patients at short-term follow-up, and is a technique that we suspect will be used with increasing frequency.

Grit-blasting alone a poor choice for short stem proximal humerus implants

Short-stem shoulder replacements are growing in popularity due to the preservation of humeral bone stock, especially in younger patients. As a relatively recent design development, the longer-term follow-up studies are not yet available. Following cohorts of patients is useful to spot problems that either have not or may not appear on joint registry data. This paper from **Heidelberg (Germany)** and **Lyon (France)** reports the mid-term results of a series of 67 shoulders, all performed with a short-stem uncemented total shoulder prosthesis for primary osteoarthritis.[8] A previous paper studying the same cohort at a mean of 2.6 years postoperatively had identified potential problems with adaptive changes seen in the proximal humerus surrounding the stem, such as cortical thinning and osteopenia in the medial calcar segment in over 50% of patients. The clinical results were, however, good at this stage. This new report updates the series of patients, who are now at a mean of 5.6 years follow-up. As before, the clinical results remain good, and certainly comparable to long-stem designs. However, the radiological results are much more worrying, and show 40% of patients developing substantial bone loss in the proximal humerus at between four and seven years of follow-up. The changes therefore remain essentially static from the 2.6 year follow-up with no evidence of frank loosening. Patients with a higher filling ratio of the stem in the metaphyseal had a significantly higher rate of adaptive changes. It is important to note that this first generation of stem was a grit-blasted prosthesis and later designs are utilizing a porous coating. The authors therefore suggest that improved coating of the stem, and the implantation of a stem that does not achieve cortical contact and fills the canal less, should decrease the stress shielding and permit improved radiological outcomes. Medium-term clinical outcomes are satisfactory and longer-term follow-up will reveal if these radiological changes are benign or not. For the time being, the take-home message perhaps should be to treat grit-blasted short stems with caution, as there is clearly a risk here of high rates of secondary failure.

REFERENCES

1. Tatro JM, Gilbertson JA, Schroder LK, Cole PA. Five to ten-year outcomes of operatively treated scapular fractures. *J Bone Joint Surg [Am]* 2018;100-A:871–878.

2. Beks RB, Ochen Y, Frima H, et al. Operative versus nonoperative treatment of proximal humeral fractures: a systematic review, meta-analysis, and comparison of observational studies and randomized controlled trials. *J Shoulder Elbow Surg* 2018 (Epub ahead of print) PMID: 29735376.

3. Gallacher S, Beazley JC, Evans J, et al. A randomized controlled trial of arthroscopic capsular release versus hydrodilatation in the treatment of primary frozen shoulder. *J Shoulder Elbow Surg* 2018 (Epub ahead of print) PMID: 29798823.

4. Rao AJ, Chalmers PN, Cvetanovich GL, et al. Preoperative doxycycline does not reduce propionibacterium acnes in shoulder arthroplasty. *J Bone Joint Surg [Am]* 2018;100-A:958–964.

5. Creuzé A, Petit H, de Sèze M. Short-term effect of low-dose, electromyography-guided botulinum toxin a injection in the treatment of chronic lateral epicondylar tendinopathy: a randomized, double-blinded study. *J Bone Joint Surg [Am]* 2018;100-A:818–826.

6. Nuelle CW, Stokes DC, Kuroki K, Crim JR, Sherman SL. Radiologic and histologic evaluation of proximal bicep pathology in patients with chronic biceps tendinopathy undergoing open subpectoral biceps tenodesis. *Arthroscopy* 2018;34:1790–1796.

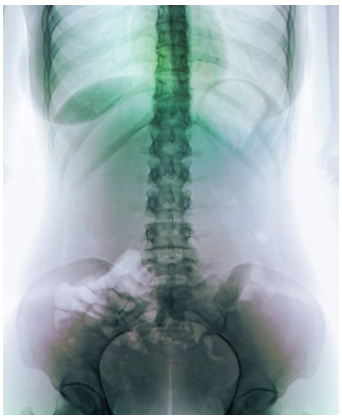
7. Pennington WT, Bartz BA, Pauli JM, Walker CE, Schmidt W. Arthroscopic superior capsular reconstruction with acellular dermal allograft for the treatment of massive irreparable rotator cuff tears: short-term clinical outcomes and the radiographic parameter of superior capsular distance. *Arthroscopy* 2018;34:1764–1773.

8. Schnetzke M, Rick S, Raiss P, Walch G, Loew M. Mid-term results of anatomical total shoulder arthroplasty for primary osteoarthritis using a short-stemmed cementless humeral component. *Bone Joint J* 2018;100-B:603–609.

Spine

Adult spinal deformity surgery: how bad is reoperation?

For most patients, having surgery to relieve the symptoms of adult spinal deformity (ASD) is enough of an undertaking. The impact of adult spinal deformity in terms of quality of life leaves some patients in a poorer position than many patients with chronic medical illness. Furthermore, corrective surgery carries with it a risk of complications reported in the literature at between 20% and 71%. For some unfortunate patients, things can get even more difficult if they are one of the 15% to 20% who need a second operation. The need for reoperation can be due to a complication, or might be from a new problem that rapidly follows the first – either way, it's probably bad news. But how bad is not entirely clear. A group from **Barcelona (Spain)** looked at the impact of second procedures from ASD on the healthcare quality of life (HQoL), and specifically the impact of unplanned reoperation within the first year of adult patients being treated for adult spinal deformity.[1] This study reports a retrospective analysis of 280 patients, most of whom had been diagnosed with idiopathic scoliosis who underwent corrective surgery in one of six European centres in four countries. The authors included any patient aged 18 years or more who underwent ASD corrective surgery with a preoperative Cobb angle $>20°$, thoracic kyphosis $>60°$, or sagittal vertical axis >5 cm with a two-year minimum follow-up. There were 280 patients who met the necessary criteria, with idiopathic scoliosis being the most common diagnosis. Of the initial cohort, 43 patients underwent 46 revision procedures (18%), most commonly due to implant-related complications; 43.5% of these were within the first month and 67% within the first three months following the primary procedure. Patients were more likely to undergo revision surgery if they were older, had a higher American Society of Anesthesiologists (ASA) grade, showed a greater sagittal deformity, or had a worse starting HQoL. At one year, the Oswestry Disability Index (ODI) and the Scoliosis Research Society outcome score (SRS22) were significantly better in the group who did not require revision surgery; however, the overall improvement in HQoL was no different between the two groups at two years. Importantly, the SRS22, ODI, and 36-Item Short-Form Health Survey (SF-36) outcomes improved by the minimal clinically important difference (MCID) only in the non-revision surgery group. In addition, the mental health component of the outcome scores was significantly adversely affected by revision surgery and took longer to recover to preoperative norms. So, are these findings unsurprising? Perhaps. The improvement in HQoL



appears to be the same, but the changes in some of the HQoL metrics for patients likely to need revision surgery don't reach the MCID in contrast to the non-revised group. Furthermore, revision surgery has a significant effect on patient mental health. As with all things spinal, information is power, and now we have an idea of how revision surgery impacts on a patient's postoperative course, improving the information we offer during the consent process and informing patient decisions.

Ligament augmentation in proximal junctional failure

The soft tissues are the key to successful outcomes in all branches of orthopaedic surgery, and this is no more evident than in spinal surgery. Soft-tissue complications are the source of most woe in complex patients, and attention must be paid to the preservation of soft-tissue structures and function if stability is to be maintained. There is a contradiction between the requirement for exposure and the consequent exposure of the spinous processes and the interruption of the associated soft tissues during a posterior fusion procedure. This is furthered by the basic desire to reduce soft-tissue injury to maintain soft-tissue function, and this seems to have struck a group from **San Diego, California (USA)**.[2] Their study aims to examine the potential benefits of augmentation of the posterior ligament structures following fusion in an effort to prevent post-surgical proximal junctional failure (PJF). The group took 200 consecutive adult patients who underwent posterior instrumentation for deformity correction (after excluding neuromuscular and neurodegenerative deformity): 100 prior to the introduction of a surgical posterior ligament augment and 100 afterwards. The precise technique is described in the paper, but generally involves weaving an elastic material through the base of the spinous processes and under alternate lamina from the level above the uppermost instrumented vertebra (UIV) to the level below in an effort to reduce the junctional stresses. The reported results make encouraging reading; 67% of patients included in the intervention group were female, with degenerative scoliosis being the most common indication for surgery. Of those reported, 51% of procedures were revision, 38% required both an anterior and posterior approach, and 40% required three column osteotomies. The mean number of instrumented levels was 11. The mean increase in post-junctional angle was 6° in the intervention group, compared with 14° in the control group ($p < 0.001$). This subsequently led to fewer revision procedures for pseudoarthrosis (14 in the control group, three in the intervention group). On first reading, this series looks great, but there are a few inevitable caveats. First, the cause of PJF is unknown. Theories abound: associated degenerative changes, facet joint failure, vertebral fracture, posterior longitudinal ligament failure, disc disease, and so on. One of the difficulties in establishing the cause of PJF is that there isn't even a strict definition of what constitutes PJF. The therapies employed differ as well. The authors in this study comment that they tend to use vertebroplasty alongside the index surgery to reduce the risk of postoperative fracture in vulnerable patients, that they use sublaminar hooks at the UIV (because of the evidence of reduced PJF when these are used), and that they use *in situ* contouring to reduce proximal stresses. Some of these techniques are not universally applied and so could confound the results; however, ligament augmentation looks like it could be useful in the battle against PJF.

Revise, revise, and revise again: complications and revisions in 50 000 disc procedures

Anterior cervical decompression and fusion (ACDF) and anterior cervical decompression and arthroplasty (ACDA) are two of the most rewarding operations to perform in spinal surgery, and often have enough of a functional benefit that the procedure can literally turn a patient's life around. ACDF is the benchmark surgical intervention for single-level degenerative myelopathy. However, ACDF has historically been associated with complications, including adjacent segment ossification and degeneration in up to 3% of patients, which can create more symptoms. An answer to this was ACDA, where the cervical disc is replaced with a device maintaining motion at this segment, hence relieving the stresses on adjacent motion segments. This, of course, adds the attendant risks and complications of an arthroplasty procedure. However, it is not clear how the two techniques compare with regards to reoperation. A team from **St. Louis, Missouri (USA)** has looked at a state-wide database of all patients aged between 18 and 65 years who underwent ACDF or ACDA between 2003 and 2010, and investigated patient outcomes for the postoperative five years (as far as they can be established in a database study).[3] Patients were excluded if they were operated on for infection, neoplasia, or pathological fracture. The authors identified 52 395 cases, of which 1469 were ACDA. There was a significantly higher short-term readmission rate for ACDF when compared with ACDA, although ACDA showed a higher risk of vertebral artery injury. No correlation existed between the procedure and infection. Reoperation within the short term was higher in ACDF group (3.55%) when compared with ACDA (2.04%) ($p = 0.015$), although long-term reoperation rates were equivocal. These results look favourable for ACDA. However, the higher incidence of vertebral artery injuries is probably misleading due to the disparity in numbers within each treatment group and the low absolute incidence. Early studies of ACDA were more supportive of the technique, and the authors comment that this may be due to the bias that tends to influence commercially funded studies. Furthermore, any study using large databases as a source of data have inherent weaknesses around clerical accuracy and loss to follow-up. Patient selection for each procedure again is likely to influence outcome, particularly in light of widespread spondylosis being a contraindication to ACDA. A useful technique then emerges and, in light of this paper, ACDA seems to be as safe as ACDF with regards to reoperation, accepting the inevitable learning curve. The difficulty with studies like these is that they are inherently biased, and those selected for the procedure are the patients who the surgeon feels will do well with one or other treatment. All this study can say is that, in the reported population, ACDA is no more likely to result in a reoperation than ACDF.

Annular closure in lumbar microdiscectomy: a randomized clinical trial

The risk of reherniation following a discectomy for disc herniation can be up to 18% within two years of initial surgery with the risk being greater the larger the defect in the annulus. There is little evidence as to which procedures, if any, can be employed to reduce this risk. This study reported from **Innsbruck (Austria)** aims to evaluate one potential way to address this risk.[4] These authors report a multicentre randomized study conducted across Europe with the aim of assessing a

bone-anchored mesh-based annular closure device. The study population involved patients who at discectomy were found to have a large annular defect (6 mm to 10 mm width). They were then randomly allocated either to the closure device (n = 276) or to undergo the discectomy alone (n = 278). The study was designed to evaluate the co-primary endpoints of recurrent herniation and a composite endpoint of patient-reported, radiographic, and clinical outcomes. These were assessed over a two-year follow-up period. In short, the results of this well-conducted study favoured the annular closure device; there was less overall recurrent herniation (50% *vs* 70%, $p < 0.001$), and greater composite endpoint success (27% *vs* 18%, $p = 0.02$). The perhaps much more clinically relevant measures of frequency of reoperations to address reherniation was also significantly different: 5% with the annular closure device and 13% in controls, which was mirrored by the reported symptomatic reherniation rates (12% *vs* 25%). There were, however, no differences reported between the two groups in terms of back pain, leg pain, ODI, and health-related quality of life over the two-year follow-up, which is a curious observation given the differences in reherniation rates seen. The intervertebral disc is known to have a limited healing potential and especially so when faced with a large annular defect. This closure technique is potentially an ideal non-fusion option to reduce the reherniation rates seen in lumbar discectomy. The concern for most surgeons is that there is the potential for a mesh to come loose or erode into the dura, causing significant harm. Only larger studies with longer follow-up can address this concern. There is, as they say, plenty of food for thought here.

Parallel closing laminectomy rongeur

■ We perhaps pay less attention to our instruments in orthopaedic surgery and research than we should. Whilst it is common place to see studies including randomized controlled trials evaluating different implants from an efficacy perspective, it is rare to see even the lowest-evidence-grade study addressing the question of instrumentation design and its effect on clinical outcomes as a research question. The Kerrison rongeur is the most commonly used specialist instrument by spine surgeons and is used in the majority of decompression procedures. The instrument design has undergone little modification since its invention and is similar across most manufacturers. The authors of this study from **St Gallen (Switzerland)** have performed a biomechanical assessment of a modified Kerrison rongeur that features a parallel closing mechanism, comparing it with the traditional, classic design.[5] Whereas the classic design involves two angled handles that are compressed like scissors, the modified version had a parallel handgrip. The study involved volunteers (including surgeons and office staff) using both instruments whilst shaft movement was measured with a stereoscopic, contactless image correlation system. The authors also produced force diagrams from both instruments. The authors undertook a mechanical study with 40 volunteer surgeons from a range of disciplines (orthopaedic surgery, n = 35; urology, n = 2; and neurosurgery, n = 3). Participants were randomized to either the older or newer instruments, and then undertook ten punches with the first instrument, subsequently using the other instrument. The main outcome measure of the study was instrument shaft movement, which was measured in 3D space using a stereoscopic, contactless, full-field digital image correlation system. The authors effectively showed that the modified version of the instrument had specific design advantages: its longer lever arm led to a smaller closing angle of the handles, meaning a shorter range of movement in the hand and thus greater accuracy. Also, for a given output, a smaller input force was required. These mechanical advantages were borne out by the shaft movement analysis: movement was much more precise, with less movement in all three dimensions. For the spine surgeon, these advantages are potentially valuable. Decompression surgery involves operating near delicate structures and multilevel surgery involving hard bone can be particularly fatiguing. Perhaps spine surgeons should give this new design a try?

Selective thoracic fusion for Lenke 1 adolescent idiopathic scoliosis

■ With a selective thoracic fusion, the challenge is predicting which compensatory lumbar curves will spontaneously correct, and which will not, following the fusion procedure. Getting this prediction wrong results in the risk of either undercorrection, lumbar curve progression, and the need for further surgery to fuse additional levels ('adding-on'), or fusing unnecessary lumbar segments. Most of the current decision-making strategies centre on coronal plane imaging including traction films and assessing which vertebrae are stable and lie partly within the path of the central sacral vertebral line. This study from **Philadelphia, Pennsylvania (USA)** assesses whether the patient's sagittal profile influences spontaneous lumbar curve correction.[6] The study involved analysis of the imaging studies of 63 patients, all with Lenke 1B and C curves, as well as imaging from 20 control subjects. The authors required biplanar x-rays pre- and post-surgery to generate a 3D reconstruction. The study involved two aspects. First, the authors assessed the rate of spontaneous lumbar curve correction following surgery and then divided patients for reporting purposes into two clusters depending on the amount of correction achieved (high amount of correction *vs* low correction). Second, the curves were assessed to determine the ratio of apical translation of the thoracic and lumbar curves from a central sacral line, and the relationships between these two aspects were investigated. The key finding here was that patients with a greater preoperative sagittal thoracic to lumbar apical translation ratio were associated with lower spontaneous lumbar correction. This is a novel approach to investigating an age-old problem. Whilst sagittal parameters are scrutinized in adult degenerative deformity, the focus in idiopathic scoliosis is assessing coronal features such as lumbar vertebral rotation, curve flexibility on side bending, and determining the stable vertebra. For the deformity surgeon, the ratio of thoracic to lumbar apical translation is a potentially useful parameter to guide decision-making. Nevertheless, a larger prospective clinical study is needed to demonstrate its reliability from plain radiographs.

Cervical discectomy and fusion with or without anterior plate fixation

■ There is somewhat of a dichotomy in clinical practice with regards to the use of anterior plates in anterior cervical spine discectomy and fusion. Whilst the removal of disc material and surgical approach is taken as a given, some surgeons would undertake a fusion without plate supplementation due to worry about space occupancy, and complications – specifically dysphagia and swallowing complications. Others would not undertake a fusion without a plate due to their worries about failure of fusion due to instability. This team based in **Rochester, Minnesota (USA)** undertook a thorough systematic review and, where possible, a meta-analysis to attempt to answer some of these questions.[7] Their review aimed to compare these two treatment strategies with regards to postoperative surgical, radiographic, and patient-reported outcomes following anterior cervical discectomy and fusion (ACDF) with or without

plate fixation. The study team were able to include a total of 15 studies (12 observational and three randomized controlled trials) in their review. These trials reported the outcomes of 893 patients overall. The bottom line from this study is that overall, ACDF with plate fixation was associated with significantly higher vertebral fusion rates (odds ratio (OR) 1.98), lower subsidence rates (OR 0.31), and more favourable visual analogue scale (VAS)-neck pain scores (mean difference 0.59) at last follow-up. On the flipside, ACDF without use of an anterior fusion plate had better long-term VAS arm pain scores (marginal mean difference 0.2). Perhaps most importantly, the authors found no differences in the rates of dysphagia (OR 1.21, 95% confidence interval 0.57 to 2.56). Overall, this meta-analysis, although based on limited data, supports the use of plates to achieve a more stable fixation with less subsidence and a higher fusion rate without the feared increase in dysphagia rates.

REFERENCES

1. Nunez-Pereira S, Vila-Casademunt A, Domingo-Sabat M, et al. Impact of early unanticipated revision surgery on health-related quality of life after adult spinal deformity surgery. *Spine J* 2018;18:926-934.

2. Safaee MM, Deviren V, Dalle Ore C, et al. Ligament augmentation for prevention of proximal junctional kyphosis and proximal junctional failure in adult spinal deformity. *J Neurosurg Spine* 2018;28:512-519.

3. Kelly MP, Eliasberg CD, Riley MS, Ajiboye RM, Soohoo NF. Reoperation and complications after anterior cervical discectomy and fusion and cervical disc arthroplasty: a study of 52,395 cases. *Eur Spine J* 2018;27:1432-1439.

4. Thomé C, Klassen PD, Bouma GJ, et al. Annular closure in lumbar microdiscectomy for prevention of reherniation: a randomized clinical trial. *Spine J* 2018 (Epub ahead of print). PMID: 29730458

5. Külling FA, Ebneter L, Rempfler GS, Zdravkovic V. A new parallel closing mechanism for the laminectomy rongeur makes it significantly more precise: a biomechanical and mechanical comparison study. *Eur Spine J* 2018;27:1172-1177.

6. Pasha S, Flynn JM, Sankar WN. Outcomes of selective thoracic fusion for Lenke 1 adolescent idiopathic scoliosis: predictors of success from the sagittal plane. *Eur Spine J* 2018. (Epub ahead of print). PMID: 29564609

7. Oliver JD, Goncalves S, Kerezoudis P, et al. Comparison of outcomes for anterior cervical discectomy and fusion with and without anterior plate fixation: a systematic review and meta-analysis. *Spine* 2018;43:E413-E422.

Trauma

X-ref ***For other Roundups in this issue that cross-reference with Trauma see: Foot & Ankle Roundup 1; Shoulder & Elbow Roundups 1 & 2; Children's orthopaedics Roundup 6; Research Roundup 7.***

Periprosthetic femoral fracture *versus* native hip fractures

Thankfully, periprosthetic fractures following total hip arthroplasty (THA) are relatively uncommon, being reported to complicate between 0.1% and 4% of patients during the lifetime of their prosthesis. However, with increasing numbers of arthroplasties being performed, and an ageing population, the number of these fractures can be expected to increase. Much has been written on the outcomes following native hip fractures, particularly in terms of mortality, but much less is known about the mortality following periprosthetic fractures of the hip. The authors of this study from **New York, New York (USA)** set out to evaluate the mortality of periprosthetic hip fractures, comparing them to native femoral neck and intertrochanteric hip fractures over a nine-year period.[1] This report is based on a database query of 1655 patients, all with a periprosthetic fracture of the proximal femur. Patients had a mean age of 78.9 years. A comparative group of 97 231 patients with a native hip fracture had a mean age of 82.6 years. Patients with a periprosthetic fracture had a lower mean comorbidity score and also had longer surgical delays. At the traditional 30 days following injury, the mortality rate for patients with a periprosthetic fracture was 3.2%, compared with 4.6% for those with a native hip fracture. Adjusting for possible confounding factors, there was no difference between the two groups for risk of death at one month. At six months, the mortality rate for those patients in the periprosthetic group was 3.8%, compared with 6.5% for those native hip fracture group. Adjusting for confounding factors, the risk of death remained lower in the periprosthetic group compared with the native hip fracture group. These differences in mortality became even more marked at one year (9.7% *vs* 15.9%) in the native hip fracture group. The risk of death was 29% lower for the periprosthetic fracture group compared with the native hip fracture group. The authors also identified factors that increased the mortality risk. In the native hip fracture group, advanced age, male gender, being Caucasian, higher comorbidity scores, and surgical delay were all associated with increased mortality risk. Those patients in the periprosthetic fracture group saw an increased risk in mortality if they were aged 80 years and over, were of male gender, and had higher comorbidity scores. Interestingly, there were no significant associations with surgical delay in this patient group. The authors did find that there was an increased risk of mortality associated with revision arthroplasty for periprosthetic fracture, as opposed to open reduction and internal fixation. This study was interesting for several reasons. First, it identified that the mortality risk is similar for both groups in the acute period following the injury, but, over the longer term, those in the periprosthetic group fared better. This is one of the largest studies of this kind published to date and involves patients from multiple institutions, enabling the authors to exclude a number of important potential biases. The difference in mortality risk for those patients who had fixation as opposed to replacement for their prosthetic fracture is not too surprising. Revision hip arthroplasty involves a greater physiological insult, with longer operative time and higher blood loss. This study also suggests that surgical delay was not a risk factor for increased mortality in the periprosthetic group, unlike the widely accepted (but yet to be proven) view in those patients with native hip fractures. Previous studies have confirmed that surgical delay in patients with native hip fractures is associated with a worse prognosis. Perhaps the periprosthetic hip fractures group have fewer significant comorbidities? What is clear is that the incidence of periprosthetic hip fractures is likely to increase, and that all institutions need a standardized pathway to manage these high-risk patients with multidisciplinary involvement, including physicians and surgeons with the necessary expertise.

Factors associated with revision surgery after internal fixation of hip fractures **X-ref**

One of the largest trials in trauma recently is the Fixation using