

contracture was maintained in 29% of needle fasciotomy patients, and in just 7% of collagenase patients, at two years of final follow-up. There was also a significant benefit in complication profile favouring the needle fasciotomy (24% complications *versus* 93%). The data presented here, although from a small study with some obvious issues with randomisation procedure, do suggest that in the longer term the needle fasciotomy is a better option.

Carpal coalitions

■ One of the most common normal variants in the hand are carpal coalitions. These are usually an incidental finding, although they can on occasion cause symptoms as they can interfere with the normal biomechanics of the wrist and hand. Given the frequency of these coalitions, there is relatively little known about them, and, in particular, how many are incidental findings and how many

identified due to their symptoms. A study team in **Boston, Massachusetts (USA)** undertook the mammoth task of searching through 1119 posteroanterior wrist radiographs to identify carpal coalitions and what the indications for the radiographs were.¹⁰

They divided their patients according to indication for radiograph: wrist pain (623 wrists); non-traumatic wrist pain (175 wrists); and other reasons (321 wrists). Perhaps surprisingly, 8.8% of patients had a carpal coalition, and they were equally frequent in patients with wrist pain, be it traumatic or atraumatic. However, wrist pain was less common in patients with no trauma or pain. Given the findings here, although carpal coalitions were seen on wrist radiographs, it seems unlikely that many were symptomatic – especially given the equal incidence in traumatic and atraumatic painful wrists. The lower incidence in the third (non-painful) group requires a little more research to unpick. However, for

the time being we would caution clinicians and patients alike who attribute painful wrists to a coalition, as there may be another occult underlying pathology which will be ignored.

REFERENCES

1. Wertli MM, Brunner F, Steurer J, Held U. Usefulness of bone scintigraphy for the diagnosis of Complex Regional Pain Syndrome 1: A systematic review and Bayesian meta-analysis. *PLoS One* 2017;12: e0173688.
2. Lin YC, Wu WT, Hsu YC, Han DS, Chang KV. Comparative effectiveness of botulinum toxin versus non-surgical treatments for treating lateral epicondylitis: a systematic review and meta-analysis. *Clin Rehabil* 2017 (Epub ahead of print) PMID: 28349703.
3. Mi B, Liu G, Zhou W, et al. Platelet rich plasma versus steroid on lateral epicondylitis: meta-analysis of randomized clinical trials. *Phys Sportsmed* 2017;45:97-104.
4. Sanders TL Jr, Maradit Kremers H, Bryan AJ, et al. The epidemiology and health care burden of tennis elbow: a population-based study. *Am J Sports Med*;2015;43:1066-1071.

5. Pas HIMFL, Moen MH, Haisma HJ, Winters M. No evidence for the use of stem cell therapy for tendon disorders: a systematic review *Br J Sports Med* 2017;51:996-1002.
6. Harvey LA, Katalinic OM, Herbert RD, et al. Stretch for the treatment and prevention of contractures. *Cochrane Database Syst Rev* 2017 (Epub ahead of print) PMID:98146605.
7. Suzuki I, Iwamoto T, Shizu K, Suzuki K, Yamada H, Sato K. Predictors of postoperative outcomes of cubital tunnel syndrome treatments using multiple logistic regression analysis. *J Orthop Sci* 2017;22:453-456
8. Kawanishi Y, Oka K, Tanaka H, Sugamoto K, Murase T. In vivo scaphoid motion during thumb and forearm motion in casts for scaphoid fractures. *J Hand Surg Am* 2017;42:475.e1-475.e7.
9. Skov ST, Bisgaard T, Søndergaard P, Lange J. Injectable collagenase versus percutaneous needle fasciotomy for dupuytren contracture in proximal interphalangeal joints: a randomized controlled trial. *J Hand Surg Am* 2017;42:321-328.e3.
10. van Hoorn BT, Pong T, van Leeuwen WF, Ring D. Carpal coalitions on radiographs: prevalence and association with ordering indication. *J Hand Surg Am* 2017;42:329-334.

Shoulder & Elbow

X-ref For other Roundups in this issue that cross-reference with *Shoulder & Elbow* see: *Wrist & Hand Roundup 2, Trauma Roundups 1, 2 and 6; Research Roundups 2 and 7.*

Humeral shaft fractures: the neglected long-bone fracture? X-ref

■ Fractures of the humeral shaft remain a management dilemma. Although there is plenty of literature to support a non-operative approach, much is from a single unit and published under the watchful eyes of Gus Sarmiento. The data supporting non-operative management are thus from older literature that has not been consistently reproducible.¹ We were delighted to see this excellent prospective randomised controlled trial from **São Paulo (Brazil)** exploring operative *versus*

non-operative treatment for humeral shaft fractures.² These authors randomised 110 patients, all with an isolated closed fracture of the humeral shaft. The authors designed their study to compare surgery using a minimally invasive bridge plate technique with non-operative management with a functional brace. Outcomes were assessed at six months using the Disabilities of the Arm, Shoulder and Hand (DASH) score. With regard to the primary outcome measure, although a statistically superior DASH score was found following surgery at six months (10.9 vs 16.9, respectively), this six-point difference in the DASH score does not reach the minimally clinically important difference and, as such, should not be considered clinically relevant. Perhaps most

striking was a marked difference in union rates between surgery (0%) and non-operative management (15%). No difference was reported between arms with regard to a range of secondary outcome measures of the SF-36 score, the Constant-Murley shoulder score and pain levels. The authors report a relatively frequent incidence of minor complications (12%), although none of these were significant (one case of superficial infection, two transient radial neuropraxia and four hypertrophic scars). The surgical technique used in this trial is not universal, and there are concerns in some quarters about the benefits of bridge plating in these cases, it is a well conducted randomised controlled trial demonstrating a marked difference in union rates between treatment modalities.

Without doubt, the humeral shaft is the ‘neglected’ long-bone fracture, and more prospective trials in this area are needed.

Humeral shaft fractures: non-operative in the severely injured? X-ref

■ After a paucity of papers concerning the humeral shaft, we were delighted to be able to present a second worthwhile paper this month in 360. While the previous paper will go some way to re-opening the debate surrounding operative treatment of isolated humeral shaft fractures, there is certainly a reasonable body of experts who would argue that a clear indication for surgery in these cases would be the multiply injured patient; the rationale being that stabilisation (appropriately) of long-bone fractures reduces the second

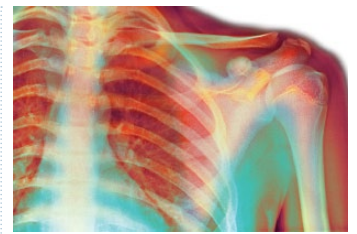
hit, and particularly in the humerus is essential for achieving appropriate rehabilitation. This single-centre retrospective cohort study from **Charlotte, North Carolina (USA)** compared 71 severely injured patients with an Injury Severity Score (ISS) of ≥ 17 , which equates to a moderately severe injury.³ As with many of this type of paper, the patients were managed according to surgeon preference, but there was a good split between surgery ($n = 40$) and a functional brace ($n = 31$). All patients had a closed diaphyseal humeral fracture and this trial used the primary outcome measure of bony union. The groups, superficially at least, were reasonably well matched, aside from the incidence of concomitant lower extremity injuries (including bilateral lower extremity) in the operative arm. The eventual outcome of the study was comparable union rates between the groups (94% non-operative vs 95% operative), and time to union was also comparable (15 weeks non-operative vs 17 weeks operative). Complications, however, were not comparable, with the operative group including two transient radial nerve palsies, one deep infection and one deep vein thrombosis (DVT). In the non-operative arm, four patients required subsequent open reduction and internal fixation (ORIF) due to loss of adequate position, with four malunions and one DVT. The authors conclude that, for the multiply injured patient, conservative management for a closed diaphyseal humeral fracture produces similar union rates and time to union to those of surgery. This study does highlight the potential for conservative management in such injuries, although with 26% either requiring secondary ORIF or suffering a significant malunion in the brace group, here at 360 we perhaps would not go quite as far as the authors in promoting brace treatment in the multiply injured. These data do, however, suggest that surgical management in the polytrauma patient is not always necessary.

Propionibacterium acnes and nonunion of clavicle fractures X-ref

■ Another month, and another paper concerning enemy number one for shoulder surgeons - *Propionibacterium acnes* (*P. acnes*). *P. acnes* is a commensal of the axilla, and in general is associated with indolent infection following shoulder surgery, with more and more data suggesting that it is commonly associated with osteolysis and loosening of shoulder prostheses.⁴ There is little data, however, to indicate its importance in other shoulder girdle procedures. This interesting retrospective case series from the Hospital for Special Surgery in **New York, New York (USA)** examines the potential for a link between clavicle fracture nonunion and *P. acnes*.⁵ The authors have drawn together 20 patients who all suffered a fracture of the clavicle and who, following the subsequent ORIF, went on to develop a nonunion. In almost half of these cases ($n = 9$), there was catastrophic failure of the metalwork. As with all retrospective small case series, treatment was heterogeneous and unfortunately only 18 cases had microbiology samples sent. Strikingly, however, in 78% of cases ($n = 14/18$), *P. acnes* was identified as the causative organism. The authors treated 15 of 18 patients as if they were clinically infected and managed them with a prolonged course of antibiotics following anterior and superior plating and grafting. The average time to union was 22 weeks, with a 100% union rate, and the authors report that no patients underwent further revision surgery. This small but interesting series concludes that clavicle ORIF nonunion can be due to both poor mechanical fixation and indolent infection. Although this is a small series, this study highlights the high rate of positive culture following clavicle ORIF nonunion, with *P. acnes* the ever-present microbe for shoulder surgeons.

Non-operative management for complex proximal humeral fractures: is reverse shoulder arthroplasty the challenger? X-ref

■ The literature on the role of reverse shoulder arthroplasty for fractures of the proximal humerus is increasing. A large data study we recently discussed in 360 documented an almost three-fold increase in the use of primary reverse shoulder arthroplasty for fractures of the proximal humerus.⁶ This potentially poses the awkward question: is reverse shoulder arthroplasty the next potential comparator with non-operative treatment for these complex fractures, particularly given the recent results of the PROFHER study?⁷ This is the question posed by authors from **Greenville, South Carolina (USA)** who, realising that there are no comparative series of reverse total shoulder arthroplasty operative versus non-operative treatments in the literature, set out to fill the evidence gap with their own retrospective review of all three- and four-part proximal humeral fractures treated with either reverse shoulder arthroplasty or non-operative treatment.⁸ The study is reported to a minimum one-year follow-up, although of course there is some significant selection bias. Nonetheless, this series is better than some in that all patients in the non-operative cohort were offered RSA but declined. Outcomes were reported through both a notes review and extensive patient-reported outcomes obtained at follow-up, including the Visual Analogue Scale (VAS) score, Single Assessment Numeric Evaluation (SANE) score, Penn Shoulder Score (PSS), American Shoulder and Elbow Surgeons (ASES) score, resiliency score, and Veterans Rand 12-Item Health Survey (VR-12) score. A total of 39 patients (20 reverse shoulder, 19 non-operative) were included in the study, although there was some marked difference in the follow-up intervals (29 months in non-operative group and 53 months in reverse shoulder group). The authors (despite the plethora of outcome measures)



were unable to find any differences in any of the patient-reported outcome scores or range of movement. This is one of those interesting papers where, despite every attempt to demonstrate an advantage, the authors concluded that there were only minimal benefits for reverse shoulder arthroplasty. Once again, for these complex fractures, non-operative management is yet to be outdone. This is a very small study with some significant limitations and, although there is clearly a role for reverse shoulder arthroplasty for these complex injuries, in light of these results the indications are somewhat unclear and longer-term outcome data alongside larger studies are clearly needed here.

Reverse total shoulder arthroplasty: a follow-up of a previous study

■ As summarised succinctly in our feature this month, there are some significant potential benefits to the reverse prosthesis, and although the short-term results in the literature are good, longer-term objective clinical studies are conspicuous by their absence. We were delighted to read the results of this study from **Tours (France)** which reports the longer-term outcomes at a minimum of ten years of follow-up for a previously reported series of 191 reverse shoulder arthroplasties.⁹ There were 87 prostheses available to report at a mean follow-up of 150 months. The authors had lost 17 prostheses to follow-up and 79 patients had died before the ten-year mark. The overall ten-year revision rate in this series was 93% using revision for any cause as an endpoint. In terms of functional scores, the outcomes were significantly poorer than the mid-term follow-up reported from the same series, with a relative constant

score of 86 points (absolute score 55 points). In terms of undesirable complications, the majority (73%) of shoulders exhibited scapular notching, and a third of patients had an operative complication. Although the longer-term outcomes reported by this study were good as regards the selected endpoint of revision, there is one significant problem: when taken in combination with the poor functional results and deterioration since mid-term follow-up, this series represents a group of patients whose shoulders have clinically failed or are failing. However, with no feasible revision option beyond the reverse, they are then not revised and consequently not counted as a 'success'.

Which outcome score to use?

The abundance of outcome measures in common use for assessment of shoulder scores is not helping objective evaluation and meta-analysis between studies. There are, in fact, over 40 scores published, although only around five are in frequent use. It is commonplace for studies to use a variety of outcome measures, and although there has been some work establishing which measures correlate, there are no data comparing the results obtained by two of the most common performance scales: the University of California at Los Angeles (UCLA) and American Shoulder and Elbow Surgeons (ASES) scores. These investigators from **São Paulo (Brazil)** have reported their own retrospective study which compares the performances of 143 patients, all treated for rotator cuff tears arthroscopically, as recorded by these two scales.¹⁰ The scores were reported at up to two years' follow-up and sampling points at six, 12 and 24 months following surgery. Overall, the cohort recorded an improvement in outcome, with significant improvements in both the UCLA (30.4 points) and the ASES (81.2 points) scores. With regard to the overall aim of the study, both scores were highly correlated but did better post-operatively than pre-operatively. The correlation between measures was excellent (r^2 of between 0.87 and 0.92). However, this

impressive correlation was not quite so good in the same cohort's pre-operative measures ($r^2 = 0.67$). Although the authors simply conclude that there is a good correlation between the two scores, there is more that can be taken away from this. Clearly, the two scores perform similarly at their ceiling (and although there was no specific evaluation of ceiling effect, there must be a significant one here), however, once there is pathology the scores perform differently. It is of some concern that two widely used scores do not correlate terribly well when assessing a shoulder with pre-operative pathology. This must call into question the validity and responsiveness of the two measures.

Glenoid loosening and prosthetic designs

The glenoid is the component which is the common point of failure for the majority of total shoulder arthroplasties. The combination of a small fixation area, which is often in cystic and degenerate bone with the large lever arm, and forces transmitted across the glenoid has resulted in almost universal difficulties with the glenoid component and loosening at the component bone interface. There are two specific strategies for component fixation in any joint replacement, the so-called onlay and inlay methods. These investigators from **Clemson (South Carolina, USA)** designed their own custom glenohumeral loading model, and used 16 matched pairs of eight cadavers to evaluate the component fixation of inlay and onlay.¹¹ The simulation was specifically set up to evaluate the rocking horse loosening mechanism which is caused by migration of the centre of motion during abduction. The simulation used 5 mm anterior and posterior translation to simulate the rocking horse effect, and testing took place over 4000 cycles using 34 kg of glenohumeral compression and a simple HD video model to document gross loosening. As would be expected, there was an increase in force due to a decrease in footprint size following total shoulder arthroplasty.

However, there were some significant differences between the two tested components. The forces seen were greater in the onlay components and there was a significant increase in the onlay component edge forces. All of the onlay components failed during fatigue failure testing at a mean of 1126 cycles while none of the inlay components did (the investigators ceased testing at 4000 cycles).

Methods of ACJ repair

We were really delighted to see this excellent paper from **Anaheim, California (USA)** published in *The Bone & Joint Journal*.¹² It is rare that high-quality comparative research is published which compares outcomes of different surgical techniques outside the confines of randomised controlled trials. This study compared four widely accepted and widely used techniques for repair of chronic acromioclavicular joint (ACJ) instability. The techniques compared were: (1) modified Weaver-Dunn procedure; (2) allograft fixed through coracoid and clavicular tunnels; (3) allograft loop coracoclavicular fixation; and (4) combined allograft loop and synthetic cortical button fixation. The patients were all treated at least four weeks following injury, and the surgical technique used was at the discretion of the treating surgeon. Outcomes were assessed according to the radiological appearance of the ACJ complex on post-operative radiographs. Surprisingly, around half of the failures were prior to the six-week point and the failure rate was 21.4% ($n = 33/144$). When comparing the two techniques, Kaplan-Meier survival analysis suggested that use of a reinforced allograft loop with synthetic cortical button fixation gave a survival of 94.4% by two years of final follow-up, while the other techniques achieved just 70% at the same follow-up interval. This is a procedure that is commonly required, however, it is known to have a significant failure rate with the figures here in line with other reports of similar techniques. What is impressive is the low failure rate of this technique when augmented by a synthetic implant.

REFERENCES

1. Sarmiento A, Kinman PB, Galvin EG, Schmitt RH, Phillips JG. Functional bracing of fractures of the shaft of the humerus. *J Bone Joint Surg [Am]* 1977;59-A:596-601.
2. Matsunaga FT, Tamaoki MJ, Matsumoto MH, et al. Minimally invasive osteosynthesis with a bridge plate versus a functional brace for humeral shaft fractures: a randomized controlled trial. *J Bone Joint Surg [Am]* 2017;99-A:583-592.
3. Dielwart C, Harmer L, Thompson J, Seymour RB, Karunakar MA. Management of closed diaphyseal humerus fractures in patients with injury severity score ≥ 17 . *J Orthop Trauma* 2017;31:220-224.
4. Hsu JE, Gorbaty JD, Whitney IJ, Matsen FA III. Single-stage revision is effective for failed shoulder arthroplasty with positive cultures for Propionibacterium. *J Bone Joint Surg [Am]* 2016;98-A:2047-2051.
5. Gausden EB, Villa J, Warner SJ, et al. Nonunion After Clavicle Osteosynthesis: High Incidence of Propionibacterium acnes. *J Orthop Trauma* 2017;31:229-235.
6. Rosas S, Law TY, Kurowicki J, et al. Trends in surgical management of proximal humeral fractures in the Medicare population: a nationwide study of records from 2009 to 2012. *J Shoulder Elbow Surg* 2016; 25:608-613.
7. Rangan A, Handoll H, Brealey S, et al; PROFHER Trial Collaborators. Surgical vs nonsurgical treatment of adults with displaced fractures of the proximal humerus: the PROFHER randomized clinical trial. *JAMA* 2015;313:1037-1047.
8. Roberson TA, Granade CM, Hunt Q, et al. Nonoperative management versus reverse shoulder arthroplasty for treatment of 3- and 4-part proximal humeral fractures in older adults. *J Shoulder Elbow Surg* 2017;26:1017-1022.
9. Bacle G, Nové-Josserand L, Garaud P, Walch G. Long-term outcomes of reverse total shoulder arthroplasty: a follow-up of a previous study. *J Bone Joint Surg [Am]* 2017;99-A:454-461.
10. Assunção JH, Malavolta EA, Gracitelli MEC, et al. Clinical outcomes of arthroscopic rotator cuff repair: correlation between the University of California, Los Angeles (UCLA) and American Shoulder and Elbow Surgeons (ASES) scores. *J Shoulder Elbow Surg* 2017;26:1137-1142.
11. Gagliano JR, Helms SM, Colbath GP, et al. A comparison of onlay versus inlay glenoid component loosening in total shoulder arthroplasty. *J Shoulder Elbow Surg* 2017;26:1113-1120.
12. Spencer HT, Hsu L, Sodl J, Arianjam A, Yian EH. Radiographic failure and rates of re-operation after acromioclavicular joint reconstruction: a comparison of surgical techniques. *Bone Joint J* 2016;98-B:512-518.