

carpal tunnel release in severe cases is possible. Furthermore, simultaneous reconstruction of thumb opposition with an opponensplasty may be unnecessary in these patients. This is a group for whom no clear solution is available and, based on the results presented here, it seems that more work is warranted in this area with follow-up of longer than a year.

False-positive rates for investigations of carpal tunnel syndrome

■ The majority of experienced clinicians will agree that the overall diagnosis of carpal tunnel syndrome is a clinical one. Taking into account factors from the history, physical examination, provocation signs, and specialist investigations where appropriate – usually EMGs, but occasionally MRI and ultrasound – is the most reliable way to reach the diagnosis. However, with the continued transition towards a value-based healthcare economy, healthcare ‘payers’ are increasingly insisting on positive investigations and failed conservative management before they will fund operative release. The problem with this approach is that none of the investigations are 100% sensitive or specific. In current practice, the use of electrophysiological or radiological investigations in the diagnosis of carpal tunnel remains hotly debated. At different centres, these investigations may be considered as essential prior to referral to a specialist, confirmatory once referred, or performed where doubt concerning the diagnosis may exist. Electrophysiological examination may be time-consuming and considered painful by some; however, it directly measures nerve function, which is ultimately the variable of interest. Radiological measurements – commonly ultrasound but also

MRI – can act as a surrogate for nerve function, usually by measuring the cross-sectional area of the nerve proximal and distal to the transverse ligament. Authors from **Pittsburgh, Pennsylvania (USA)** have sought to determine the false positive rate of both electrophysiological studies and ultrasound scanning in individuals with no clinical suggestion of carpal tunnel syndrome, which remarkably is not currently known.⁸ They reviewed the investigation results of 40 hands that had been referred for electrophysiological examination for a diagnosis of either cubital tunnel syndrome or cervical radiculopathy. All patients were screened using the CTS-6 tool. This validated diagnostic tool seeks to determine the risk of carpal tunnel syndrome by assessing six criteria: numbness and tingling in the median nerve distribution, nocturnal numbness, weakness and/or atrophy of the thenar musculature, a positive Tinel sign, a positive Phalen test, and reduced two-point discrimination. The factors do not carry identical weightings but a score greater than or equal to 12 confers an 80% risk of carpal tunnel syndrome. Included patients had a CTS-6 score of 0, indicating a negative answer to each of the criteria. Of the 40 patients, 20 had negative electrophysiological and ultrasound investigations. Using the CTS-6 score as a benchmark, there was an overall false positive rate of 50%. Electrophysiological testing had a higher rate (43%; 95% confidence interval (CI) 26 to 59) than ultrasound (23%; 95% CI 9% to 36%). When using a confirmatory test, clinicians seek investigations with a low false positive rate. That both these investigations were positive, despite an absence of symptoms suggesting carpal tunnel syndrome, raises questions regarding their ongoing use in this role.

Whether these investigations represent subclinical carpal tunnel syndrome is unclear; if they do, the clinical implications and prognosis for that patient is not currently known. Given the use of the CTS-6 as a benchmark, we at 360 will continue to use old-fashioned history taking and clinical examination as our primary diagnostic tool.

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Shoulder & Elbow

X-ref For other Roundups in this issue that cross-reference with *Shoulder & Elbow* see: *Hip Roundup 5*; *Research Roundup 5*.

Serious adverse events and lifetime risk of reoperation after elective shoulder arthroplasty

■ In a month of headline papers on large joint arthroplasty (see the Bristol group papers in *The Lancet*), we were delighted to see this paper from the team in **Oxford (UK)**, which looks at the outcomes of shoulder arthroplasty across the UK using large data methods.¹ The number of total shoulder arthroplasties (TSA) performed

worldwide has increased significantly over the last two decades, with the number of reverse polarity prostheses, in particular, growing at an increasing rate. As with all relatively new healthcare interventions, a phenomenon described by ‘Scott’s parabola’ will likely occur – and this article is certainly one to pour some water on unfettered expansion. The study was designed to evaluate both the survival of TSA and serious adverse events in patients undergoing TSA. The NHS England hospital episode statistics dataset were interrogated, and 58 000 elective TSAs performed in almost 52 000 adults above the age of 50 years between April 1998 and April 2017 were found. The overall

lifetime risk of revision was calculated, and the rates of serious adverse events at 30 and 90 days post-surgery were recorded. Unsurprisingly, the number of TSAs per year increased more than five-fold during the study period. Age and sex stratification showed that the lifetime risk of revision surgery varied from 2.7% in women aged over 85 years, to 23.6% in men aged 55 to 59 years, with the risk of revision highest during the first five years after surgery. The risk of a serious adverse event was 3.5% at 30 days and 4.6% at 90 days and these were unsurprisingly associated with increasing age and comorbidity, but also male sex. The category of serious adverse events included pulmonary

embolism, myocardial infarction, lower respiratory tract infection, acute kidney injury, urinary tract infection, and cerebrovascular events. Of these, urinary tract infection formed almost one-third of cases. All-cause death was 0.23% at 30 days and 0.47% at 90 days, with overall mortality lower than the expected rates for the general population. This is a very important piece of work and, with access to large-volume population data from a universal national healthcare system, there is less confounding information from socioeconomic, geographical, or commissioning factors. The data is extremely useful for shared decision-making with patients. All younger patients, especially men, should be aware of the relatively high likelihood of early failure and requirement for revision. Elderly patients with comorbidities form another group where patient selection is very important, meaning that postoperative care pathways should be scrupulously designed to avoid complications.

The terrible triad injury: replacement or reconstruction? X-ref

■ The treatment of a complex radial head injury can be exceptionally difficult, especially in conjunction with injury to the other stabilizers of the elbow, such as those seen in the terrible triad injury pattern. The dilemma between a complex reconstruction and preservation of the patient's own radial head, or a radial head arthroplasty is still very much up for debate. There is, however, a trend towards a preference for radial head arthroplasty, rather than reconstruction, as the early stability may allow quicker mobilization and a better functional outcome. This group from **Leicester (UK)** have performed a systematic review and meta-analysis to compare the outcomes of these terrible triad patients.² Outcomes of interest were the Mayo Elbow Performance Score (MEPS) and range of movement, with postoperative complications also being compared. By searching the major indices, the authors were able to identify nine studies with a total of 210 patients consisting of 98 arthroplasties and 112 reconstructions. No statistically significant differences were found in terms of overall MEPS or range of movement between the two groups, and the rate of re-operation was high for both groups, at approximately 18%. Overall, complication rates were unsurprisingly high at 65%. Given the equivalent outcomes between the groups, the obvious conclusion is that reconstructable injuries should undergo exactly that, but an arthroplasty should be used where appropriate. Clearly, this does not answer the question of which injury patterns should be

reconstructed, but, pragmatically, the surgeon should be confident that whichever treatment they choose, early active range of movement is achieved. There was concern over the long-term outcomes of radial head arthroplasties, especially in the younger age groups. The majority of the reports in the literature do not have long enough follow-up to be able to establish the survival of the radial head implants in the longer term; however, the longer the follow-up, the less favourable arthroplasties tend to look. Our appreciation of the anatomy, advancements in prostheses, and understanding of common technical errors such as over-lengthening the radius should hopefully do much to mitigate some of the poor outcomes with which arthroplasty has previously been associated. At the end of the day, a replacement can be removed later in an elbow that has rehabilitated to a good functional level and range of movement, whereas a poor initial outcome is often hard to salvage. It is for these reasons that so we very much agree with the authors – replace where possible.

Return to sport after arthroscopic rotator cuff repair X-ref

■ The sporting population, both competitive and recreational, are, by the very nature of their activities, at a greater risk of rotator cuff injury, but are also more demanding regarding a successful outcome. Furthermore, professional athletes often expect, and indeed require, a return to the level of performance achieved during their pre-morbid state, facing income loss and potential compromise on selection. This group from **Vail, Colorado (USA)** performed a systematic review and meta-analysis to analyze and determine return to sport rates after rotator cuff repair and predictive factors, particularly those associated with a lower rate of return.³ Repairs performed arthroscopically, including both partial- and full-thickness injuries, were included for all age groups and levels, and including all types of sport. Following screening, there were 15 studies suitable to be included in this systematic review and the conclusions of this review are based on the reports of 499 shoulder injuries in 486 patients. These reports had an overall mean follow-up of 14 months and 18 patients were lost to follow-up. Within these studies, 347 reported patients were particularly identified as athletes, 81 of whom were professionals, and the most prevalent sports were baseball, golf, American football, and tennis. The meta-analysis presented here showed that the return to sport, at a similar or higher level of play, was 70%, but only 61% of professional

competitive athletes were able to return. Furthermore, a detailed meta-analysis showed that the mean follow-up time and mean age at surgery did not influence the return to sport rate. Overall, the rate of return for what is, at high sporting levels, quite a significant injury seems very reasonable but athletes, especially professionals and those playing overhead sports, should be counselled regarding the very real risk of failure to return to their livelihood. As the authors point out, the reasons for failure to return may be multifactorial, and other factors including psychological issues and levels of confidence may be at play and may have an increased impact at the more exacting end of the sporting spectrum.

Midshaft clavicle fractures: under meta-analysis X-ref

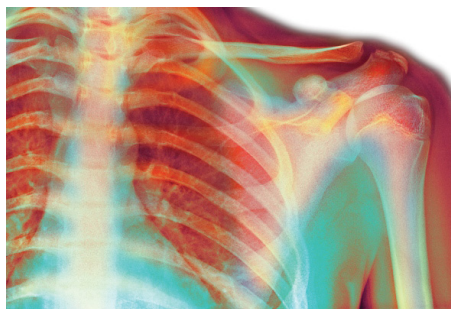
■ The treatment of the humble midshaft clavicle fracture is one of the most common injuries, but also one that generates a significant level of debate within the upper limb and trauma communities. Furthermore, there is likely a considerable variation in practice between surgeons and units in regard to the decision to operate on these fractures or manage them conservatively. Add to this the large number of randomized trials published on the topic over the past ten years, and there is plenty of scope for a convenient selection of papers that happen to support one bias or another. This paper from **Lugano (Switzerland)**, seeks to assimilate the available evidence base in the form of a meta-analysis and give some objective insight into what the assembled evidence shows.⁴ After a systematic review, 14 randomized controlled trials reporting the outcomes of 1546 patients were deemed suitable for inclusion in the meta-analysis. As is now relatively well known, a significantly lower risk of nonunion was found in the surgical group, representing a risk reduction of around 10%. Time to union was 5.1 weeks shorter with surgery, a finding that may or may not inform decisions depending on the demands of the individual patient and the economics of the local health environment. The complication rate, including the number of re-interventions, was unsurprisingly higher in the surgical group at 31% versus 20% in the nonoperative group. It was surprising that the authors stated that the shoulder function was significantly better at short-term follow-up in the surgical group in terms of The Disabilities of the Arm, Shoulder and Hand (DASH) score difference of 4, without qualifying that this is far short of most accepted definitions for the minimal clinically important difference (MCID) for this metric.

This criticism is also true for their observation that both Constant and DASH scores at long-term follow-up were better in the surgery group at differences of 5.3 and 4.3, respectively. The long-term prognosis for those who do go on to nonunion has been relatively poorly studied in the literature due to the smaller number of patients involved in each centre, and the long period required for a follow-up study. Furthermore, we do not yet have a firm grip, other than for constitutional influences, on factors predictive for nonunion or poor outcome. Here at 360 we advocate an informed discussion of the relative merits and risks of operative intervention with each individual patient, but would not accept the conclusion that surgery provides uniformly better results when compared with nonoperative treatment.

After the cuff: early active motion or sling?

■ Throughout the history of treatment of rotator cuff tears by surgical means, the pendulum has swung back and forth in regard to the degree of immobilization, or otherwise, which is prescribed postoperatively. In the early days of open repair, a natural evolution from initial caution to more permissive mobilization occurred. Yet, with the introduction of arthroscopic surgery, the pendulum has swung back towards the more cautious end of the spectrum. With modern repair techniques and anchor technology, the question now is once again being asked if patients are missing out on the potential rehabilitation benefits of early mobilization. As a firm and inescapable endpoint, the radiological outcome of repair failure is sharp in the mind of many surgeons who instinctively err on the side of caution. In the first of two studies addressing this topic in this issue of 360, we review a randomized controlled trial performed in **Alberta (Canada)** comparing two rehabilitation protocols.⁵ Their intervention group received early active motion, while the control group were treated with sling immobilization after arthroscopic cuff repair. The authors recruited 206 patients with full-thickness tears who were randomized by the team to either early motion with self-weaning off the sling or sling immobilization for six weeks following surgery. Recruited patients had an average age of 56 years and underwent arthroscopic repair. Outcomes were assessed at regular intervals up to a final follow-up of 24 months and included ultrasound assessment of repair integrity at 12 months. Additional outcomes included shoulder range of movement (ROM), pain, and subjective health-related quality of life

(HRQOL) scale collected by a blinded assessor. In terms of study retention, 83% of those enrolled completed 24 months of follow-up and, while at six weeks postoperatively the early motion group had significantly better ROM, by the final 24 month follow-up there were no significant differences apparent between the groups. At one year, 25% of patients demonstrated a recurrent full thickness rotator cuff tear on ultrasound examination, but again the distribution was not significantly different between the early motion and sling groups. This does seem to be a relatively small study sample size but does at least seem to demonstrate non-inferiority. Advocates for early mobilization will be pleased with these findings, but we feel this paper does not fully answer the question, although it is a certainly a level of evidence which we would commend others to pursue.



Sling versus no sling after cuff repair: take two

■ To continue on the theme and add to the evidence base, we would also draw 360 readers' attention to the work of a second group based in **Geneva (Switzerland)** and their newly reported randomized controlled trial of sling versus no sling for arthroscopic rotator cuff repair.⁶ This group have taken a more pragmatic approach, and only randomized patients who had small or medium rotator cuff repairs performed. Their study, therefore, potentially more closely mirrors clinical practice. Furthermore, the protocol included early passive mobilization exercises in both groups for the first four weeks followed by progressive active mobilization, and the difference between the two was the presence or absence of a sling. A total of 80 patients were randomized, with 40 in each group. Compared with the group placed in a sling, the no-sling group demonstrated greater external rotation and active elevation at six weeks, and greater internal rotation and active elevation at 12 weeks, postoperatively. Ultrasound examination at six months after surgery showed no significant differences in terms of tendon thickness, the rates of bursitis, or in repair

failure between the sling and no-sling group. The Single Assessment Numeric Evaluation (SANE) score was decreased and pain was increased with sling use. The authors conclude that sling immobilization may not be required following small or medium rotator cuff repairs and, on this evidence, we would tend to agree.

Preoperative shoulder injections are associated with increased risk of revision rotator cuff repair

■ The injection of non-water-soluble corticosteroids into the shoulder provides an important part of the armamentarium of the shoulder surgeon, but we should always be mindful of the potentially deleterious effects of our treatment. It has previously been recognized that the potent anti-inflammatory effect of these agents may inhibit normal healing processes when we come to repair these tissues. Furthermore, and probably less frequently, there is also a possibility of inoculation of infection into these deep tissues, or increasing infection rates in following secondary surgery. This group from **Charleston, South Carolina (USA)** have performed a 'big data' study to examine the effect of preoperative shoulder injections on the rate of revision rotator cuff repair.⁷ A retrospective investigation of patients undergoing primary rotator cuff repair and the timing of preoperative shoulder injections was undertaken. Data from privately insured subjects was obtained from 2010 and 2014, and multivariable logistic regression models were used to evaluate patients requiring revision surgery after confirming the laterality of injection and the index procedure. Altogether, arthroscopic rotator cuff repair was performed on 4959 patients during the study period, and 392 of these underwent subsequent revision surgery within three years of the index procedure. Patients receiving injections within six months of the primary rotator cuff repair were at a statistically significant increased risk of revision surgery, with adjusted odds ratios of 1.375 when up to three months prior, 1.822 when three to six months prior, and 1.237 when six to 12 months prior, but this last result was not significant. It is unclear if steroid injection was a proxy for the severity of the disease, lack of response to treatment, or other uncontrolled findings; but the results are nevertheless of concern. The risk of revision declines significantly when more than six months have elapsed between injection and ipsilateral primary surgery, and so it makes sense to try to delay intervention for this period of time if it is required. Indeed, the use of injections at all should be considered carefully in patients likely to proceed to rotator cuff repair.

Injections prior to rotator cuff repair are associated with increased rotator cuff revision rates

■ In a further article in this issue, and on the same topic, this group from **California (USA)** have also performed a separate 'big data' study of shoulder injection prior to rotator cuff repair.⁸ Again, large national insurance databases were interrogated to provide the study cohort and a total of 22 000 patients who received ipsilateral shoulder injections prior to rotator cuff repair were included in the eventual analysis. These patients were then matched by age, sex, body mass index, smoking, and comorbidities to a matched group who underwent rotator cuff repair without prior injections. Revision rotator cuff repair was the endpoint studied. This study again echoes the finding that patients receiving corticosteroids prior to cuff repair are more likely to undergo revision surgery, and this occurred at an odds ratio of 1.52. Furthermore, these findings were time-dependent and patients receiving injections closer to the time of index surgery were more likely to undergo revisions. The effect was also cumulative, in that patients receiving two

or more injections had a greater than two-fold increased risk at a combined odds ratio of 2.12. What really is impossible to say is what happens to those patients who have an injection and do not go on to surgery. If injections are obviating the need for surgery in some groups of patients, which even a few months in shoulder practice will convince the casual observer that they do, then the scale to which this effect might occur becomes important. If there is a significant improvement in these groups, such that subsequent surgery is avoided, then this is potentially a worthwhile pursuit, but if surgery is essentially inevitable for the majority, then these results cast doubt on how appropriate this practice may be. Regardless, surgeons would probably do well to observe the findings here both in terms of the dose effect and the duration of time to surgical intervention where the injection therapy fails.

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Spine

X-ref For other Roundups in this issue that cross-reference with Spine see: *Research Roundup 1*.

Odontoid process and mortality: can we use non-spinal scoring systems?

■ Contemporary research has suggested that fractures of the odontoid process are associated with mortality rates similar to those associated with hip fractures. However, while there has been much investment and publicity surrounding improvements in care for femoral neck fractures, such as a joint care model, medical interventions, and a best practice tariff, this is not true for fragility fractures of the odontoid process. This group from **Brighton (UK)** has sought to determine if the Nottingham Hip Fracture Score (NHFS) and the Sembo score are as useful in predicting outcomes in patients with fractures of the odontoid process as they are in patients presenting with hip fracture.¹ The team undertook a retrospective study and reviewed the clinical records of patients aged 65 years and over who presented with fracture of the odontoid process at two hospitals. Every patient was managed with a semi-rigid cervical collar and data were

evaluated to search for predictors of mortality at 30 days and one year. In all, 82 patients were identified, with a mean age of 83.7 years (67 to 100). The overall mortality across the cohort was in line with other recently published studies: 15% at 30 days and 34% at one year. Close interpretation of the data showed that the presence of a head injury and the NHFS assigned to the patient predicted mortality at both 30 days and one year. Further analysis showed that patients with an NHFS score greater than 5 had a significantly higher risk of mortality at both 30 days and one year. This cohort study shows that overall frailty is an important predictor of mortality in fractures of the odontoid process. The paper uses a pragmatic system for scoring a condition of frailty to see whether it applies to a similar condition. We suggest that this tactic could be used more regularly to avoid having to reinvent the wheel with other similar conditions, such as pubic ramus or subdural haematoma. Now that hip fractures are scored using a validated frailty score in addition to a prognostic score (usually the NHFS), we would like to see a comparison of these two approaches. Given the current climate of reducing overall spend

on healthcare, it does seem that there may be an argument for these patients to be placed on a frailty pathway with a view to improving their overall outcomes, reducing dependency, and reducing overall healthcare spend.

Steroids in dysphagia following spinal surgery

■ Anterior cervical neck surgery is now routine in spinal practice, and the preamble to surgery should always include a discussion regarding the risk of dysphagia. Dysphagia and hoarseness are due to stretch, haematoma compression, or damage to the recurrent laryngeal nerve. The strategy for managing this problem revolves around adequate nutrition, as well as allowing the usual neuroparaxia to resolve through conservative management. An alternative strategy is to use steroids to speed recovery, and it is the outcomes from this management strategy that a group from **Beijing (China)** have investigated with a systematic review.² The authors searched the usual biomedical databases for relevant randomized controlled trials and uncovered 67 studies on