must be interpreted within the limitations of this study, which are clearly moderate given the loss to follow-up rate.

Decompression for recurrent carpal tunnel syndrome provides significant functional improvement and patient satisfaction

The efficacy of carpal tunnel decompression in appropriate selected cases is well established and documented within the literature. However, recurrent carpal tunnel syndrome symptoms can result from a variety of anatomical causes not limited purely to recurrent circumferential fibrosis around the median nerve. The outcome of revision surgery is therefore less certain and relatively poorly documented, especially with reference to quality-of-life outcome measures and patient-reported outcome measures. While only a relatively small single-centre study, this work from **Edinburgh (UK)** is very well designed to address these issues and achieve a high level of confidence in the findings.[8] For the purposes of the study, the Quick version of the Disabilities of the Arm, Shoulder and Hand Score (QuickDASH), patient satisfaction, and EuroQol five-dimension questionnaire were collected both preoperatively and at least six months postoperatively from revision open carpal tunnel decompression patients over a five year period until 2018. In all, there were 14 patients who underwent the procedure, with one excluded due to lack of preoperative data. The median time to revision was 13 years (range 4 to 35) following primary surgery, and the mean patient age was 57 years. No patient had an outstanding medicolegal claim. Surgical technique and postoperative rehabilitation were consistent for all patients, with a tourniquet utilized, the previous wounds reopened, and the scarred retinaculum divided under direct vision. Incision was extended proximally as required to confirm complete release, which was visually verified. The mean free and postoperative QuickDASH was 55 and 29, respectively, demonstrating both statistical and clinically significant improvement. There was a mean improvement in the EQ-5D-5L of 0.11, which did not reach statistical significance, and 13 patients stated satisfaction after the procedure. There were no reported complications and no cases of incomplete initial division of the flexor retinaculum. Overall, open revision carpal tunnel decompression can result in improvements in both functional outcome and health-related quality of life that are clinically significant. Obviously, this is a paper with relatively small numbers of participants gathered from a single centre, and the results must be tempered by these facts. However, here at *360*, we admire the sound methodology that demonstrates the value of this procedure.

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Shoulder & Elbow

Recovery after proximal humerus fractures: are psychological and social factors most important?

Psychosocial factors are known to influence both surgeon- and patient-reported outcomes for conditions of the upper limb, and there is even evidence that they may be the most important factor in some conditions. A recent systematic review previously discussed here at *360* emphasized the association of these factors with disability and upper limb injuries. Prospective randomized clinical trials have reported the positive effects of preoperative priming on patient-reported outcome scores. An international collaborative study, primarily based in **Oxford (UK)**, was designed to evaluate the psychological and social aspects most closely linked to recovery following a proximal humerus fracture.[1] The authors enrolled 177 patients (128 women, mean age 66 years (18 to 95)) presenting with an isolated fracture of the proximal humerus and asked them to complete a range of patient-reported outcome measures (PROMs) within a week of injury. Outcome scores measured included the Patient-Reported Outcome Measurement Information System Upper Extremity physical function computer adaptive test (PROMIS UE). Scores were recorded again between two to four weeks following injury and, finally, between six to nine months following injury. Following bivariate and multivariate regression analysis, the fear of movement on the Tampa Scale for Kinesiophobia-11 (as measured within the first week of injury) and self-efficacy (at two to four weeks following injury) were the strongest predictors of the PROMIS UE scores at six to nine months. The authors conclude that, following a fracture of the proximal humerus, the key modifiable factors include overcoming the fear of movement or further injury within the first week following fracture, as well as improved self-efficacy within the first month through resilience and effective coping strategies. This study highlights the importance of routinely assessing and managing the psychosocial aspects of injury. As we at *360* have discussed before, it also poses the question of how we adapt current PROMs to consider the obvious influence of psychosocial status.

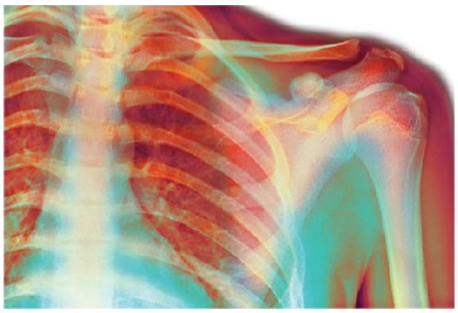
Steroid injections should be at least two weeks prior to arthroscopic shoulder surgery

Recently, several papers have documented the risks associated with preoperative injections in patients undergoing arthroscopic rotator cuff repair. A previous big data study discussed here at *360* reported that patients who received an injection in the month prior to arthroscopic rotator cuff repair did have a significantly higher surgical site

infection rate. In this paper from **Chicago, Illinois (USA)**, the authors again seek to utilize a big dataset – the PearlDiver insurance database – to determine whether there is any relationship between the timing of a steroid injection prior to shoulder arthroscopy surgery and the subsequent development of postoperative infection.[2] The study identified 50,478 patients who had undergone a shoulder arthroscopy, 4,115 of these having had an injection in the six months prior to surgery. Documented surgical site infection within six months post-surgery was the primary outcome measure. For two-monthly intervals and two-weekly intervals (for patients who received injections in the zero- to two-month period prior to surgery), subanalysis was performed. There was no difference between the injection and non-injection groups in terms of overall infection rate (1.53% vs 1.56%) or infections that required intravenous antibiotics and/or surgical management (0.56% vs 0.55%). The only significant finding was an increased rate of infection in those patients that received an injection within the two weeks prior to surgery (8.86%, n = 79) and a decreased rate in those who did not (1.56%, n = 46,363; $p < 0.0001$). For the two-week injection cohort, there was no difference in baseline demographics (sex, diabetes, smoking, the presence of rheumatoid arthritis, or Charlson Comorbidity Index scores). The authors conclude that arthroscopic shoulder surgery can be safely performed at least two weeks following steroid injection. As with many papers in this area that utilize similar big data techniques, there are notable limitations to this study: the quality of the database is unknown; the lack of important baseline demographic and surgical data; the relatively short-term follow-up, and the potential for patients to have received treatment not recorded in the dataset. However, this study grants the literature information on the safety of steroid injections prior to arthroscopic shoulder surgery, lending reassurance to those who try to ameliorate symptoms in the preoperative months. It is also one of the few that has a large enough sample size to make a meaningful analysis by time interval. In this case, breaking the two months prior to surgery into two-week periods clearly demonstrates a safe window of more than two preoperative weeks.

Hydrogen peroxide skin preparation: the answer to *Cutibacterium acnes* in shoulder arthroplasty?

■ It is a well-established cause for indolent infection in shoulder surgery, but what is the answer to *Propionibacterium acnes*, now known as *Cutibacterium acnes*? The pages of *360* have been inundated with reports of the treatments for, and the problems posed, by *C. acnes*. Here at *360*, we recently discussed a single-centre prospective randomized controlled trial that included 56 patients undergoing anatomical or reverse shoulder arthroplasty. Subjects were randomized to either standard perioperative cefazolin (n = 27) or a combination of doxycycline and cefazolin (n = 29). While acknowledging that this study was underpowered, the authors did not find any benefit of preoperative doxycycline in reducing positive culture rates in patients undergoing shoulder arthroplasty. In this prospective, controlled, non-randomized, single-blinded study from **Salt Lake City, Utah (USA),** the authors report on 65 patients undergoing primary anatomical or reverse total shoulder arthroplasty and allocated to either standard preoperative skin preparation (31/35 analyzed) or standard preparation with 3% hydrogen peroxide preparation (30/30 analyzed).[3] The primary outcome measure was a positive culture result from aerobic or anaerobic intraoperative samples taken from the skin, dermis, shoulder joint, and air (negative control). Patients were followed up for a minimum of three months post-surgery to ensure that there were no latent complications to the skin preparation used or evidence of latent infection. A sample size calculation determined that 28 patients were needed per group to detect a 50% reduction in *C. acnes* positive culture rate. The groups were well matched at baseline and no adverse reactions related to the skin preparation were noted. Of the positive cultures, *C. acnes* accounted for the vast majority. The rate of triple positive cultures was lower in the peroxide group (0% vs 19%; $p = 0.024$), as was the number of positive cultures from the joint (10% vs 35%; $p = 0.031$). These results are startling and, despite the appreciable limitations in the study design and the potential for overinterpretation, they suggest a large effect size and should not be ignored. Interestingly, on sub-group analysis, these differences were only significant in male patients. There was one postoperative infection with *C. acnes* observed in the control group; it required surgery and six weeks of intravenous antibiotics. The authors conclude that, particularly in male patients, the addition of preoperative hydrogen peroxide skin preparation could reduce deep-tissue contamination. However, as they acknowledge, there are clear limitations to this study related to the small numbers and lack of power, the non-randomized design, and the short-term follow-up. As we have said before here at *360*, larger studies are needed, and it would seem sensible that these focused on high-risk patients.



MRI and the shoulder: what's normal and what's not?

■ Shoulder pain is common and MRI is frequently used post-radiograph as second-line imaging to aid in diagnosis. However, previous studies have documented a surprisingly high rate of incidental findings that are either unrelated to the patient's symptoms, or found in those who are asymptomatic. Despite this being a widely recognized phenomenon, there are relatively few studies quantifying the false positive, or asymptomatic lesion, rate in MRI scanning of the shoulder. In this interesting study from **Minneapolis, Minnesota (USA),** the authors took bilateral shoulder MRIs of 123 patients (246 shoulders) that presented from the community with unilateral shoulder pain, allowing for a unique opportunity to examine asymptomatic patients at risk of shoulder pathology.[4] Patients with any evidence of adhesive capsulitis, substantial loss of motion, previous upper-limb fractures, recurrent shoulder dislocations, or neck-related pain were excluded. The blinded, anonymized images were reviewed by an experienced board-certified orthopaedic surgeon and a radiologist. Overall, 88% of the patients were under 60 years of age, and so a lower rate of background incidental pathologies could reasonably be expected. Despite this, however, a large number of abnormalities were reported on all scans taken. Rotator cuff tendinopathy was very commonly reported in symptomatic shoulders at rates of 92.7% and 74.8%, and in asymptomatic shoulders at 88.6% and 73%, by the radiologist and surgeon, respectively. This calls into question the diagnostic accuracy of a MRI scan in isolation. These results were similar for acromioclavicular joint abnormalities in both the symptomatic (91.9% radiologist, 79.7% surgeon) and asymptomatic shoulders (89.4% radiologist, 73.2% surgeon). Findings that may be considered more clear-cut, such as full-thickness rotator cuff tears and glenohumeral osteoarthritis, were predominantly reported in the symptomatic shoulder. The observed agreement between the two reviewers ranged from 45% to 98%, with the

kappa agreement value ranging from slight to moderate (0.00 to 0.51). The limitations of this study are related to the relatively small number of patients included in some of the sub-analyses and the lack of intraobserver analysis. Nevertheless, the paper does highlight the limited role MRI has to play in the decision-making process for patients with unilateral shoulder pain fitting the above criteria. MRI findings should be closely correlated to the clinical picture to justify surgery. This study raises almost as many questions as it answers. The cohort used is rather unusual: they have contralateral symptomatic shoulders and so have a high risk of shoulder pathology. It would have been interesting to see a comparison of these findings with an age-matched group without shoulder pathology. Do the scan findings simply relate to shoulder degeneration and not to specific pathology?

Surgery or nonoperative management for rotator cuff tears? X-ref

■ The role of surgery for a rotator cuff tear, particularly in the older patient, remains controversial. While at first glance it would make sense that repair of an injured tendon gives better results, the reality is often somewhat different. Retear rates are high and, in many series, outcomes are no better than with conservative management. Surgical intervention, of course, carries its own set of complications. Studies looking at the role of nonoperative management, subacromial decompression alone, and surgical repair in this patient group have reported conflicting results. The Effectiveness of Open and Arthroscopic Rotator Cuff Repair (UKUFF) trial was a large multicentre randomized study published in 2017 that found no difference between open and arthroscopic rotator cuff repair. Interestingly, three years after commencing, the trial was modified; the third nonoperative arm was removed due to an 85% early crossover rate to surgery. In this meta-analysis from **Toronto (Canada),** the authors carried out a systematic review of six randomized controlled trials (RCTs) (two Level I, four Level II), which included the reported outcomes of 677 patients, of whom 626 (92.5%) had complete one year follow-up.[5] The frequency-weighted mean age of the patients was 66 years, with a minimum age of 44 years. The primary outcome reported was the Constant–Murley Score (CMS). Secondary outcomes included crossover from nonoperative to operative, retear rate following surgery, and overall complications. The authors report a significantly better CMS at one year post-surgery when compared to nonoperative management, with a mean difference of 6.15, and to subacromial decompression in isolation, with a mean difference of 5.81. However, both these differences are below the minimum clinically important difference (MCID) for the CMS, which is routinely quoted as being in the region of ten points. The conservative-to-surgical crossover rate for the studies was 11.9% (16/134), and the overall reported retear rate in the surgical cases was 32.9% (55/167), ranging from 18.6% to 73.7%. The authors conclude that surgical repair of degenerative rotator cuff tears in older patients does give significantly better results than nonoperative or subacromial decompression alone. However, the differences were appreciably below the MCID, and this suggests that a more bespoke approach when offering surgical management is best. The authors do acknowledge that there are limitations to the data used in the analysis. These include the older age of the cohort (though this is consistent with the epidemiology of tears), the small number of patients available for meta-analysis, the lack of power of several RCTs, the heterogeneous nature of the surgical techniques used, and the relatively short-term follow-up of the studies. Here at *360*, we suggest that this work demonstrates that nonoperative management can likely be employed in the majority of patients, with surgery reserved for specific cases.

Total elbow arthroplasty or open reduction and internal fixation for elderly distal humeral fractures: long-term results from a randomized trial X-ref

■ Medical literature has documented the increasing use of total elbow arthroplasty (TEA) for fractures of the distal humerus. For instance, here at *360*, we discussed a recent study that suggested TEA is marginally more cost-effective than fixation in elderly patients. The trend is reflected in registry data; however, there is little objective scientific data to validate this change in clinical practice. The only Level I evidence to date is from Canada, where a small trial found more predictable and superior functional results with TEA when compared to open reduction internal fixation (ORIF). Still, long-term data remains sparse. Building on this study from the Canadian Orthopaedic Trauma Society (COTS) group, authors led from **Phoenix, Arizona (USA)** present the long-term outcome from this published prospective randomized controlled trial comparing ORIF with TEA for type C distal humeral fractures in 'elderly' patients over 65 years of age.[6] Of the 42 patients reported in the original study, the authors present data on only 40 patients, which include 15 ORIF patients and 25 TEA patients, due to five intraoperative crossovers from the original study. As would be expected in a trial that has an inclusion criterion of elbow fragility fractures, a number of patients had died at the time of this second report. In the ten patients who were alive, the outcomes for this second study were reported at a mean follow-up of 12.5 years. For the 25 patients who had died, outcomes were reported at a mean follow-up of 7.7 years. There were five patients who were lost to follow-up. While it was not a statistically significant difference, the reoperation rate was 4/15 (27%) in the ORIF group and 3/25 (12%) in the TEA group. The former had reoperations mainly for hardware removal, although one patient did have late TEA revision. In the TEA cohort, there were two operations for stiffness and one full revision for deep infection. For the ten patients with long-term patient-reported outcome follow-up, the mean elbow function was 7.7/10 in the ORIF group and 8.9/10 in the TEA group. The authors conclude that TEA is an effective procedure for distal humeral fractures in the elderly, with good long-term survival and no late revisions. It is acknowledged that there are study limitations related to its retrospective design, small size due to loss to follow-up, and the expertise of surgeons that performed the original surgery, who were all upper limb fellowship trained. However, this is the first long-term data gathered in this area from an original randomized controlled trial. Here at *360*, we were concerned by the plating configurations of some of the initial fixations, one of which used pelvic recon plates. We suspect that our understanding of rigid internal fixation has moved on in the interval since this trial was done. Therefore, we would still 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.

A higher reoperation rate following arthroplasty for failed fixation than for primary treatment of proximal humeral fractures X-ref

■ The optimal treatment of proximal humerus fractures (PHFs) is a source of great debate and one that is certainly not settled. The Proximal Fracture of the Humerus: Evaluation by Randomisation (PROFHER) trial investigated surgical versus non-surgical treatment in adult patients and cast light on the current treatment options. However, for many patients, the study posed

as many questions as it answered. Its follow-up, PROFHER-2, is currently recruiting. The aim is to investigate reverse arthroplasty in comparison to hemiarthroplasty and non-surgical care for the more severe three- and four-part bony injuries in elderly patients. Here at *360*, we await the results of this study with bated breath. To us, at least, the triallists in the PROFHER-2 study have done a much better job of defining the uncertainty surrounding the trial question than in the previous trial. Regardless of the primary treatments employed, it is important to consider the implications of the initial treatment strategy on later treatment options, especially in the context of suboptimal outcomes or failure. To those who believe that an initial open reduction and internal fixation (ORIF) preserves the possibility of later arthroplasty, there is a counterargument: the results of the secondary procedure are compromised by the first. Up to now, there has been little data on which to base this assertion; however, this superb paper from **Toronto (Canada)** changes that.[7] The authors investigated the treatment options for PHFs using data on secondary arthroplasty from regional administrative databases. Patients were identified who sustained PHFs over an 11-year period, who were aged 50 years and over, and who treated with an initial ORIF or arthroplasty. Subjects that underwent ORIF and then returned for revision arthroplasty within two years were included in the report and their results were analyzed. Over 1,600 patients underwent primary arthroplasty; 98 had a failed ORIF and underwent secondary arthroplasty. Of those in the primary arthroplasty cohort, 72 patients (4.4%) had a reoperation within two years, compared with 19 patients (19.4%) in the revision ORIF-arthroplasty group. This difference was statistically significant, even after adjusting for potential confounders (age, sex, and comorbidities), such that, in a multivariate analysis, patients undergoing a secondary post-ORIF arthroplasty had a 5.8-times higher odds of reoperation compared to those undergoing primary arthroplasty. Certainly, there is an increasing trend towards primary reverse arthroplasty for proximal humerus fractures in elderly patients; however, the effect of this on longer-term outcomes is unclear. This paper encourages stronger consideration of the use of primary arthroplasty in elderly patients, but the appropriate strategy for those below retirement age is very much still a subject for further research.

Radiographic Union Score for Humeral Fractures predicts humeral shaft nonunion

Humeral shaft fractures are a not an infrequent injury and are often treated nonoperatively, with variable rates of nonunion (10% to 20%). Nonoperative treatment is the treatment of choice for many centres and, assuming that the patient goes on to union, the results are essentially identical to the surgical option. We at *360* cannot see this 'default position' changing soon. What is tricky, however, are the difficulties that arise with nonunions. Patients who go on to nonunion have more technically challenging surgery, and there is evidence that the rates of complications like nerve palsy are higher in nonunion surgery than primary fracture fixation. Given that nonunion is often a diagnosis made after many months of perseverance with inconvenient braces and relative immobility, an early predictor of nonunion would be a great addition to the literature. It will allow timely counselling of patients in danger of an operation that comes with its own risk profile. Therefore, researchers from **Edinburgh (UK)** have sought to develop a Radiographic Union Score for Humeral Fractures (RUSHU) and to establish whether this may be used to identify patients at risk of nonunion.[8] To develop the scoring system, a two-stage approach was adopted, with an initial patient cohort of 20. These patients were selected at random from the trauma database of a large teaching hospital. After the scoring system was refined, the same method was applied to a second cohort of 60 patients, 20 of whom had developed nonunion and 40 of whom had proceeded to unite with nonoperative management. Radiographs were studied at six weeks following injury for the purposes of scoring, and the definition of nonunion was considered as the lack of radiological union at six months. The scoring system was adapted from the Radiological Union Scale in Tibial Fractures (RUST) score, and each of the four humeral cortices visible on anteroposterior and lateral radiographs were given a score between one and three based on callus formation and established bridging. Therefore, the score totalled between 4 and 12. The first cohort were scored by three observers, the second by two. They were blinded to the outcome. After the refinement process, the interobserver intraclass correlation coefficient was 0.79, suggesting substantial accord. At six weeks, patients whose injury went on to union had a significantly higher median score than those whose injury did not, with scores of 10 and 7, respectively. Patients with a score of less than 8 were 12 times more likely to proceed to nonunion, but this was tempered by the five nonunion patients with a score of over 8, forming a fairly sizeable false negative rate of 25%. However, in this relatively small cohort, the implication is that, if all patients with a score of over 8 at six weeks following injury underwent operative intervention, the number needed to treat to avoid one nonunion would be 1.5. Albeit at the six-week mark following injury, the scoring system does appear to be fairly effective, and we at *360* anticipate the refinement that will surely follow in due course.

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