X-ref *For other Roundups in this issue that cross-reference with Knee see: Research Roundups 1, 2 & 5.*

Inadequacy of joint aspiration during two-stage septic revision knee surgery X-ref

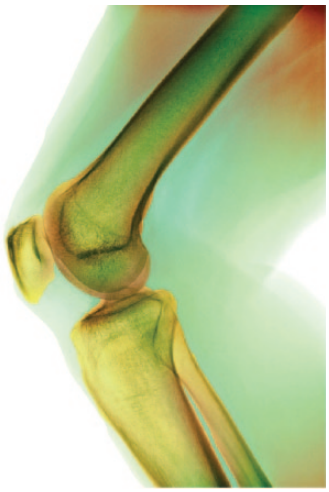
The two-stage exchange arthroplasty is still widely considered the benchmark for treatment of periprosthetic joint infection (PJI). Typically, all metalwork and pre-existing cement is removed and an antibiotic-loaded bone-cement spacer is implanted during the first stage of the procedure in conjunction with copious irrigation and debridement of the soft tissues and bones. Although not validated, many surgeons take an interim aspiration after a two-week antibiotic holiday prior to the second stage. This is undertaken with the intention of confirming the clearance of the infection. Authors from **Berlin (Germany)** investigated the diagnostic validity of undertaking this two-week synovial spacer aspiration between stages of a two-stage revision for PJI in 62 patients.[1] In this retrospective review, the research team reported their results of 62 patients (27 male, 35 female) who had all undergone a two-stage septic total knee arthroplasty (TKA) revision with synovial spacer aspiration performed two weeks before the planned second stage and after a two-week antibiotic holiday. Clinically, the spacers were in place for around six weeks in conjunction with targeted antibiotic therapy, and following the two-week antibiotic holiday (making eight weeks from stage one), aspirations were taken using a sterile technique. If no fluid could be obtained, sterile saline was used as lavage fluid and re-aspirated. Samples were sent for culture. The definitive 'gold standard' diagnosis of persistent PJI was defined in this study according to the results of microbiologic and histologic samples taken at the second-stage procedure. The sensitivity of spacer aspirations was extremely low at only 21%. In the seven cases with positive spacer aspirations, the organism identified from the aspirate matched the original infecting organism, representing a true persistent infection in only four cases. In 27 cases, the spacer aspiration led to a false negative result. The results of this study suggest that there is no diagnostic validity to an aspiration prior to the second stage in identifying persistent PJI.

Volume and total knee arthroplasty: is there success in numbers?

As volume is often identified as a factor that influences risk of revision and patient-reported outcomes in total hip arthroplasty or unicompartmental knee arthroplasty, investigators in a second paper led by researchers in **Berlin (Germany)**, but incorporating results from across the country, set out to establish whether this is also likely to hold true for total knee arthroplasty (TKA).[2] The difficulty is that most previous studies of TKA are inherently biased due to the patient populations included (single-insurer databases with limited clinical data). In the current study, the authors evaluated a comprehensive German insurance claims database to determine the risk of revision for 44 465 patients undergoing 45 165 TKAs in 966 hospitals across the nation. The authors split the units into 'high-volume' and 'low-volume' centres depending on the number of procedures performed per year. Of the 44 465 patients undergoing TKA, 20 177 cases (45%) were performed at high-volume hospitals (> 252 cases per year) and 7202 (16%) cases were performed at low-volume hospitals (< 93 cases per year). The primary aim of the study was to determine whether hospital volume is associated with risk of revision at one and two years post-operatively. After controlling for age, gender, comorbidities, and socioeconomic status, authors found that having surgery at a high-volume hospital (defined as > 252 cases per year) was associated with a decreased risk of revision within two years, compared with that of those undergoing surgery at hospitals performing fewer than 145 cases per year, even without accounting for likely differences in complexity of surgery mix. Furthermore, the odds ratio of having a revision in the first two years after surgery was 1.6 higher in hospitals that only performed ten to 56 cases per year. The authors undertook an analysis of risk factors and established that independent risk factors for revision within two years included lower age, male gender, body mass index ⩾ 40 kg/m^2, fluid and electrolyte disorders, chronic pulmonary disease, congestive heart failure, peripheral vascular disease, depression, neurologic disorders, and alcohol abuse. The results of this study could push practitioners to refer patients to higher-volume hospitals if they are candidates for TKA. While it is not always feasible for a patient to seek care at an outside institution, hospital volume is an important factor to take into consideration when pursuing elective TKA. We wonder if, in the same way that trauma is organised into hub and spoke networks in most developed nations, the same should be happening with arthroplasty.

Total knee arthroplasty in patients with heart failure

Nearly 20% of Americans over the age of 40 are diagnosed with heart failure (HF), which significantly increases complications, morbidity, and mortality risk after surgery, even when appropriate medications are initiated. As the United States and other Western populations continue to age, many of these patients will now go on to require total knee arthroplasty (TKA) for end-stage knee osteoarthritis. Although heart failure is generally considered a risk factor for any surgery, the specific associated peri-operative risks following TKA are unknown. The purpose of this study from **Cleveland, Ohio (USA)** was to evaluate the peri-operative and 30-day outcomes of patients with heart failure undergoing TKA.[3] The authors report on a cohort identified of 111 624 patients who underwent elective TKA, with patient data extracted from the American College of Surgeons National Inpatient Quality Improvement Program (ACS NSQIP). A surprisingly low proportion of patients – just 251 (0.22%) – in this cohort had a coded diagnosis of HF. Univariate analysis showed many differences in pre-operative, peri-operative, and post-operative data between patients with and without HF. Patients with HF had increased lengths of stay, were more likely to be re-admitted within 30 days, and were more likely to return for further surgery than were patients without HF. Heart failure patients also had a higher prevalence of complications including superficial surgical site infection, pneumonia, re-intubation, acute renal failure, ventilator > 48 hours, blood transfusion, and septic shock. Multivariate analysis showed that patients with HF had increased risks of any complication, wound dehiscence, and myocardial infarction than did patients without HF. These results are consistent with previously published reports that suggest that patients with HF are at a higher risk for myriad peri-operative complications. Arthroplasty surgeons should certainly expect an increased length of stay for HF patients following TKA, and should refer to this study when



providing counselling to HF patients prior to undergoing TKA. We were somewhat surprised, here at *360*, to see such a low prevalence of HF reported in this patient population. The surgical team report an incidence of HF of just 0.22% in their cohort, as compared with most published studies, where the rates are quoted as about 5%.[4] This, of course, calls into question the validity of the results.

Chronic opioid users in total knee arthroplasty: do we pander to the addicts?

■ Chronic opioid use has been identified as a risk factor associated with poor post-operative outcomes following total knee arthroplasty (TKA). Despite the relative success of TKA in providing pain relief and improvements to quality of life, post-operative opioid use continues to be a challenge to surgeons and patients alike. This is likely to be multifactorial, but for a condition where around 5% to 10% of patients have recalcitrant knee pain after surgery, it is not surprising that between 20% and 30% of patients in the United States continue to request opioid prescriptions at one year post-operatively. This number is, of course, significantly higher for chronic opioid users. There is no recommended timeline for when patients should be weaned off their analgesic medications; however, three months post-operation seems to be a generally acceptable endpoint for both treating surgeons and the general TKA population. The aim of this study was to identify which characteristics are associated with pre-operative chronic opioid use and which factors increase the risk of chronic opioid use post-operatively following TKA. Over a five-month period, the authors from **New York, New York (USA)**[5] report the outcomes of 338 consecutive patients who underwent primary TKA at one institution. Morphine-equivalent doses for each patient were collected through New York State's Internet System for Tracking Over-Prescribing Prescription Monitoring Program (I-STOP PMP), starting three months pre-operatively, through to six months post-operatively. Patients were 'chronic pre-operative opioid users' if they were consuming ⩾ 20 mg/day morphine-equivalents for a minimum of 30 consecutive days within the three-month pre-operative period. At six months post-operatively, this cohort of patients was then classified as either chronic post-operative opioid users or patients who were no longer taking opioids. Perhaps surprisingly to European readers, a total of 54/338 patients (16%) were considered chronic pre-operative opioid users, and perhaps even more surprisingly, at six months post-operatively, 23/54 (43.4%) of chronic pre-operative opioid users were still taking opioids. Patients with pre-operative opioid dose consumption ⩾ 12 mg/day in the three months prior to surgery had a six-fold increased risk of continuing opioid consumption at six months post-operatively. Persistent chronic opioid use was associated with male gender, prior injury or surgery to the knee, current tobacco use, history of cerebrovascular disorders, history of thromboembolism, obesity, and history of psychiatric disorders. While the results of this study were not surprising, opioid consumption > 12 mg/day prior to joint arthroplasty surgery is highly concerning and should be taken into consideration when counselling patients and devising a pain management plan prior to surgery.

Catastrophic varus collapse after total knee arthroplasty

■ Varus collapse of the tibial tray following primary total knee arthroplasty (TKA) is an uncommon but catastrophic complication that requires revision surgery. The mechanism of this failure is essentially unknown, although it has been suggested that increased body mass index (BMI) and small tibial implant sizing may contribute. In an interesting study from **North Carolina (USA)**, authors evaluated the pre-operative coronal alignment of patients who failed due to tibial varus collapse following primary TKA.[6] This is an important paper, as so little is known about this mechanism of failure; if this is obesity-related, as suspected, design modifications may be required for tibial base plates in obese patients. The study revolves around the results of a large cohort of 1106 TKA revisions performed during an 11-year study period at a single institution. Of these, the authors were able to report on 27 'linked' patients (2.44%) who underwent both primary and revision surgery at the same institution, with the indication for revision being medial varus collapse. For the purpose of this study, the authors defined varus collapse as a change of > 10° in tibial component position from the immediate post-operative radiographs. In this cohort, revision surgery was performed at a mean of 6.9 years (1 to 19 years) post-operatively from the primary implantation procedure. The mean pre-operative coronal alignment was 4.2° varus, which was corrected to a mean of 5.2° valgus immediately following the primary TKA. Interestingly, by the time of the revision surgery, all but three knees had collapsed to a coronal alignment within 2° of their native varus pre-operative alignment. In fact, there were eight patients whose knee collapsed to their exact pre-operative varus alignment. Possible explanations for the varus collapse could be any combination of the following: stress shielding, avascular medial tibial bone, ligamentous imbalance, increased activity levels, obesity, and small implant sizes. Further work is required to determine the reason for this 'varus relapse' and to identify the best reconstructive management of the problem. However, it is worth noting the authors' findings that the mean BMI in the collapse subgroup was 38 kg/m². This is one of those studies that starts with large headline figures, and ends up reporting just a few patients. This, of course, underlines the difficulties in drawing conclusions in these conditions. We have a feeling that, as increased activity levels, obesity, and osteoporosis in the ageing population become more prevalent, this may be a problem that is here to stay.

Tantalum metaphyseal cones and revision knee arthroplasty

■ The management of metaphyseal bone defects during revision total knee arthroplasty (TKA) requires comprehensive pre-operative planning and access to a variety of implant types. Increasingly in recent years, the development of highly porous metals, such as tantalum, has allowed for the use of cones and augments to reconstruct the joint with the potential for excellent biologic fixation while supplementing bone loss with prosthesis augmentation. Porous tantalum cones appear to offer promising results in revision TKA; however, many surgeons choose not to go for these expensive cones and instead employ a hybrid technique using readily available revision components, typically a diaphyseal stem with proximal cement augmentation or grafting. These authors from **Chicago, Illinois (USA)** compared the clinical and radiological outcomes between 49 revision TKAs reconstructed using cones and 49 revision TKAs reconstructed using a cementless, diaphyseal-engaging stem with

cement through the metaphysis and under the base of the tibial component.[7] Although there are, of course, some inherent flaws in this kind of case-controlled comparative series, it does add a lot of information to what is already known without the difficulties of conducting a randomised controlled trial. The authors did their best to establish that the cohorts were matched and ensured that, as far as the indications for revision TKA go, the cone and non-cone groups were matched on Anderson Orthopedic Research Institute Classification of Bone Defects. The cone cohort consisted of 39 knees with tibial cones only, three with femoral cones, and seven with both tibial and femoral cones. However, patients in the cone group were older and had a higher mean body mass index than those in the non-cone groups. There were no other demographic differences that were significant. Outcomes were assessed with functional and radiological criteria. From the functional perspective, the changes in Knee Society Scores and Knee Society Functional Scores from pre-operation to post-operation were greater in the non-cone group than in the cone group, but no differences emerged in post-operative range of movement, total complications, re-operations, revisions, or patient satisfaction. Radiologically, all porous cones appeared to osseointegrate successfully, while a single revision TKA in the non-cone group exhibited femoral stem loosening and subsequently required an additional revision. The complication rates were similarly high for both groups (31% in non-cone cohort and 39% in cone cohort), including deep periprosthetic infections, stiffness requiring manipulation, and periprosthetic fractures. The initial question nonetheless remains: are these porous cones worth the added cost? The results of this study suggest that there is no added benefit to the use of cones clinically or radiologically, although an in-depth cost analysis is required to support this. The potential benefits of the porous trabecular metals are likely to be found in the reduction of longer-term loosening, and as this series is only presenting a 3.5-year follow-up it would be nice to see a longer follow-up study (preferably ten years) where the benefits or otherwise can be established.

On the day of surgery following unicompartmental knee arthroplasty

Day-case unicondylar knee arthroplasty (UKA) has been widely reported from the United States but there have been few reports from other countries. There are obvious financial benefits, but is this in the patient's best interest, especially outside of the American system where patients are often discharged to physiotherapy-led institutions? Will the re-admission rate increase as a result? How do you manage patient expectation when they expect to be in hospital for a few days? This study from **Torquay (UK)** reviewed the authors' experience of implementing a pathway to allow same-day discharge for patients following a UKA.[8] In their institution, 130 consecutive patients underwent UKA and were suitable for same-day discharge if their medical comorbidities were considered stable, and home circumstances allowed safe discharge. What was not considered were the American Society of Anesthesiologists (ASA) grade, age, or body mass index, while expectations were managed through an outpatient session run by a consultant orthopaedic surgeon, a team of physiotherapists, and specialist orthopaedic and anaesthetic nurses. Patients were placed first on the operating list, or an operation had to start before midday for the patient to be eligible. The care pathway included a general anaesthetic supplemented by a subsartorial saphenous nerve block. Post-operative antibiotics were not given; instead, patients were given intravenous teicoplanin and gentamicin. Post-operatively, patients were mobilised fully weight bearing with crutches, encouraged to transfer from a supine to a standing position, walk > 100 feet without assistance, and ascend and descend a flight of stairs. Patients were also enrolled in a routine physiotherapy outpatient class and radiographs were taken and reviewed. All patients were contacted 24 hours post-operatively and reviewed in clinic at six weeks post-operation. Of the 130 patients who were included in the study, 47% (61 patients) could be discharged on the same day and none were re-admitted within a 31-day period. Of the remaining 69 patients, 11 patients met the discharge criteria but were not discharged on the same day. The authors identified reasons for this including a failure to start the operation before midday, failure of physiotherapy assessment, inadequate pain control, and a leaky wound. While the authors reported a high discharge rate of 85% on the day of surgery, this was on a very select group of patients managed in a carefully controlled pathway. What was clear from this interesting study was that same-day discharge following UKA is possible but it takes a sizeable investment, including: pre-operative education clinics staffed by consultants, physiotherapists, and nursing staff; a 24-hour helpline for patients to use; increased physiotherapy availability to mobilise patients promptly after their surgery; and same-day radiographs. The authors feel that the most critical factor to the success of same-day discharge is the timing of the procedure, which they advised should start before midday to allow the patient time to recover. The authors feel that the anaesthetic technique including a subsartorial saphenous nerve block is important for same-day discharge. Clearly, same-day discharge following UKA is possible and, in some patients, desirable, but not all patients are suitable and careful patient selection is critical. I would argue that, as well as the two factors cited by the authors as important for same-day discharge, the management of patient expectation is also key.

Cost-effectiveness of patellofemoral *versus* total knee arthroplasty in younger patients

Partial knee arthroplasties are a somewhat contentious issue in knee surgery circles, with even the most commonly performed medial unicompartmental knee arthroplasties in dispute in both academic and clinical practice. Patellofemoral joint arthroplasties are, if anything, the subject of even greater debate. With the newer, second-generation patellofemoral joint arthroplasty designs, the authors of this study set out to establish if there is now any potential cost-effectiveness benefit to either patellofemoral arthroplasty or total knee arthroplasty designs. The authors from **New York, New York (USA)** used a Markov transition model, which allows cost-effectiveness to be modelled for two interventions (on this occasion patellofemoral joint arthroplasty *versus* total joint arthroplasty) with simulated patients. The authors modelled the lifetime costs of the prosthesis, while quality-adjusted life year (QALY) gains and incremental cost-effectiveness ratio (ICER) were calculated from a healthcare payer perspective. The authors used revision rates from the UK National Joint Registry, and undertook their sensitivity analysis based on a $50 000 per QALY willingness to pay. In short, and somewhat unexpectedly, patellofemoral arthroplasty was more expensive ($49 811 *versus* $46 632); however, it yielded more effective QALY improvement (14.3 QALYs *versus* 13.3 QALYs). The ICER was $3097 for the patellofemoral arthroplasty and, as with many of these analyses, was found to be highly dependent on the utility values used to drive the modelling. This paper sets realistic survival rates and quantifies the QALY improvement and the ICER for both interventions. This, we are sure, will be used to debate and/or decide

treatment eligibility for patients with patellofemoral arthritis requiring arthroplasty in future.

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Foot & Ankle

X-ref *For other Roundups in this issue that cross-reference with Foot & Ankle see: Research Roundup 5.*

Haemoglobin A1c as a predictor of post-operative infection following elective forefoot surgery

■ It is well documented that diabetes is a significant risk factor for post-operative wound infection in foot and ankle surgery. The glycated haemoglobin (HbA1c) test is used as a marker of the long-term glycaemic status in diabetes, with an elevated level representing poor control. It is accepted that an elevated HbA1c is a risk factor for complications in diabetes, and there have been a number of studies examining the potential risk elevation for diabetic patients following surgery, based on their HbA1c levels. In this study from a group in **Charlottesville, Virginia (USA)**, the study team used insurance database records, which were analysed for patients with diabetes who underwent elective primary forefoot surgery.[1] Patients in whom a HbA1c test had been performed within three months of the date of their surgery were then selected. In those with multiple results, the result taken at the timepoint closest to the date of their surgery was included. In total, the records of 4630 patients were analysed to form the basis of this study. The patients were then grouped according to their recorded HbA1c result. Subgroup analysis was undertaken by stratifying patients into HbA1c increments of 0.5 mg/dl, commencing at a group with < 5.49 mg/dl up to a final group with > 11.5 mg/dl. Surgical site infection (SSI) data were extracted and analysed from the insurance database records, and patients were included who were at least one year post-surgery to ensure data capture was complete for all early and late infections. Data were then stratified into the groupings relative to HbA1c levels. The overall SSI rate was 3.73% in this study. The authors used a fairly thorough regression analysis to control for patient demographics and comorbidities. They established that patients with a HbA1c level of 7.5 mg/dl or higher had a significantly higher risk of subsequent SSI than those with a level that was below this threshold. Poor glycaemic control in the period surrounding forefoot surgery is a risk factor for SSI in this series, and this seems to fit with clinical observations. This study, through the size of the sample, enables us to advise our patients of the increased risk of SSI after forefoot surgery, and both provides a threshold for glycaemic control upon which a significantly increased risk can be advised, and underlines the importance of tight glycaemic control in patients with diabetes undergoing forefoot surgery.

Driving after hallux valgus surgery

■ "When is it safe to return to driving after hallux valgus surgery?" is a question commonly asked by our patients in clinic. It is a requirement that patients can demonstrate that they are in control of the vehicle at all times, and clearly ideal if they don't do any harm to their recently osteotomised first ray. A research group from **Philadelphia, Pennsylvania (USA)** carried out the now familiar post-operative driving study on patients following right-sided first metatarsal osteotomy.[2] Their aim was to establish at what stage in the post-operative phase the patients returned to a brake reaction time (BRT) comparable with that of a control group. In total, 60 patients were included in the study with a mean age of 52 years. Distal metatarsal osteotomy was performed in 24 patients and proximal osteotomy in 36 patients. At six weeks post-surgery, patients completed a driver readiness survey, along with a Visual Analogue Scale (VAS) for pain. They then also completed the BRT test using a reaction time tester. This is a validated commercial device consisting of an accelerator and brake pedal, a handheld control unit, and a red and green light system. The subject was instructed to press the accelerator pedal until the green light came on. They must then fully apply the brake pedal immediately upon seeing the light turn to red. A mean of three tests was taken as representing the BRT. The highest recorded time in the control group (0.85 seconds) was considered the minimum acceptable BRT by the investigators. Patients who failed to achieve a time below this were brought back each week for repeat testing until they achieved this time. At the first assessment, six weeks post-surgery, 85% of patients achieved a BRT below the minimum accepted time and were deemed safe to drive. There was no difference in the rates of pass *versus* fail at six weeks in the distal or proximal osteotomy groups. At six weeks, the driver readiness survey proved to be a reliable indicator of the ability to pass the BRT test. When asked, "Based on what I think my braking reaction time is, am I ready to drive?", all patients who answered "agree" or "strongly agree" went on to pass the test. Of the patients who failed their BRT, eight of nine returned for re-testing. Three patients returned one week later while five patients chose to return after two weeks. All patients passed the BRT on that visit. Based on this study, it seems reasonable to advise patients that a return to driving is safe at eight weeks following metatarsal osteotomy for hallux valgus correction. It also seems that patients themselves do know when it's safe for them to return to driving.