

open carpal tunnel decompression is associated with an increased incidence of trigger finger in the operative hand. This study has the great advantage of considering background incidence but, in a retrospective study with uncertain fidelity of data and unknown loss to follow-up, it is difficult to be absolutely certain of the conclusions. It is certainly of interest for hand surgeons, patients, and health-care funders who wish to get to the bottom of this apparent relationship. While the jury is still out in terms of causation, what is clear from the currently amassed evidence is that there is a relationship between the two, which needs to be explored more closely.

### TFCC in the absence of instability?

Continuing our focus on ulnar-sided wrist pain in this edition of 360, we consider another pathology that is not always symptomatic, and for which the treatment choices are therefore in question. Triangular fibrocartilage complex (TFCC) tears can also cause ulnar-sided wrist pain but the natural course of the pathology is not well understood and, in common with other diseases with a potentially degenerative aetiology, such as rotator cuff tears, there is an increasing incidence of asymptomatic tears with age. It is well recognized that a TFCC repair should be considered in those with symptomatic distal radioulnar joint instability, but is this also the case in those without instability? This is a well-studied pathology in the literature and one of the difficulties is that the reported incidence of asymptomatic degenerative tears clouds the message. This group from **Anyang (South Korea)** have undertaken yet another single-centre retrospective study

examining the TFCC.<sup>8</sup> However, unlike previous studies, their three-year cohort of 117 patients reports on individuals with TFCC tears but no distal radioulnar joint (DRUJ) instability. Diagnosis of a symptomatic tear required for the purposes of this study required ulnar-sided wrist pain, identification of a tear on MRI or CT arthrograms, and a positive ulnar grind test or ulnocarpal stress test. Overall, 25 patients were excluded as they met criteria for surgical intervention and 19 patients were lost to follow-up before six months. A total of 72 wrists were included in the final report (42 men and 30 women) with a mean age of 40 years and an age range of 18 to 70 years. This group was followed for a minimum of six months (mean 16 months) and the reported visual analogue scale (VAS) pain score and patient-rated wrist evaluation (PRWE) were recorded at the initial visit as well as at one, two, three, and six months in addition to final follow-up. A PRWE score of less than 20 points was taken to indicate complete recovery, while more than 20 points was considered to be incomplete. Survival analysis and Cox regression modelling were used to estimate the time to recovery, as well as to evaluate the effects of age over 45 years, obesity, sex, dominant hand, traumatic tears, ulnar positive variance, and chronic symptoms over six months. Overall, 30% of cases had completely recovered at six months and 50% had at one year. It was not possible from the candidate risk factors to identify any risk factors that were significant. This may be the product of an insufficient sample size, but nevertheless the paper does illustrate the potential success of treating TFCC tears non-surgically in the first instance, and the authors recommend

a minimum of six months nonoperative management in their conclusion. We would agree that further study to evaluate possible predictors of failure of nonoperative management would be useful, in order to identify those who will require surgery in due course.

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## Shoulder & Elbow

**X-ref** For other Roundups in this issue that cross-reference with Shoulder & Elbow Elbow see: **Sports Roundup 2; Trauma Roundup 8; Children's orthopaedics Roundup 8.**

### Proximal humeral fractures in the elderly: delayed reverse total shoulder arthroplasty is an option **X-ref**

The subject of indications for surgery for proximal humeral fractures remains controversial, as does the question of which operations one should undertake. The PROFHER (Proximal Fracture of the

Humerus: Evaluation by Randomisation) study reported no benefit for open reduction and internal fixation (ORIF) over conservative management in a particular subset of patients, with hemiarthroplasty and ORIF chosen as the comparator to nonoperative treatment for these complex fractures. Recent data have suggested a three-fold increase in the use of primary reverse shoulder arthroplasty for these injuries, while a study we have previously discussed here at 360 found no apparent differences in outcome between nonoperative management and reverse shoulder arthroplasty. The jury

is still very much out; until the results of PROFHER-2 are reported, we may not know with any certainty if reverse shoulder arthroplasty should become the 'go to' option for proximal humeral fractures. However, good results have been previously reported with the use of delayed reverse total shoulder arthroplasty for cases of malunion or nonunion. One question that will not be answered by the current crop of randomized controlled trials is how the outcomes compare between acute or delayed intervention with a reverse prosthesis. After all, if the complication profile is the same and

there are no differences in function, then the wisest route may be to treat the majority conservatively and simply intervene with a reverse prosthesis at a later date in those who do not do well. This systematic review with meta-analysis from **Lebanon, New Hampshire (USA)** sought to answer the question: is the delayed reverse shoulder arthroplasty a reasonable approach? The authors were able to include 16 studies (four comparative (46 patients); 12 case series) that incorporated a total of 322 patients undergoing reverse shoulder arthroplasty for fracture complications. The epidemiology of the patients included was consistent with the current literature and the mean follow-up was 45 months. No difference was found in the clinical outcomes or reoperation rates between patients undergoing acute or delayed surgery. Although the authors found a better range of external rotation in the delayed group, which was statistically significant, this was only 6° greater and is likely to be of doubtful clinical relevance. Despite the notable limitations of this study associated with the poor quality of data available in the literature, the authors sensibly conclude that, given the risks associated with surgery in an older population, primary conservative management should be at least considered for these patients, given that delayed reverse shoulder arthroplasty appears to yield a comparable outcome. The large UK PROFHER-2 randomized trial looking at nonoperative management *versus* hemiarthroplasty *versus* reverse shoulder arthroplasty is underway, which will add to the literature but will not guide the option of a delayed operative approach. Nonoperative management is yet to be bettered; there is clearly a role for surgery, but in a set of patients that is yet to be defined, with predicting nonunion key to advancing the literature in this area.

### **ORIF or arthroplasty for distal humeral fractures: which is more cost-effective?**

#### **X-ref**

■ The rising use of total elbow arthroplasty (TEA) for distal humeral fractures is likely to be related to the increasing number of elderly osteoporotic fractures in this injury group. The TEA is an attractive option for the older fragility fracture, offering a high rate of patient satisfaction and rapid return to function. However, this potentially comes at the cost of a revision and infection burden. The only level 1 evidence to date is from the COTS (Canadian Orthopaedic Trauma Society) group, which found more predictable and superior functional results with TEA compared with open reduction and internal fixation (ORIF) in what was, sadly, a rather small study. However, long-term follow-up data remains

sparse and most authors still suggest that ORIF should be used in patients where it is viable. In this study from **Durham, North Carolina (USA)** and **Chicago, Illinois (USA)**, the authors performed a retrospective review of patients aged 60 years or older who underwent acute ORIF or TEA for a type C2 or C3 fracture of the distal humerus, with the aim of undertaking a cost-effectiveness analysis.<sup>2</sup> Patients were included if they had a minimum clinical follow-up of three months and a telephone follow-up survey was performed at least two years post-surgery. Of the initial 129 patients identified, only 54 fit these inclusion criteria, of which only 23 patients made up the final study cohort. As part of the study, the authors developed a Markov model from the highest level of available literature, representing transitioning health states in relation to the treatment method used. The primary outcome measure was the quality-adjusted life-year (QALY) calculated from the EuroQol (EQ)-5D, with secondary outcome measures including the Mayo Elbow Score, the Disabilities of the Arm, Shoulder and Hand (DASH) score, range of movement, and complications. All outcomes were comparable between the two groups, but with a trend towards a superior Mayo Elbow Score in favour of TEA (92 vs 78;  $p = 0.075$ ). Although reoperation rates were comparable, at 41% with ORIF and 45% with TEA, reoperation occurred much earlier in the ORIF group (5.4 months vs 37 months for TEA). These rates are somewhat higher than might be expected. Sensitivity and cost-effectiveness analyses demonstrated that the cost of each intervention was comparable for patients aged 65 years (US\$19 407 for TEA vs US\$20 669 for ORIF), with the higher initial costs of TEA offset by the high early re-intervention rate with ORIF. The cost per QALY for TEA was superior (US\$2375.76 vs US\$2677.26 for ORIF). This study is undoubtedly limited by the retrospective design, the very small numbers included, and the limitations of the current literature when considering the Markov model. Despite this, it is one of the first to compare the cost-effectiveness of these two interventions for distal humeral fractures in the elderly. The authors of the study conclude that TEA is marginally more cost-effective than fixation in the more elderly patients, but wisely temper this by noting that each case should be assessed on merit regarding the best options for the patient and the fracture. Here at 360, we would suggest that TEA is best reserved for less active elderly patients in whom the complexity of the fracture means that stable fixation is not possible, and in patients with concomitant inflammatory arthropathy.

### **ORIF or arthroplasty for radial head fractures?**

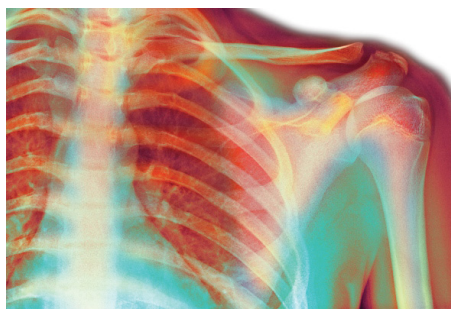
■ Complex unstable radial head fractures are a unique surgical challenge due to their association with instability of the elbow and/or forearm. While the ‘terrible triad’ is well recognized, there is also a range of other patterns of elbow instability associated with poor outcomes. In all instances, the aim of treatment is to restore stability, with restoration of the radiocapitellar contact and radial column often an essential step. Radial head excision is only really possible when there is no evidence of instability, leaving fixation or arthroplasty as the surgical options. Some literature has suggested that unstable fracture patterns managed with internal fixation are prone to failure, nonunion, and inferior functional outcomes. That said, radial head arthroplasty opens up the difficulties of revision surgery, implant infection, and loosening. The treatment of the isolated radial head fracture is also the subject of much debate, with surgeons favouring one treatment or another, and the evidence is mostly small cohort or randomized trials. In this network meta-analysis from **Hamilton (Canada)**, the authors analyzed 20 studies, including four randomized controlled trials (RCTs) and 16 cohort studies, with sample sizes ranging from 25 to 165 patients.<sup>3</sup> The aim of the analysis was to compare interventions for treatment of displaced radial head fractures. The demographics of those included were consistent with those reported in the current literature. The RCTs looked at fixation with metal implants, fixation with biodegradable implants, and radial head arthroplasty. For the network meta-analysis of functional outcomes, the Broberg and Morrey Score was available in 281 patients; the authors reported greater odds of attaining a good or excellent outcome with arthroplasty when compared with metal (odds ratio (OR) 22.5) or biodegradable fixation (OR 11.8). Similarly, the analysis of postoperative complications in 288 patients found reduced odds of developing a complication with arthroplasty when compared with metal (OR 0.15) or biodegradable fixation (OR 0.16). The authors acknowledge the small sample sizes and the limited quality of the trials included. The effect estimates reported in the study were very low to moderate for the functional outcome scores, and very low to low for complications. The authors were also unable to make any meaningful comparisons with regard to other treatment methods such as excision or nonoperative management. However, here at 360, we would support the study’s suggestion that radial head arthroplasty is superior to fixation, as this would seem to negate any potential concerns regarding fixation failure

and, more importantly, loss of elbow or forearm stability.

### Nonoperative management of distal biceps ruptures: how bad can it be?

■ Surgical repair of distal biceps tendon ruptures is commonly performed, with 95% of patients reported to have a good or excellent outcome with comparable strength testing to the contralateral side. Despite this, complications do occur and can be catastrophic for the patient, with a recent study discussed in 360 reporting the notable major and minor complication rates following surgery. The outcome of nonoperative management is relatively unknown and the loss of power, in particular of supination, does not always correlate with an overall poor outcome for the patient. This prospective cross-sectional study from two centres, **Pittsburgh, Pennsylvania (USA)** and **London (Canada)**, compared a conservatively managed cohort of 14 patients with a unilateral distal biceps rupture against a matched uninjured group of 18 control volunteers.<sup>4</sup> Criteria to be included in the study were: a minimum of six months of nonoperative management of a complete distal biceps tendon rupture, diagnosed by a positive hook test and on MRI; and no pre-existing condition or surgery in the injured or contralateral arm. Outcome measures included the Disabilities of the Arm, Shoulder and Hand (DASH) score, the Single Assessment Numerical Evaluation (SANE), the Biceps Disability Questionnaire (BDQ), and mechanical testing (including supination arc and power). The control group were male volunteers aged between 40 and 65 years of age who had no history of injury to their biceps and no pre-existing condition that would compromise the mechanical assessment. The groups were well matched in terms of basic demographics, with a mean time from rupture of 3.1 years. The authors reported significantly inferior DASH score (23 vs 6) and SANE score (60 vs 100) for the nonoperative group when compared with the control group. In terms of the mechanical repetitive testing in the nonoperative group when compared with their contralateral uninjured arm, the authors found a decreased supination arc and an adaptive increased shoulder contribution to rotation. Despite these adaptations, the average corrected supination power was still significantly decreased by 47%. This study is limited by selection bias, the small number of patients included, and the older patient population when compared with the current literature. Although the authors performed a *post hoc* analysis that determined that only nine patients per arm were required to detect a 15% difference in the mechanical testing

variables, whether this correlates with patient-reported outcome measures (PROMs) is unknown and it would seem wise that future studies should be powered to a PROM. Nevertheless, this series is one of the larger studies to date documenting the outcome following nonoperative management of these injuries, and it provides useful prognostic information when counselling patients regarding management. The authors demonstrated clinically meaningful impairment on the functional scores in the DASH score (23.2 (SD 10.3)) and SANE score (59.6 (SD 16.2)). However, it is important to remember that the comparator here is a normal individual, not an operated biceps tendon rupture, where a pre-rupture outcome is extremely unlikely.



### What is a critical-sized glenoid defect?

■ Here at 360, we rarely include papers based on computer-simulated data; however, we were interested to come across this finite element analysis study from **London (UK)**, which has a clinically relevant message.<sup>5</sup> The stability of the shoulder is dependent on the load upon it, and the authors of this study set out to establish the 'critical size' of glenoid defect that, under physiological loading, would lead to further anterior instability following an arthroscopic Bankart repair. The critical size of such a defect has been debated at length and has previously been stated to be 20% of the length of the glenoid. Two finite element models were generated to assess stability of the shoulder during 30 different activities of daily living. These were applied for the intact glenoid and in differing scenarios of anterior bony defects of increasing sizes in 2 mm increments. The critical defect size was defined as the smallest defects leading to dislocation and the finite element models were validated against *in vitro* cadaveric measurements of anterior stability of the shoulder. The dislocation forces were found to be within one standard deviation of experimental values. The model showed a high risk of dislocation during activities of daily living after a Bankart repair for defects of 16% of the length of the glenoid. To avoid that risk, our threshold for a

bony procedure should perhaps therefore be lower than previously thought. There is, of course, considerable variation in the anatomy of defects in individual patients, and the model here showed a straight defect parallel to the longitudinal axis, which is clearly an oversimplification. Also oversimplified are the soft-tissue capsular ligamentous restraints and the fact that the results are only generalized to the mid-range of shoulder movements. However, we commend the study group for some excellent theoretical work, which may move forward our understanding of the subject.

### Superior capsular reconstruction in irreparable cuff tears

■ For patients with irreparable rotator cuff repairs, there are few reconstructive options. While reverse total shoulder arthroplasty can relieve pain and restore motion, this is an aggressive and somewhat drastic solution for those patients with little or no glenohumeral osteoarthritis, and also comes with few possibilities for later revision in the event of failure. There have been a range of operative options suggested in the past, including allograft and artificial 'hoods'. More recently, superior capsular reconstruction (SCR) has been proposed as a less aggressive arthroscopic treatment for irreparable rotator cuff repairs to relieve pain. The reports in the literature suggest that, in many cases, it has also been demonstrated to restore motion. This study from an internationally renowned group of shoulder arthroscopists in **San Antonio, Texas (USA)** investigated the rate and magnitude at which active forward flexion returned in patients who underwent SCR for massive irreparable rotator cuff tears in the presence of profound pseudoparalysis.<sup>6</sup> This pseudoparalysis was quantified as active forward flexion of less than 45° seen in patients without significant glenohumeral osteoarthritis, who had an intact or reparable subscapularis, a massive rotator cuff tear, and full passive flexion. Follow-up of a minimum of 12 months was also required. These criteria resulted in the inclusion of ten patients, nine of whom regained active overhead use of the operative arm, with a mean postoperative active forward flexion of 159° (SD 15°). All secondary outcomes, including visual analogue scale for pain, American Shoulder and Elbow Surgeons (ASES) subjective shoulder score, and active external rotation, were also reported to demonstrate significant improvement. Seven of the ten SCR grafts undertaken demonstrated healing on MRI, with no complications reported. Overall, 90% of patients with massive irreparable rotator cuff tears with significant pseudoparalysis,

which would otherwise require reverse total shoulder arthroplasty for pain relief and restoration of motion, were successfully treated with SCR. However, it should be noted that this cohort is small, retrospective, potentially subject to selection bias, and with limited follow-up. While these results are in keeping with previously published literature demonstrating the effectiveness of SCR in irreparable rotator cuff tears, it is important to recognize that this is a highly technical procedure with results reported in this investigation by a highly proficient arthroscopic shoulder surgeon, and results may not necessarily be generalizable.

### Full-thickness rotator cuff tears and progression?

■ The evidence would suggest that while full-thickness rotator cuff tears are a primary cause of shoulder pain in the adult population, there are many full-thickness tears that are asymptomatic. It is unclear which tear characteristics lead to symptoms, and the overall role of tear progression in patient symptoms and the influence on patient outcomes are similarly unknown. There are some surgeons who believe that tear progression with delayed operative treatment worsens patient outcomes, but this conclusion itself remains controversial. This group from **Calgary (Canada)** have performed a fairly extensive systematic review to determine the rate of radiological tear progression in nonoperatively treated rotator cuff tears, and thereby establish the optimal treatment of these injuries.<sup>7</sup> The published literature was reviewed for reports of full-thickness tears; reports of partial-thickness tears were excluded. These papers were analyzed for both clinical and radiological progression, as defined by an increase in tear size > 5 mm on ultrasound or MRI. Eight studies were suitable for inclusion in the review, with a mixture of level I to level IV evidence, and the reports of 411 tears were analyzed. No differences were demonstrated in the rate of tear progression between those patients in the asymptomatic and symptomatic groups, with progression rates of 40.6% at 46 months and 34.1% at 37 months, respectively. The number needed to treat was calculated for an 8% re-tear rate at two years' follow-up, showing that seven rotator cuff repairs would be required

to prevent one radiological progression. It should be noted that these tears are mainly chronic and degenerative in nature, and that the inherent propensity for tears to progress in size may well be independent of symptomatology. The groups were also not perfectly matched in terms of demographics, with a slightly younger age and shorter follow-up in the symptomatic group, the effect of which is unclear. Furthermore, there was no standardization of nonoperative treatment protocols in this paper, and heterogeneity exists in the literature definitions of progression of cuff tear size. However, we can conclude from this study that it is likely that most tears will not progress significantly over short- to medium-term follow-up and, depending on the individual patient, most could be discharged with advice to re-present if symptomatic.

### Bridge technique for bony Bankart lesions X-ref

■ The bony Bankart bridge (BBB) is a technique used to repair bony Bankart lesions by incorporating the bone fragment into the Bankart repair. This technique utilizes medial anchors on the glenoid neck and anchors at the chondral-fracture surface junction. Short-term results previously reported were favourable and the same group from **Vail, Colorado (USA)** now reports their five-year mid-term results.<sup>8</sup> Patients were included if they had a minimum of five years' follow-up available and had undergone the BBB technique described by the authors. Patients were excluded if they had any other pathologies or procedures such as open reduction or rotator cuff tears. Outcomes were assessed using the Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH), American Shoulder and Elbow Surgeons (ASES) Single Assessment Numeric Evaluation, and 12-Item Short-Form Health Survey (SF-12) scores. A total of 13 patients with a mean age of 39.6 years underwent the procedure, with a mean follow-up of 6.7 years reported here. The mean glenoid bone loss was 22.5%, indicating that the technique was employed for cases that certainly mandated repair; these results are reflective of current practice from the perspective of patient demographics. All of the patients reported here had a significant improvement in their SF-12

scores at over five years of follow-up and, while three patients had ongoing subjective instability, 75% of patients returned to sport at least at an equal level to preoperative participation. No patients underwent additional surgical treatment. While the evidence suggests that this is an elegant and seemingly effective technique for repair of bony Bankart lesions, it is important to remember that this is a small cohort reported with a lack of control group, which prevents generalization and comparison with other more standard techniques. However, the results do seem durable, and if outcomes are indeed comparable to other more invasive surgeries, then this method holds considerable attraction.

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