.

Cementless Oxford unicompartmental knee arthroplasty at 1000

Perhaps the one thing more controversial in knee arthroplasty than the unicompartmental knee itself is the cementless variants. There have been some early reports of the cementless Oxford medial unicondylar knee arthroplasty (UKA), which have shown that the survival and clinical outcomes were similar to the cemented Oxford UKA. This is encouraging, given the slight concern over radiolucent lines in the cemented variants. However, longer-term data is needed before more widespread use can be encouraged. In the introduction of this paper from **Oxford (UK)**, the authors highlight the results of two randomized controlled trials, which revealed that the cementless UKA was found to have fewer radiolucent lines around the tibial component, as well as a faster surgical time.[3] While the radiolucent lines seen in cemented UKA have not been shown

to be associated with poor outcome or tibial loosening, they could be seen in some centres as a reason to revise the components. What is desperately needed here is longer-term data, and this study reports on the ten-year survival of 1000 consecutive knees implanted by designer and non-designer surgeons. The indications for a UKA in this series included medial compartment osteoarthritis (OA), which could also include chondrocalcinosis or patellofemoral arthritis. Severe lateral compartment OA, frail, absent, or reconstructed anterior cruciate ligament, or a previous high tibial osteotomy were excluded. This series reports 1000 cementless Oxford UKA's implanted in 865 patients with a mean age of 65.9 years (35 to 94). Some patients were inevitably lost to follow-up but 858 cases had a minimum follow-up of five years and 124 had a minimum follow-up of ten years, with an overall mean follow-up of seven years. The ten-year survival was reported as 96.8% considering revisions for any cause. Encouragingly, there was no difference in the survival rate for the designer and non-designer surgeons. With conversion to a total knee arthroplasty (TKA) as the endpoint, the ten-year survival was 98.4, with 25 revisions in total. The most common cause for revision was arthritis in the lateral compartment, as well as bearing dislocation, tibial plateau fractures, and tibial component loosening. In terms of clinical outcomes, 88% of patients were classified as achieving a good or excellent clinical outcome based on the Oxford Knee score at a mean follow-up of seven years and the postoperative scores appeared to change very little with time. In addition, the results appeared to support the use of a cementless UKA in patients regardless of age and bone quality. There was no difference in survival and clinical outcome compared with the more conventional cemented UKAs. Previously, there has been some concern about tibial or femoral loosening. There were no definite cases in this study, but two cases of revision because of concern regarding tibial fixation. The first revision was due to poor seating of the tibial component because the keel slot was not deep enough, and the second case was due to tibial loosening. Tibial fracture was attributed to the learning curve and modifications to the technique have been introduced to reduce this problem. Tibial re-cutting, a medial sagittal cut, a deep tibial resection, and posterior cortical damage during the vertical tibial cut or preparing the keel slot should be avoided. The surgeons performing the cases included in this study were high-volume users of the Oxford UKA and were well-experienced in the surgical technique and selecting appropriate patients. In the hands of an appropriately experienced surgeon, excellent outcomes can be achieved following a cementless Oxford UKA, but it is perhaps not appropriate for the occasional user.

Edoxaban to prevent deep vein thromboembolism in patients with total knee arthroplasty: a randomized trial

Stepping into the already-crowded market for thromboembolic prophylaxis in orthopaedic surgery, this randomized trial from **Kobe (Japan)** caught our eyes here at 360.[4] The authors designed a study with the aim of establishing

what the best administration duration was for edoxaban (one of the newer factor Xa inhibitors). The authors report a 202-patient randomized trial of edoxaban administration. Patients were randomized to either one week or two weeks of postoperative prophylaxisis. All of the patients underwent a single total knee arthroplasty (TKA) at a single institution during 2014 or 2015. The patients were then treated with edoxaban for either a week (n = 93) or two weeks (n = 109). All of the patients underwent ultrasounds at seven and 14 days to assess for the incidence of deep vein thrombosis (DVT) and patients all received 15 mg of edoxaban. Unusually, for such a small study, the authors found a significant difference between the groups, with a higher rate of DVT in the single-week administration group (n = 7/93) *versus* the two-week administration group (n = 0). The authors point out that six patients had to withdraw due to hepatic dysfunction (2.9%). Set against the findings that no patients had a clinically symptomatic DVT, this leads us right back to the same old problem where, due to the lack of suitably powered studies, we are left trying to draw inferences about the clinical relevance of DVT trials that use surrogate outcome measures. Although the study is probably short on power – despite the design of Doppler ultrasound as a surrogate endpoint for clinically relevant DVT, this is not as sensitive as venography, where clinical relevance is questionable – it is of interest for those planning to use extended thromboprophylaxis. It seems that stopping at a week may be too soon, certainly with the Xa inhibitors. Various methods for administering coagulation inhibitory substances, including edoxaban, have been tried to reduce those at risk for deep venous thrombosis after artificial joint arthroplasty surgery. This study showed an appropriate administration period of edoxaban.

Computer-assisted knee arthroplasty under the trial spotlight

■ Navigation has been vexing orthopaedic surgeons and orthopaedic researchers for a number of years now. It sounds like an attractive option to have the computer assist in the placement of the implant, position of the cuts, and essentially provide feedback on surgery. Computer navigation is just that, like a GPS system for joint arthroplasty. Robotic surgery (either constrained or active) is a different kettle of fish, as the machine actively undertakes the surgery. In one of the few randomized controlled trials on augmented joint arthroplasty, surgeons from **Bergen (Norway)** set out to establish the benefits, or otherwise, of computer-assisted total knee arthroplasty.[5] The authors present the short-term (two-year) clinical and radiological results of this trial. In this well-designed randomized controlled trial, the authors allocated 190 patients to either computer-assisted or conventional total knee arthroplasty. At the primary outcome point of two years, there were 172 patients (a remarkable 97%) available for follow-up. Outcomes were assessed with a variety of patient-reported outcome measures (PROMs) including Knee Injury and Osteoarthritis Outcome Score (KOOS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Knee Society Score (KSS), visual analogue scale (VAS), and EuroQol-5 Dimensions (EQ-5D). The radiological outcomes were also reported and the OMERACT (Outcome Measures in Rheumatology-Osteoarthritis Research Society International) criteria, which are an agreed core outcome set for orthopaedic surgery, were followed. While it was not possible to blind the surgeon to the intervention, both patients and outcome assessors were blinded to the treatment allocation. Although the results of this study are encouraging, they are not definitive from the perspective of computer-guided knee arthroplasty. There were no differences in the overall PROMs score; however, the authors report a superior mean improvement in two subscales of the KOOS (7.4 for symptoms and 16.2 for sport and recreation) and on a single subscale of the WOMAC (8.8 for stiffness). There was also significantly more 'high' responders in the guidance group than the conventional group (82.8% *vs* 68.8%). While this is encouraging in terms of the potential benefits of computer guidance for this surgery, the results should be interpreted with caution as selecting individual subscales that happen to be 'positive' from the scores is highly likely to introduce a type 1 error.

Projected volume of primary total joint arthroplasty in the United States, 2014 to 2030

■ As the population ages, it is anticipated that the volume of total joint arthroplasty procedures will increase with time. Bearing in mind that it takes 20 years to train an orthopaedic surgeon, having an accurate estimate for future capacity requirements is essential. However, older predictions stated that the growth would be astronomical, which has not turned out to be reflected in the actual joint arthroplasty burden. This updated prediction from **Philadelphia, Pennsylvania (USA)** uses Nationwide Inpatient Sample (NIS) data to predict an increase in total hip arthroplasty of 71% and an increase in total knee arthroplasty by 85% between 2014 and 2030, which are much more reasonable estimates given the current forecasts.[6] Changes in inpatient *versus* outpatient coding and payments may change these numbers somewhat in the future; however, this study does provide groundwork for baseline values going forward.

Infected total knee arthroplasty with extensor mechanism disruption

■ There is almost no end to the misery that can be a chronically infected total knee arthroplasty (TKA). One of the most significant functional deficits can be the impairment of the extensor mechanism. Repeated surgery in the presence of infection can result in excessive scarring, iatrogenic injury, and rupture secondary to chronically infected soft tissues. Loss of the extensor mechanism itself is, of course, a significant functional issue. As there are more and more projected prosthetic joint infections (PJIs) over time, extensor mechanism repairs may become more common. Currently, experience is sparse and, for most revision surgeons, the prospect of a two-stage revision and an extensor mechanism repair is one that does add a certain amount of trepidation before undertaking the procedure. The surgeons at the Mayo Clinic in **Rochester, Minnesota (USA)** have been able to share a reasonable number of cases operated over a few years.[7] Their report of 16 patients over a 15-year period who underwent a two-stage revision in combination with a Marlex-mesh reconstruction remains one of the few publications concerning two-stage revision and synchronous extensor mechanism repair. The authors were able to report all 16 patients to an average of four years' follow-up. In all cases, the PJI was diagnosed on the basis of the Musculoskeletal Infection Society (MSIS) criteria. Clinical outcomes, including survivorship, Knee Society Score (KSS) results, and complications, were assessed. Overall, 13 of the 16 total knees were still implanted and functioning at the final follow-up, giving an overall survival of two years at 75%, with both mesh survival and infection-free survival sitting at 86%. Clinical results were respectable, with the abolition of the extensor lag and improvement in the KSS from 48 to 74 after mesh reconstruction and reimplantation. Surgeons are often wary to implant mesh for fear of increased infection risk. However, this study with an average of four years' follow-up (2 to 8) demonstrates high survivorship rates without infection. Thus,

Marlex-mesh reconstruction should be considered in extensor mechanism deficient patients undergoing two-stage exchange arthroplasty for PJI.

Failure after modern total knee arthroplasty: a prospective study of 18 065 knees

As reported in this issue of *360*, the number of total knee arthroplasties (TKAs) per year is projected to reach three million in the United States by 2030. With the predicted increase in primary TKAs performed, this will inevitably lead to an increase in TKA failures and subsequent revisions. The main reasons identified for TKA failure include infection, aseptic loosening, instability, polyethylene wear, stiffness, and patellofemoral complications. Unfortunately, this data is drawn from large registry databases that often do not account for incomplete patient follow-up and have relatively low data fidelity. The authors of this paper from **New York, New York (USA)** have used a large single-institution database that prospectively collected demographic and clinical data for patients who underwent primary TKA during a five-year period from May 2007 to December 2012.[8] The authors of this paper describe a total of 18 065 primary TKAs in 16 083 patients. A total of 405 knees (2.24% revision rate) in 400 patients went on to fail and require implant revision surgery. Over 85% of the revisions described were attributed to infection, instability, aseptic loosening, or stiffness. Factors that increased the risk for TKA revision included a younger age, a history of drug abuse, use of a constrained design, bilateral primary TKAs, and an original diagnosis of post-traumatic osteoarthritis. Interestingly, commonly indicated risks like body mass index, gender, or Charlson Comorbidity Index were not related to risk for failure in this study. It has become clear that reasons for revision TKA are changing. Historically, device-related failure due to polyethylene wear and osteolysis were much more common. It appears that modern improvements in material processing and sterilization have successfully reduced these complications and, as described by this series and others, infection is moving to the forefront. Our focus must turn to mitigating infection risk, as this is one of the most devastating indications for revision TKA.

Revision total knee arthroplasty for prosthetic joint infection

Prosthetic joint infection (PJI) following total knee arthroplasty (TKA) is an extremely challenging clinical scenario. Revision TKA, whatever the indication is known to be, is associated with increased short-term complications over primary TKA, such as urinary tract infection, respiratory failure, and re-admission. However, the short-term complications specifically associated with TKA revisions for PJI are not well-described. Authors of this paper from **New York, New York (USA)** utilized data from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database to determine short-term complications and re-admission rates for revision TKA for PJI, relative to primary TKA, and revision TKA for all other indications.[9] A total of 162 981 patients formed the population for this study and they all underwent a primary TKA. A further 10 584 underwent revision TKA for all non-PJI indications, and 2196 underwent revision TKA for PJI. The overall complication rate was nearly double for all revision TKAs (both non-PJI and PJI) compared with primary TKAs, and the complication rate for revision TKAs for PJI was almost triple the rate for non-PJI revisions. Patients undergoing revision for PJI were at increased risk of any complication, death, respiratory complications, renal complications, sepsis, deep surgical site infection, blood transfusions, non-home discharge, and hospital re-admissions relative to non-PJI revisions. Operative time and postoperative length of stay (LOS) was also significantly longer for PJI revisions than non-PJI revisions (+3.7 minutes; +2.1 days). Results of this study confirm the increased risk of complications for all revision TKAs, but also highlight the substantial risks specific to revision TKAs for PJI.

REFERENCES

1. Namba RS, Inacio MCS, Pratt NL, et al. Persistent opioid use following total knee arthroplasty: a signal for close surveillance. *J Arthroplasty* 2018;33:331-336.

2. Sultan AA, Khlopas A, Sodhi N, et al. Cementless total knee arthroplasty in knee osteonecrosis demonstrated excellent survivorship and outcomes at three-year minimum follow-up. *J Arthroplasty* 2018;33:761-765.

3. Campi S, Pandit H, Hooper G, et al. Ten-year survival and seven-year functional results of cementless Oxford unicompartmental knee replacement: A prospective consecutive series of our first 1000 cases. *Knee* 2018;18:30585-4. (Epub ahead of print) PMID: 30150067.

4. Ishida K, Shibanuma N, Kodato K, et al. A prospective randomized comparative study to determine appropriate edoxaban administration period, to prevent deep vein thromboembolism in patients with total knee arthroplasty. *J Orthop Sci* 2018. (Epub ahead of print).

5. Petursson G, Fenstad AM, Gøthesen Ø, et al. Computer-assisted compared with conventional total knee replacement: a multicenter parallel-group randomized controlled trial. *J Bone Joint Surg [Am]* 2018;100-A:1265-1274.

6. Sloan M, Premkumar A, Sheth NP. Projected volume of primary total joint arthroplasty in the U.S., 2014 to 2030. *J Bone Joint Surg [Am]* 2018;100-A:1455-1460.

7. Perry KI, Salib CG, Larson DR, et al. Two-stage exchange and Marlex-Mesh reconstruction for infection with extensor mechanism disruption after total knee arthroplasty. *J Bone Joint Surg [Am]* 2018;100-A:1482-1489.

8. Pitta M, Esposito CI, Li Z, et al. Failure after modern total knee arthroplasty: a prospective study of 18,065 knees. *J Arthroplasty* 2018;33:407-414.

9. Boddapati V, Fu MC, Mayman DJ, et al. Revision total knee arthroplasty for periprosthetic joint infection is associated with increased postoperative morbidity and mortality relative to noninfectious revisions. *J Arthroplasty* 2018;33:521-526.

Sports

Hip arthroscopy outcomes and return to play or duty

There has been a renewed interest in outcomes and return to play following hip arthroscopy, particularly after treatment of femoroacetabular impingement (FAI), and this is only set to continue with the publication of the first large randomized trial demonstrating improved outcomes from **Coventry (UK)**.[1] The authors highlight improved outcome *versus* physiotherapy in terms of functional outcomes, and several more trials are due to report shortly. The findings of the FASHION study are at odds with a recent randomized controlled trial that demonstrated similar outcomes in patients undergoing arthroscopy compared with those treated with physical therapy alone. These investigators from **Texas (USA)** screened 104 eligible patients, 80 of whom went on to participate in the study.[2] This study focused on highly active patients with over 90% current active duty military personnel. Patients all had