were determined and compared. Values differed significantly between normal and injured conditions in all positions. No significant difference was noted between normal and reconstructed conditions, suggesting that reconstruction improves DRUJ biomechanics and more closely approximates normal stability. As the authors suggest, the study of this joint is challenging and, while the results of this cadaveric study appear good, we would be keen to see the results of a sizeable clinical series. It does, however, seem to be another reasonable option in the armamentarium.

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Shoulder & Elbow

X-ref ***For other Roundups in this issue that cross-reference with Shoulder & Elbow see: Hip & Pelvis Roundups 2 & 7; Knee Roundup 3; Research Roundup 1.***

Subacromial decompression *versus* diagnostic arthroscopy for shoulder impingement

■ It has been a poor year for advocates of arthroscopic subacromial decompression (ASD). Further to the Can Shoulder Arthroscopy Work? (CSAW) trial, this group from **Helsinki (Finland)** have now published the Finnish Shoulder Impingement Arthroscopy Controlled Trial (FIMPACT).[1] This was a well-designed, multicentre, randomized, sham-controlled trial. The strength of this trial was in the construction of the surgical intervention arm, which included diagnostic arthroscopy to exclude other pathology. The report focuses on the outcomes of 210 patients who were enrolled over a ten-year period in three public hospitals in Finland. Each patient presented with a minimum of three months' symptoms of subacromial shoulder pain, and had undergone MRI with intra-articular contrast to exclude a cuff tear. These patients were then randomly allocated to surgery or exercise therapy. Those who underwent surgery were assessed with a diagnostic arthroscopy, and those with shoulder pathology other than impingement were excluded. The remaining surgical patients were further randomized in the intraoperative setting to either a subacromial decompression or diagnostic arthroscopy only, in which case the procedure was terminated (sham group). Patients were followed up to 24 months, with primary outcome measures consisting of visual analogue scale (VAS) scores on activity and at rest, and secondary outcomes of the Constant score, the Simple Shoulder Test score, and 15D score. The primary comparison was ASD *versus* diagnostic arthroscopy, and a secondary comparison was made between ASD and exercise therapy. A statistically significant benefit of ASD over exercise therapy was found in both the primary outcome measures (VAS at rest (-7.5, -14.0 to -1.0); VAS on arm activity (-12.0, -20.9 to -3.2)), but this did not exceed the pre-specified minimal clinically important difference. The authors encourage caution with respect to this comparison; there may be a true effect that the study is underpowered to detect, or there may be an artificial difference due to removal of a small number of cuff tear patients from the operative group. The study concludes that both ASD and the diagnostic arthroscopy placebo resulted in significant improvements in pain and functional outcomes, with no difference in the incidence of adverse events. However, the patients assigned to ASD had no superior improvement over those assigned to diagnostic arthroscopy. The experience amongst the shoulder surgeons here at *360* is that subacromial decompression as a stand-alone procedure is performed infrequently, and only in chronic cases resistant to conservative measures.

Age, gender, and reverse shoulder arthroplasty

■ There has been a rapid expansion in the use of reverse polarity total shoulder arthroplasty in recent years and, whilst the reverse was first designed as an intervention for elderly patients with cuff tear arthropathy, its use in younger patients is increasing. It is therefore important to understand how patient demographics affect the success of the procedure, and so we were interested in this study from investigators in **Gainesville, Florida (USA)** and **New York, New York (USA)**.[2] The authors sought to study the effects of gender and age on outcomes following reverse shoulder arthroplasty (RSA). The paper uses the results of 660 patients, all with either cuff tear arthropathy or osteoarthritis with a rotator cuff tear. Patients underwent a RSA, performed by one of 13 shoulder surgeons, and their results were included in an international database. Simple Shoulder Test (SST) scores, University of California, Los Angeles (UCLA) scores, Constant scores, American Shoulder and Elbow Surgeons (ASES) scores, and Shoulder Pain and Disability Index (SPADI) scores were recorded in addition to range of movement measurements. A linear mixed-effects model was then used to analyze the relationship between clinical improvements, gender, and patient age. When controlling for age, men had significantly better scores in all of the available outcome metrics. When controlling for gender, increased age resulted in improvements in the shoulder scores but poorer outcomes in terms of range of movement. The group also looked at the timing of plateau in improvement of measured outcomes following surgery and found this to be at 12 months in 80% of patients for their metric scores and

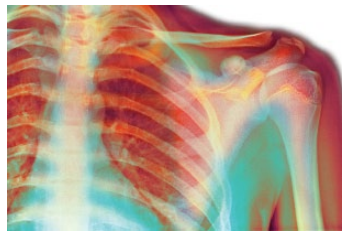
in 70% of patients for range of movement measurements. Most improvement occurred in the first six months following RSA. For transparency, it should be noted that the study was performed by Exactech designer surgeons and employees, but we are unable to see any clear bias resulting from this. The headline is that men had better outcome scores than women, and that older patients had better outcome scores – but smaller improvements in function – than younger patients. This study is useful for counselling patients prior to surgery and establishing their expectations.

Glycaemic control and deep infection after shoulder arthroplasty

■ Infection is a disastrous complication of any arthroplasty and, although still relatively rare in shoulder arthroplasty, the rates are slightly higher for reverse prostheses. Diabetes mellitus has been strongly associated with an increased risk of wound complications and deep infection following total hip and knee arthroplasty. Consequently, there has been interest in diabetic control, and the effect or otherwise that this may have on complication rates in diabetics undergoing surgery. There have been multiple meta-analyses and studies of significant size in recent years, which have given a somewhat mixed picture, particularly of the association of glycated haemoglobin (HbA1c) with operative and perioperative complications. Whilst common sense would predict deleterious effects of diabetes on shoulder arthroplasty, the relationship between impaired glucose control and deep infection has not been conclusively demonstrated. This group from **Charlottesville, Virginia (USA)** interrogated a national database for patients with diabetes mellitus undergoing primary shoulder arthroplasty, in order to investigate the effects of HbA1c level on wound complication and deep infection rates in this specific operative intervention.[3] Overall, there were 8000 patients with diabetes who were suitable for inclusion in the study, and who had HbA1c levels available and recorded within three months of surgery. These results were linked to data surrounding superficial wound complications observed within six months of surgery, and deep infection within one year of surgery. The authors then went on to undertake receiver operating characteristic (ROC) analysis to determine the most accurate threshold values of HbA1c to predict likely complications. Somewhat unsurprisingly, patients with diabetes had markedly higher rates of wound complications (1.4% *vs* 0.9% in non-diabetics). The same was also true of deep infection (0.17% *vs* 0.14%). The rate of wound complications and deep postoperative infection also increased notably as the perioperative HbA1c level increased. The ROC analysis showed an inflection at a level of 8 mg/dl, showing a threshold for a markedly increased risk of infection. This study highlights the importance of counselling patients with diabetes regarding their increased risk of these complications. Furthermore, whilst the HbA1c is obviously only a general indicator of glycaemic control, the level of control during the actual perioperative period and hospital stay was not studied in detail here. Whilst there are limitations to large population database studies, including the reliance on clinical coding and the inability to control for some other risk factors, this study does add evidence for those surgeons who insist on improved glycaemic control or a threshold HbA1c prior to surgery.

The posterior bundle of the medial collateral ligament in posteromedial rotatory instability of the elbow

■ Of all the ligamentous stabilizers around the elbow, the role of the posterior bundle collateral ligament



is amongst the least understood. These authors from the Mayo Clinic, **Rochester, Minnesota (USA)**, who are perhaps the most widely regarded and extensively published group on elbow biomechanics, sought to investigate the role of the posterior bundle of the medial collateral ligament (PMCL) in posteromedial rotatory instability (PMRI) of the elbow.[4] Specifically, they hypothesized that the PMCL must be disrupted for PMRI to occur, and that ulnohumeral contact pressures are significantly higher when the PMCL was disrupted in elbows with an anteromedial coronoid fracture and disrupted lateral collateral ligament (LCL). This is a cadaveric study with a very specific aim. Using fresh frozen cadavers placed on a jig that allowed motion under gravitational varus, joint contact pressures were measured using a transducer. Six elbows were subject to serial lesions of a stabilizing structure and sequentially measured, first in intact form, and then by the following scenarios: an anteromedial subtype two coronoid fracture, the addition of a LCL tear, and the addition of a PMCL tear. No subluxation or joint incongruity occurred in the specimens under gravity varus loading until the PMCL was sectioned. The mean articular contact pressure significantly elevated following the addition of the lateral collateral lesion to the coronoid lesion. The PMCL group contact pressures were significantly higher than those of the intact group, but not higher than those of the LCL lesion group. It therefore appears that, in the presence of an anteromedial fracture and disruption of the LCL, the posterior bundle of the MCL has to be disrupted for gross subluxation of the elbow to occur. However, joint contact pressures do increase after an anteromedial fracture and LCL disruption, even in the absence of this subluxation. Whilst only a cadaveric study, this appears to have been well conducted and adds to our understanding. What is less clear is the role of repair of the posteromedial bundle in clinical practice, given the shape of the ligament, the close proximity of the ulnar nerve, and the morbidity of elbow ligament repair in general. We look forward to more clinical studies in this important but poorly understood and rarely investigated area.

Prediction of the irreparability of rotator cuff tears

■ Preoperative prediction of the reparability of rotator cuff tears is useful both for patient counselling and for the planning of lists, if a more time-intensive alternative such as superior capsular reconstruction is being considered at the same sitting. We understand broadly that factors such as retraction of tear and fatty infiltration indicate that a tear may be irreparable, but how accurately? This group from **Busan (South Korea)** sought to investigate by combining a number of preoperatively identifiable factors in a multivariate model, in order to determine their influence and to establish the overall diagnostic accuracy of previously identified risk factors.[5] A group of 758 patients with full-thickness tears were included in this study, and 12.5% of these were found to be irreparable at surgery. Irreparability was judged for the purposes of this study as visual defects in coverage that were still seen after repair when the released tendon was mobilized over its insertion. This definition was based on the ability to perform this arthroscopically. These two groups were compared, and independent predictive factors for being in the 'irreparable group' were found to include chronic pseudoparalysis, the presence of a large mediolateral tear,

narrow acromiohumeral distance, positive tangent sign, and fatty infiltration of the supraspinatus. The tangent sign is the failure of the supraspinatus to extend above a line from the superior coracoid to the scapular spine on the MRI scapular Y view. Interestingly, infraspinatus and subscapularis fatty infiltration, age, gender, duration of symptoms prior to surgery, and involvement of the supraspinatus and infraspinatus in combination were not significant independent predictors. This study is obviously limited by the human factor in judging the reparability intraoperatively, which is fairly unavoidable, and also because what is reparable in one surgeon's hands may not be in another's. The main limitations with respect to the applicability of this study are the practicalities of performing the complex calculation required by the equation that the paper generated. As observed by an editorial in the same journal, this could be formulated into an app or other such tool, which may lead to a clinical update of this work. For now, however, this paper does serve to identify factors that the surgeon can take into consideration as nudging towards or away from the likelihood of an irreparable tear.

The salvage reverse at five years

■ Treating displaced three- and four-part proximal humeral fractures is a considerable challenge and, historically, where indicated, a hemiarthroplasty has been used as the implant of choice. The difficulties with hemiarthroplasty for this diagnosis have been the development of stem loosening, glenoid erosion, and – perhaps most importantly – poor function due to a defunctioned rotator cuff or pre-existing cuff arthroplasty. For this last reason, the use of primary reverse polarity total shoulder arthroplasty is increasing, particularly in the older patient. Many recent studies describe superior results for reverse shoulder arthroplasty (RSA) compared with hemiarthroplasty in the acute fracture position. However, a reverse is still relatively contraindicated in younger patients, with difficulties associated with glenoid loosening and high complication rates. Hemiarthroplasty offers the opportunity to retain bone stock, but function relies on retention and healing of the tuberosities, which is often difficult in these patients. Where a hemiarthroplasty fails, often the only remaining option is a RSA. This study from **Münster (Germany)** aims to evaluate the clinical outcomes following conversion from a failed hemiarthroplasty, a salvage operation that is relatively poorly studied.[6] In this series, 28 patients were followed up to a mean of 61 months and, as the primary procedure was undertaken with a convertible shoulder design, the humeral stem was preserved in nine patients but had to be revised in the other 19. Patients were followed up using the American Shoulder and Elbow Surgeons (ASES) score, the Constant score, and plain radiographs for loosening. Considering this was revision surgery for a fracture prosthesis, reasonable results were achieved, with a final mean ASES score of 59 and mean adjusted Constant score of 63%. Mean forward flexion was 104° and abduction was 98°. Nine complications were encountered, including two infections, two cases of instability, three scapular fractures, and one patient with reported symptomatic loosening. Although a relatively small series, the complication rate is considerable, and must be balanced against the anticipated risks and outcomes of reverse arthroplasty performed as a primary procedure in these cases. The big question at present is: How young is too young for a reverse arthroplasty in these patients? Once the long-term outcomes of reverse arthroplasty in younger patients are more fully understood, these may be balanced against the outcomes demonstrated in this study in order to enable surgeons and patients to make an informed choice.

Computer adaptive tests in the upper limb X-ref

■ We are increasingly required to justify healthcare expenditure in this age of healthcare rationing, and we are all familiar with patient-reported outcome measures (PROMs), which evaluate the subjective impact of conditions and treatments. Although beloved by healthcare funders and commissioners, PROMs are not without their faults. The fixed scale has commonly been developed using classic test theory, requiring a response to all questions to achieve a valid score, and many tests struggle with non-linear response and floor and ceiling effects. There is often a trade-off between the range of questions and the precision of the scores. Given the large time input for patients and healthcare resources in terms of data entry, the longer, often 'validated', tests have increasingly been condensed into short-form tests, which can compound these problems. Part of the answer to this could be computer adaptive tests (CATs), which may overcome some limitations by employing an 'item response theory' score that limits tests to relevant questions based on previous responses. This group, coordinated from **Oxford (UK)**, undertook a systematic review to assess the use of CATs in studies of trauma to the upper limb.[7] They identified a total of 31 studies that used CATs. They found that CATs correlated well with fixed scales and had minimal or no floor and ceiling effects. Significantly fewer questions and/or less time was required for completion. The patient-reported outcomes measurement information system (PROMIS) was the most frequently used CAT system, and the study also shows that the reported use of CATs is increasing. The early studies show valid and reliable outcome measurement, with CATs performing as well as, if not better than, established fixed scales. The superior measurement properties promised by a CATs approach in terms of floor and ceiling effects and ease of use are distinct advantages in outcome assessment. The authors acknowledge that further study is required, as most of the included studies are from the United States. Further psychometric evaluation involving longitudinal studies and groups of patients with specific injuries is required. There are also difficulties concerning resources, regulation, compliance, and cross-cultural translation before their adoption can be truly universal. The advantages are evident, however, and are nicely framed in this worthwhile read.

Heterotopic ossification following total elbow arthroplasty X-ref

■ Heterotopic ossification (HO) is a recognized sequela of both trauma and elective orthopaedic procedures to the elbow. In most cases, HO is relatively benign, but it can contribute to poor patient outcomes and, in some patients, requires further surgical intervention. The true incidence of heterotopic ossification and overall effect on clinical outcomes have not, however, been studied in detail. We were therefore interested to read this study from **Sheffield (UK)** examining the incidence following total elbow arthroplasty (TEA) in both elective and traumatic settings.[8] Of a total of 55 primary TEAs performed over an eight-year period with an observed follow-up period of at least six months, 29 were performed for rheumatoid arthritis and 26 for acute trauma. All but one were undertaken with a Coonrad–Morrey prosthesis, and the mean age at time of surgery was 70 years. For the purposes of the study, radiographs were reviewed and classified according to the Brooker classification on anteroposterior and lateral radiographs. Oxford Elbow Score and Mayo Elbow Performance Score were also recorded. Across this whole series, the authors did not use prophylaxis, either pharmaceutical or radiological, yielding an overall HO

incidence of 84%. This was higher in the trauma group at 96%, compared with the elective arthroplasty group at 72%. The authors reported mainly low-grade Brooker classes, with 61% of the HO being class I. Most of the disease was observed at the posterolateral aspect of the elbow, followed by the anterior aspect and along the collateral ligaments. Overall, the presence of HO did not significantly affect range of movement within either the trauma or elective groups, which was well maintained at a flexion arc of 93° and 97°, respectively.

The elbow-specific outcome scores were not significantly affected by a higher class of HO, and showed good improvement in all groups. The authors do not therefore advocate routine prophylaxis, and instead suggest consideration of this on a case-by-case basis.

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Spine

X-ref ***For other Roundups in this issue that cross-reference with Spine see: Children's orthopaedics Roundup 8; Research Roundup 2.***

A pain in the neck

Neck pain is a common and disabling condition. When combined with back pain, it can be difficult to treat and has significant ramifications for patients' quality of life, affecting both working and driving. The related psychological and sensorimotor symptoms are often also associated with a phobia of cervical movement, which combines to form a potent disabling condition. Targeting these symptoms through directed therapy would be a sensible strategy to improve a patient's quality of life; if this can be conservative in its nature, then there is much to be gained. The difficulty has always been in settling on the ideal conservative programme, and then proving if it works or not. This study from **Queensland (Australia)** brings technology into the fray by evaluating the use of therapies that utilize virtual reality (VR) or laser projection against a control group to assess their impact on the Neck Disability Index (NDI), cervical motion, visual analogue scale (VAS) score, and kinesiophobia at four weeks and at three months.[1] The authors tested their interventions using a randomized controlled trial methodology to compare conservative therapy, virtual reality, and laser projection with outcomes assessed at over three months of follow-up. Patients were included in the trial if they were aged 18 years or over with at least three months of neck pain, a reduced peak cervical movement velocity, and a VAS score of 20 mm or more. The study here describes patient allocation using a flowchart, which describes how 141 patients were evenly distributed between the three arms within phase one (which finishes after four weeks of therapy), followed by a further randomization of the control group after four weeks between the VR and laser groups with reassessment at three months. The authors describe that the control group, who received no specific therapy, showed no improvement over the investigation period; however, the VR and laser projection groups showed marked improvement in every domain. Between the two interventions, VR exceeded the improvement seen in laser projection ($p < 0.05$ in all cases). The number needed to treat using these therapies, in order to show a ten-point improvement in the NDI (the minimally important clinical difference for this scale), is ten patients. So, we have an interesting study investigating a difficult-to-treat condition that supports the early adoption of new technology in managing this difficult problem. However, as always, there are some limitations. There is a reported 15% dropout from the interventions and a 29% loss to follow-up at three months. Furthermore, there are limitations with the technology at this stage, particularly with VR, which can, and does in this study, cause disorientation and motion sickness. These therapies have enormous potential, which can be tailored to the patients' ability, provided they are willing to try new technology. We are sure that in conditions like this, where the pathology is driven at least in part by self-reinforcement, such technology may become increasingly useful.

To navigate or not to navigate?

Navigation is increasingly being used in spinal surgery and is even beginning to be considered essential by some units to help in accurately instrumenting the spine and avoiding complications such as incorrect level and misplaced hardware. Accurate pedicle screw insertion is key to maximizing kyphosis and rotation correction during scoliosis surgery, and has the advantage of preventing catastrophic complications. However, some potential users are cautious in defining the benefits of navigated surgery. These suspicions have led a group from **Yamanashi (Japan)** to conduct an observational cohort study with the aim of investigating the influence of the O-arm on pedicle perforation and pedicle screw deviation, and to identify the risk factors for screw perforation.[2] The authors conducted an observational study of 404 screws inserted into patients undergoing surgery for adolescent idiopathic scoliosis (AIS), and used postoperative CT to examine screw trajectory and establish the incidence of pedicle perforation. These findings were then correlated with the order of screw insertion, the presence of previous screw perforation, and the distance of the screw from the navigation reference frame. The authors found that no patients required revision surgery and none suffered any complications. The mean number of screws inserted per patient was nine,