that a significant number of patients have intraspinal anomalies on preoperative MRI in cases that otherwise would have been presumed to be idiopathic. There are currently no clear guidelines on the use of preoperative MRI in diagnostic workup. Of the 50 studies included, 20 advocate routine MRI screening and 30 recommend selective screening of patients based on risk factors. The most important question is, of course, whether neurological complications can be mitigated by early identical identification via MRI scan. Unfortunately, few of the studies included examined this; of those that did, the complication rate was higher in patients with anomalies, but was still only 0.8% *versus* 0.2%. Knowing an abnormality exists may enable individual treatment strategies, although for some anomalies there is little consensus in the neurosurgical community about their optimal treatments. The authors note that further studies on the impacts of routine MRI screening are required, but recommend screening patients with risk factors.

REFERENCES

1. Mitchell PD, Viswanath A, Obi N, Littlewood A, Latimer M. A prospective study of screening for musculoskeletal pathology in the child with a limp or pseudoparalysis using erythrocyte sedimentation rate, C-reactive protein and MRI. *J Child Orthop* 2018;12:398-405.

2. Buckle C, Wainwright AM. A systematic review of long-term patient reported outcomes for the treatment of anterior cruciate ligament injuries in the skeletally immature. *J Child Orthop* 2018;12:251-261.

3. Makarov MR, Jackson TJ, Smith CM, Jo CH, Birch JG. Timing of epiphysiodesis to correct leg-length discrepancy: a comparison of prediction methods. *J Bone Joint Surg [Am]* 2018;100-A:1217-1222.

4. Makarov MR, Dunn SH, Singer DE, et al. Complications associated with epiphysiodesis for management of leg length discrepancy. *J Pediatr Orthop* 2018;38:370-374.

5. Caskey S, Hammond J, Peck J, Sardelli M, Atkinson T. The effect of booster seat use on pediatric injuries in motor vehicle frontal crashes. *J Pediatr Orthop* 2018;38:e382-e386.

6. van Praag VM, Lysenko M, Harvey B, Yankanah R, Wright JG. Casting is effective for recurrence following Ponseti treatment of club foot. *J Bone Joint Surg [Am]* 2018;100-A:1001-1008.

7. Choudry QA, Paton RW. Neonatal screening and selective sonographic imaging in the diagnosis of developmental dysplasia of the hip. *Bone Joint J* 2018;100-B:806-810.

8. Heemskerk JL, Kruyt MC, Colo D, Castelein RM, Kempen DHR. Prevalence and risk factors for neural axis anomalies in idiopathic scoliosis: a systematic review. *Spine J* 2018;18:1261-1271.

Research

X-ref ***For other Roundups in this issue that cross-reference with Research see: Knee Roundup 3; Shoulder & Elbow Roundup 7; Trauma Roundup 4.***

Alpha-defensin and the Synovasure lateral flow device for the diagnosis of prosthetic joint infection X-ref

■ Prosthetic joint infection (PJI) continues to be a challenging complication following arthroplasty. Before even considering a management plan for PJI, it is important to come to a reliable diagnosis, although this can be surprisingly difficult in some cases. Whilst conventional inflammatory markers – C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), and white blood cell (WBC) count – have been used for some time, new biomarkers have more recently been identified, the most highly studied of which is alpha-defensin. Alpha-defensin is an antimicrobial peptide that interrupts bacterial cell wall synthesis, and its activity is an indirect marker for bacterial activity. An assay, enzyme-linked immunosorbent assay (ELISA), has been developed to measure the amount of alpha-defensin quantitatively, either in the laboratory or with a lateral flow cassette (Synovasure) in the operating theatre as a point-of-care testing system. This point-of-care test is extremely useful as a result can be obtained in ten minutes of the sample being obtained. The aims of this study from **Nottingham (UK)** were to evaluate the diagnostic use of alpha-defensin, focusing on more recent studies, and to evaluate the lateral flow cassette used in point-of-care testing in theatres.[1] The authors undertook a thorough meta-analysis; 179 studies were identified, of which 11 studies met the inclusion criteria. Of these, four reported a laboratory-based ELISA to measure alpha-defensin with a pre-specified threshold value of 5.2 mg/l and six used a lateral flow cassette. The pooled sensitivity of the ELISA was 0.95 (0.91 to 0.98) and specificity was 0.97 (0.95 to 0.98). In comparison, the lateral flow cassette had a pooled sensitivity of 0.85 (0.74 to 0.92) and specificity of 0.90 (0.91 to 0.98). In addition, there was a significant difference in the likelihood ratio test between the laboratory and the lateral flow test for sensitivity but not for specificity. The key points of this study were that, whilst the sensitivity and specificity of an alpha-defensin assay performed in the laboratory are excellent when using a pre-specified threshold value of 5.2 mg/l, the results of using a lateral flow cassette showed lower sensitivity and specificity. This is an apparent conflict with the manufacturer's data sheet, which suggests a 100% positive agreement and 96% negative agreement with the laboratory test. Although the reasons for this difference are not clear, the authors postulate that it may be due to patient selection, technical errors occurring during the test, or point-of-care users being less diligent in performing the tests compared with trained laboratory staff. The authors highlight that industry involvement in the positive studies for Synovasure may have resulted in a publication bias. The authors also pointed out that the Synovasure performs with a similar sensitivity and specificity to the leucocyte esterase test or synovial CRP, although it is more expensive. The conclusions of this study are based on the current literature of using a point-of-care test in theatre, the lateral flow cassette, to test for the presence of an infected arthroplasty. At best, the Synovasure can be used as an adjunct to diagnose a PJI, but it would appear that the sensitivity of this test is not quite as robust as was previously thought. Therefore, users of this device as a point-of-care test should exercise considerable caution and take into account more conventional tests when trying to diagnose a PJI.

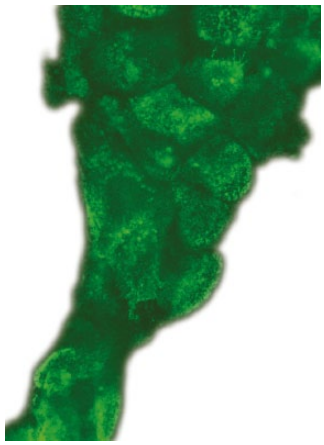
Readmission after cervical spine arthrodesis: rates, trends, causes, and risk factors X-ref

■ The authors of this study from **New York, New York (USA)** have done some interesting work on establishing healthcare utilization following elective surgery, in this case cervical spine arthrodesis.[2] This is a very timely study, as the push to reduce costs has resulted in shortening of admissions, reduction in follow-up, and a general 'slimming down' of planned care pathways. The authors performed a retrospective database analysis of patients to quantify emergency department (ED) utilization and inpatient readmission rates after primary cervical arthrodesis. Capturing the data for readmission, representation, and complications is always tricky, as patients occasionally present to other healthcare providers.

In a densely packed and competitive healthcare provider market, many providers focus simply on planned surgery and, as such, do not always have a handle on their complication rates. This study utilizes a New York State all-payer healthcare database, which allows for more complete follow-up. The authors identified 87 045 patients who underwent primary subaxial cervical arthrodesis over a 15-year period. The authors collated readmission and ED utilization data as point estimates within 30 and 90 days of discharge, and as trends over time. Overall readmission rate was 4.2% at 30 days and 6.2% at 90 days, with A&E contact rates at 6.2% within 30 days of admission and 11.3% within 90 days of surgery. The outcome of this study is that patient comorbidities, traumatic pathologies, and surgical approach are associated with increased postoperative complications. Anterior procedures carry the lowest risk, followed by posterior and then circumferential approaches. Although there are some things that the surgeon can do to reduce the chances of readmission or further healthcare contact after planned surgery, some causes of patient readmission are not modifiable. As such, the only sensible approach we can see is to move towards a more personalized heathcare system.

How many doses of tranexamic acid is enough in arthroplasty? X-ref

■ Tranexamic acid and lower transfusion thresholds have significantly reduced transfusion rates after total joint arthroplasty, consequently lowering the total costs of surgery and eliminating complications associated with blood transfusion. To a certain extent, the debate has shifted from whether patients should have tranexamic acid (TXA) when undergoing major joint arthroplasty surgery, to exactly how TXA should be administered. Intravenous (IV), oral, and topical dosage all have their proponents, as well as a research base – albeit a sometimes limited one – on which to justify their use. Here at *360*, we were delighted to see this paper from researchers in **La Jolla, California (USA)**, which attempts to determine whether patients should have one or two IV doses of TXA, if IV is the chosen route of administration.[3] The authors identified 1736 patients who underwent total hip arthroplasty (THA): 592 without TXA, 454 on a single-dose regimen of TXA, and 690 who received a dual-dose regimen of TXA. There were a further 2042 total knee arthroplasty (TKA) patients also reported as part of the study: 744 without TXA, 499 on a single-dose of TXA, and 799 on a dual-dose regimen of TXA. Outcomes were assessed in terms of haemoglobin (Hb) levels, rate of allogeneic blood transfusions, and complication rate with each regime. In the THA cohort, there were no significant differences observed in the mean postoperative decrease in Hb (2.9 g/dl *vs* 3.1 g/dl), and the single- and double-dose groups both fared better than the control group. The investigators also undertook a more complex analysis, with a multivariable adjustment for age, gender, and preoperative haemoglobin level. Again, no differences were seen between the two intervention groups. In the group of THA patients, there was a 12.5% risk for transfusion in those who did not receive TXA, compared with 0% in the single-dose group and 0.7% in the dual-dose group. There was a very similar picture in the TKA cohort, with mean postoperative decreases in Hb of 2.4 g/dl in both the single- and the double-dose group, a statistically significant improvement over the control group, and a fall in postoperative transfusion requirement from 4.3% to < 0.4% in both groups. In this period of decreased cost associated with bundled payments, and with the potential increased clotting associated with greater administration of TXA, this study demonstrates that a single TXA dose is as effective as a dual-dosing regime. Based on these



data, a single-dosing regime should be used in all total joint arthroplasty cases as standard care.

Poor postoperative glycaemic control associated with adverse outcomes following total joint arthroplasty

■ There has been a lot of interest in perioperative glycaemic control prior to surgery, where we routinely screen for glucose and haemoglobin A1c (HbA1c), especially in diabetic patients. However, the data are far from conclusive as to the implications for complication rates, with conflicting reports and no solid evidence from meta-analysis about the prognostic value of HbA1c. These authors from **Philadelphia, Pennsylvania (USA)** set out to establish whether perioperative glucose control is a better prognosticator as a risk factor for adverse outcomes than the preoperative screening variables.[4] The basis for their report was the nearly 22 000 patients who underwent total hip and knee arthroplasties at their institution over a 16-year period. The authors included patients who had had at least three postoperative glucose readings, and calculated a coefficient of variation for each patient. The authors also collated what they regarded as 'adverse outcomes' data, which, for the purposes of this investigation, included increased length of stay as well as 90-day mortality, reoperations, prosthetic joint infection, and surgical site infection. As would be expected, the final cohort of patients included a much smaller subset: slightly under 5000 patients, 20% of whom had recognized diabetes. In terms of associations with outcomes, those patients with a higher coefficient of variation had increased length of stay, 90-day mortality, risk of prosthetic joint infection, and surgical site infection. In terms of quantifying the association, each 10% rise in the coefficient of variation increased length of stay on average by 6.1%, mortality risk by 26%, and risk of infection by 20%. Attention to variability in diabetic control is important here. Some of this variability will be due to inherent patient facts; however, other variation will be due to diabetic control in the perioperative period. The use of diabetic diets and optimized diabetic control is clearly the way forward in perioperative management. The observation that glucose variation may have a role to play in diabetic control is interesting in itself.

CT pulmonary angiography in lower limb arthroplasty X-ref

■ There are few incidence studies of a reasonable quality that look at the rates of pulmonary embolism (PE) following lower limb arthroplasty. Incidence is, of course, essential in order to establish the risk for an individual person of suffering the complication when undergoing the procedure. There are a range of randomized trials that use the surrogate endpoint of venographically proven deep vein thrombosis (DVT); however, pulmonary embolism remains a relatively unknown quantity as a complication of large joint arthroplasty. This paper from **Belfast (UK)** set out to establish the rates of CT pulmonary angiography (CTPA), in a carefully followed-up cohort of patients undergoing large joint arthroplasty.[5] In their population of 11 249 patients, all of whom underwent large joint total arthroplasty, there were no deaths within 90 days. The overall mortality rate from PE was 0.08%. A suspected

PE requiring a CTPA occurred in 229 patients (2%) and just over a third of the requested scans (n = 86, 38%) were positive. In terms of procedural details, CTPA was performed twice as often following total knee arthroplasty as it was following total hip arthroplasty. When CTPA was performed, scans were twice as likely to be positive. Overall, around a quarter of the patients (n = 11/47, 23%) with a CTPA-proven PE suffered from a peripheral unilateral pulmonary embolus. This is currently the definitive study on pulmonary embolus in large joint arthroplasty. The authors note that around 1 in 50 post-arthroplasty patients will need to have a CTPA on clinical grounds. Although there were no deaths from PE in those patients who underwent a CTPA, there were three complications from therapeutic anticoagulation, two of which were in patients who turned out not to have a PE. Here at *360*, we're sure that this won't be the final chapter in the PE saga.

Altitude and venous thromboembolism

■ This paper from **Miami, Florida (USA)** asks, and answers, a simple question: Does the change in blood known to occur with higher altitude result in a higher rate of venous thromboembolism (VTE) following total hip arthroplasty (THA)?[6] The authors used the PearlDiver database to establish the risk factors for VTE for those living at high altitude *versus* those who were not. The details of patients over a nine-year period who had undergone a THA were cross-referenced with ZIP codes of the performing hospitals and subdivided into those living > 4000 feet and < 100 feet above sea level. Interestingly, living > 4000 feet above sea level is associated with a greater risk of VTE, with an odds ratio of 1.74 favouring patients in lower altitudes. There was also a propensity for higher PE rates, with an odds ratio of 1.59 again favouring patients in lower altitudes. Although perhaps small print for many patients and surgeons, this is an important finding in patients who are undergoing their surgery at higher altitude, and it does fit with what is known about high-altitude medicine.

What constitutes 'success' on the Oxford Hip and Knee Scores?

■ In the early days of joint arthroplasty outcome scores, patients and their joints were usually classified as a 'success' through the introduction of arbitrary threshold values and the description of categories of excellent, good, acceptable, and poor. We have moved far away from these definitions with the development in understanding of item response theory and the psychometric properties underlying the modern outcome scores. No longer is it acceptable for patients to be classified according to a score made up by the surgeon. Whilst this marks a step forward for research, the development of better outcome measures has introduced its own problems. One is that the scores are now being used for applications for which they were never designed, including rationing, definition of success, and monitoring of surgical performance. Although usually undertaken with the best of intentions, these sorts of applications of outcome scores come with their own risks. For some, it is attractive to be able to define a 'success' or clinical failure. This is what the group from **Edinburgh (UK)** have attempted to do with the Oxford Hip and Knee Scores.[7] Although a relatively crude model, this paper is quite useful in that it helps to define a 'successful' operation. Their model is built around data for 3203 total hip arthroplasty (THA) patients and 2742 total knee arthroplasty (TKA) patients using a composite success criterion based on structured questions, which was used to perform receiver operating characteristic (ROC) analysis with the aim of establishing the most suitable threshold for a 'good' result. Using their definition of composite treatment success criterion, the sample had a suitable number of successful surgical procedures (77.6% of THAs; 67.3% of TKAs), allowing a 0.87 area under the curve on ROC analysis. The thresholds calculated were > 37 points on the Oxford Hip Score and > 32 points on the Oxford Knee Score.

REFERENCES

1. Marson BA, Deshmukh SR, Grindlay DJC, Scammell BE. Alpha-defensin and the Synovasure lateral flow device for the diagnosis of prosthetic joint infection. *Bone Joint J* 2018;100-B:703-711.

2. Derman PB, Lampe LP, Pan TJ, et al. Postoperative emergency department utilization and hospital readmission after cervical spine arthrodesis: rates, trends, causes, and risk factors. *Spine (Phila Pa 1976)* 2018;43:1031-1037.

3. Wilde JM, Copp SN, McCauley JC, Bugbee WD. One dose of intravenous tranexamic acid is equivalent to two doses in total hip and knee arthroplasty. *J Bone Joint Surg [Am]* 2018;100-A:1104-1109.

4. Shohat N, Restrepo C, Allierezaie A, et al. Increased postoperative glucose variability is associated with adverse outcomes following total joint arthroplasty. *J Bone Joint Surg [Am]* 2018;100-A:1110-1117.

5. Karayiannis PN, Hill JC, Stevenson C, et al. CT pulmonary angiography in lower limb arthroplasty. *Bone Joint J* 2018;100-B:938-944.

6. Damodar D, Donnally CJ III, Sheu JI, et al. A higher altitude is an independent risk factor for venous thromboembolisms after total hip arthroplasty. *J Arthroplasty* 2018;33:2627-2630.

7. Hamilton DF, Loth FL, MacDonald DJ, et al. Treatment success following joint arthroplasty: defining thresholds for the Oxford hip and knee scores. *J Arthroplasty* 2018;33:2392-2397.

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