

with the average, and potentially amend mindset, resilience, and expectations. We commend the authors of this paper, as this is certainly an important but understudied area of our field.

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# Shoulder & Elbow

**X-ref** For other Roundups in this issue that cross-reference with *Shoulder & Elbow* see: *Sports Roundups 1 & 4; Children's orthopaedics Roundups 5 & 7; Research Roundups 3 & 5.*

## Chronic opioid use following shoulder arthroscopy: who is at risk?

■ The opioid epidemic is prominent in the media and has been the subject of several studies in the orthopaedic literature. While the epidemic within North America is well documented, there are also data to suggest a rising prescription of strong opioids in Europe. The potentially unnecessary prescription of opioids within orthopaedic surgery has been reported, with a recent randomized trial concluding that paracetamol was not inferior when compared with paracetamol combined with tramadol for patients undergoing surgery for a limb fracture. This has been coupled with the significant publicity surrounding some of the newer 'less dependent' opioids, such as oxycontin and oxycodone, suggesting that they have been mismarketed and may be as addictive as traditional opioids. In this retrospective case-control 'big data' study from **Detroit, Michigan (USA)**, the authors utilized insurance claims information from the Truven Health MarketScan Research Databases.<sup>1</sup> The authors identified all opioid-naïve patients who underwent shoulder arthroscopy in a five-year period and then used this as their study baseline population. The study was designed to establish the new onset incidence of opioid dependence in this previously naïve cohort following relatively minor surgery. The primary outcome measure for this study was new prolonged opioid use, which the authors defined as continued opioid use 91 to 180 days following the index surgery. From the total cohort of 104 154 patients, the authors found

that 8.3% (n=8686) had prolonged opioid use, as per their definition of greater than three months use. The highest rates of prolonged use were seen following limited debridement surgery (9.0%), rotator cuff repair (8.5%), anterior labral repair (8.5%), and an extensive debridement procedure (8.2%). On multivariate logistic regression analysis, female sex, pre-existing pain disorders, a high total opioid use in the perioperative period of  $\geq 743$  oral morphine equivalents, patients with a background of a mood or anxiety disorder or self-harm, alcohol dependence, and an opioid prescription in the 30 days preceding the surgery were all associated with prolonged opioid use. These authors went on to conclude that the high-risk groups they have identified should be closely monitored in the postoperative period. Despite the limitations of this study, it is another useful addition to the literature highlighting the issues associated with opioid use following orthopaedic surgery. It is clear that more research is required on how to best manage those patients at risk of developing opioid dependence.

## Steroid injections prior to arthroscopic rotator cuff repair: what is the risk of infection?

■ There have been numerous papers recently looking at the risks associated with preoperative injections in patients undergoing arthroscopic rotator cuff repair. One study has recently found that patients who underwent an injection within six months prior to surgery had a higher risk of revision cuff repair within the first three years following the index procedure. This is a difficult topic, with surgeons worrying that steroid may increase infection rates, but with patients needing symptomatic treatments and many not requiring surgery if the injection is successful. Until now, there has

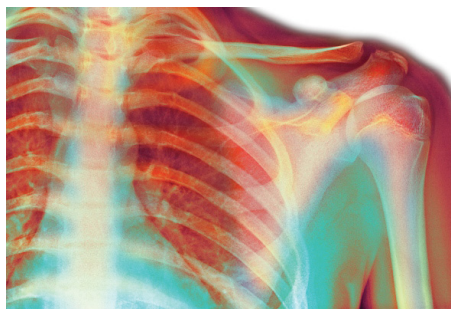
not been a definitive answer from a large dataset, which is a significant omission in the literature given the relatively low point prevalence of infection. In this multicentre study from across the **United States**, the authors utilize 'big data' to determine if patients who undergo a steroid injection in the year prior to arthroscopic rotator cuff repair are at increased risk of postoperative infection.<sup>2</sup> The study identified 12 060 patients who had undergone an injection and compared them with a control group of 48 763 patients without a prior injection, all of whom underwent an arthroscopic cuff repair during the period of the study. The primary outcome measure was a documented surgical site infection within six months post-surgery. On primary univariate analysis, there was no difference in surgical site infection rates between the two groups (0.7% vs 0.8%;  $p = 0.2$ ). However, when stratified by month, patients who received an injection in the month prior to surgery did have a significantly higher infection rate (1.3% vs 0.8%;  $p = 0.04$ ). Multivariate logistic regression analysis revealed that male sex, obesity, diabetes, smoking, and a steroid injection in the month prior to surgery were independent factors associated with an increased rate of surgical site infection. The authors conclude that despite an increased risk of infection associated with a corticosteroid injection in the month prior to surgery, there is no increased risk if the injection is performed before this. There are limitations to this study, including: the unknown quality of the database used, in particular the fidelity of the event rates; the lack of other baseline data that could be important in determining the risk of infection, such as surgical details and technique; the potential for late infections; and the higher number of older patients included. However, this study, along with other recent research, does

highlight the debate regarding the role of steroid injections prior to rotator cuff repair. Based on this data, surgery should be delayed by more than a month when possible.

### The older shoulder fracture patient

■ As with other studies, PROFHER-1 (the Proximal Fracture of the Humerus Evaluation by Randomization trial) found no benefit of open reduction and internal fixation (ORIF) over nonoperative management for proximal humerus fractures. A recent study discussed here at 360 also found no difference in the outcome between conservative management and reverse shoulder arthroplasty. In this retrospective comparative review from **Frankfurt (Germany)**, the authors included 125 elderly patients (mean age 74 years) with a minimum of one-year follow-up that were managed over a seven-year period for a proximal humerus fracture with either ORIF ( $n = 66$ ) or reverse total shoulder arthroplasty ( $n = 59$ ) in their retrospective cohort study.<sup>3</sup> The groups were reported to have comparable Charlson indices as a marker for comorbidities and general health. The treatment choice was based on patient and fracture characteristics, but the actual eventual decision seems to have been the choice of one of the four shoulder surgeons who contributed to the study. In the reported cohort, there were 24 Neer three-part fractures, 73 Neer four-part fractures, 25 head-split fractures, and three fracture dislocations. The authors found that in the period of follow-up, there was an overall higher complication rate (38% vs 22%) and revision rate (12% vs 5%) for ORIF. Multivariate regression analysis was performed and found no significant differences between the two groups when controlling for age, sex, fracture classification, body mass index, and Charlson index. The authors identified that risk factors for major complications in the ORIF group were a background of osteoporosis, varus fractures, posteromedial metaphyseal extensions of  $< 8$  mm, head-shaft displacements of  $> 4$  mm, and comminuted greater tuberosity. For patients who underwent reverse shoulder arthroplasty, a higher complication rate was associated with a higher Charlson index, a background of diabetes, or an altered greater tuberosity. The authors conclude that reverse shoulder arthroplasty led to a reduced rate of complications for proximal humerus fracture fixation in elderly patients and that the prognostic factors they have identified should be targeted to reduce the risk of complications. This study has obvious limitations associated with the retrospective design, including selection bias, and there are no functional or patient-reported outcomes presented. The UK PROFHER-2 randomized

trial is underway and is aiming to determine how nonoperative management compares with both shoulder hemiarthroplasty and reverse shoulder arthroplasty for fractures of the proximal humerus. However, nonoperative management for these injuries in the elderly is yet to be obviously and clearly bettered in the current literature.



### Instability in terrible triads injuries of the elbow: is the coronoid important?

■ A recent network meta-analysis discussed in a previous issue of 360 suggested that radial head arthroplasty is superior to fixation for displaced fractures of the radial head, as this would seem to negate any potential concerns regarding fixation failure and, more importantly, recurrent elbow or forearm stability. Terrible triad injuries of the elbow are commonly managed with the protocol put forward by the team in Toronto, Canada that recommends fixation or arthroplasty of the radial head, fixation of the coronoid where possible, and repair of the lateral ulnar collateral ligament (LUCL) complex. In this retrospective cohort study from **Changwon (South Korea)**, the authors set out to evaluate the impact on coronoid fixation in terms of stability outcomes in patients presenting with terrible triad injuries.<sup>4</sup> Overall, the authors reviewed the outcomes of a cohort of 76 patients with a mean age of 48 years, all of whom had undergone surgical management for a terrible triad injury of the elbow. The primary outcome measure reported in this study was recurrent instability, which was determined with chart and radiograph review performed at a minimum of two years post-surgery. There were 59 patients who underwent radial head fixation; in all cases, the coronoid was repaired through an anteromedial approach. The authors report a recurrent instability rate of 19.7%, with revision surgery carried out in 12 of these 15 cases. Factors associated with recurrent elbow instability were high-energy trauma, the time between injury and the index surgery, radial head fracture comminution (Mason type 3), medial collateral ligament injury, and no repair of the coronoid. Despite this, no factors were associated with recurrent instability

on multivariable logistic regression. The study has clear limitations, including the retrospective design and relatively small number of patients, which limit the potential of statistical analysis to determine risk factors associated with instability. Furthermore, the recurrent instability rate in this study is somewhat higher than the rate of 5% reported in recent literature. This study is also at odds with some surgeons' suggestion that coronoid fractures associated with terrible triad injuries are routinely small fractures of the anterolateral facet of the coronoid. Some data has suggested that radial head arthroplasty/fixation and LUCL repair are alone sufficient to restore elbow stability. Like all rare injuries, it seems likely that the terrible triad will continue to result in small case series publications.

### A prospective evaluation of early postoperative complications after distal biceps tendon repairs

■ The distal biceps rupture and mobilization, yet many advocate nonoperative treatment, especially in older patient groups, pointing to the complication rates and marginal reported benefits in some case series. Debate continues concerning the best approach, reattachment technique, and rehabilitation regimen. The authors of this paper from **Philadelphia, Pennsylvania (USA)** reviewed their own multisurgeon results of acute distal biceps repair in their institution over an 18-month period.<sup>5</sup> Acute repairs were described as those performed within 12 weeks of the injury. There were 18 sports medicine surgeons, 12 hand surgeons, and seven shoulder and elbow surgeons completing the surgeries. A total of 324 repairs were performed during the review period. Of these, 48 underwent surgery beyond 12 weeks post-injury, 12 required a graft for repair, and 53 had incomplete follow-up to the 12-week period. Thus, 113 patients were excluded, leaving 211 patients who underwent 212 simple acute distal biceps repairs. The mean patient age was 48.7 years, with an even split between right- and left-sided injuries. There was one bilateral injury. The predominant repair techniques were a one-incision tension-slide using a suture button, which constituted half of the cases, and a two-incision modified Boyd-Anderson, which covered 47%. Only seven patients underwent a one-incision suture anchor technique. The mean time to surgery in this series was three weeks and mobilization was generally commenced at a mean of 1.5 weeks postoperatively. Complications were seen in 65 patients (30.7%) and were classified as minor unless they required an additional surgical procedure. The one-incision group had a

statistically significant greater incidence of complications compared with the two-incision group of 44% vs 15%, respectively. Overall, 92% of the complications were classified as minor. The commonest complication reported was a sensory neurapraxia occurring in the distribution of the lateral antebrachial cutaneous nerve in 32 patients, in the superficial radial nerve distribution in 18 patients, in the ulnar nerve distribution in four patients, and a combined neurapraxia in both the superficial radial and lateral antebrachial nerves in three patients. These complications were more common in the one-incision group. All the neurapraxias resolved spontaneously or were continuing to improve by six months, except for three patients (one in the two-incision cohort and two in the one-incision cohort) who had persisting symptoms. There were two cases of wound dehiscence and one superficial infection, which resolved with oral antibiotics. There were five major complications; two patients in the dual incision group required a surgical washout of deep infection and there were three re-ruptures (one in the one-incision cohort and two in the two-incision cohort), all of which underwent revision repair. Only one case of heterotopic ossification was noted, although mean follow-up was limited to 17.6 weeks. This is a large retrospective review of multiple surgeons' results and clearly shows that the risk to the lateral antebrachial nerve is significant but rarely results in longstanding problems for the patient. This risk seems greater if performing a single-incision repair, although the low frequency of complications may mean the study is underpowered to confidently state this. The authors conclude that surgeons should feel confident in continuing to use their preferred repair technique, as the rate of major complications and unresolved nerve injuries appears to be similar regardless of technique used. The data are also helpful when determining whether to repair at all, with a headline complication rate of 30%.

### **The acromial and scapular spine fractures after reverse shoulder arthroplasty**

■ Reverse shoulder arthroplasty places the scapular spine and its acromial extension under increased stress, due to the reliance on the deltoid to initiate and maintain movement, which is achieved through an increased lever arm. The resultant forces on the scapular spine and acromion are subsequently much greater following reverse shoulder arthroplasty. Furthermore, baseplate screws directed into the scapular spine may also create a stress riser predisposing to fracture in this hard cortical bone. The incidence of fractures is variably reported in

the literature and so, here at 360, we were pleased to see this sensibly performed review of acromial and spines fractures from **Florida (USA)**.<sup>6</sup> Like all good systematic reviews, the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines were used. The studies included here were used to estimate the reported incidence of fractures following both primary and revision reverse shoulder arthroplasty. The literature search strategy yielded 686 papers and, after exclusions, 90 articles remained suitable for review, with over 9000 arthroplasty outcomes reported. The headline result from this review is that the overall incidence of acromial and/or scapular spine fractures was 2.8%, and this did not differ significantly between primary arthroplasties or those performed for revision. The authors then went on to further analyze this result and attempt to establish the fracture rates dependent on indication for surgery and prosthetic design. Patients with inflammatory arthropathies showed the highest rate of acromial fractures, reported at 10.9%, while the incidence was 3.8% in those performed for massive rotator cuff tears. Interestingly, traumatic indications such as post-traumatic arthritis had a lower incidence of fracture at 2.1%, and no patients where the arthroplasty was performed for acute proximal humerus fracture suffered a subsequent acromial fracture. The type of prosthetic design made a significant difference; a higher rate of fractures was reported with lateralized glenosphere designs compared with those that are more medialized. Overall, the incidence was 3.8% for lateralized prostheses, 2.5% for a medial glenoid/medial humerus design, and 1.5% for a medial glenoid/lateral humerus design. We should note that these are only the fractures we know about, and this problem is likely to be underdiagnosed or conservatively managed without investigation due to limited symptomology. This study is useful, as figures for this complication can be utilized in preoperative patient counselling, we are wisely reminded to take care with our cranially orientated screws, and our choice of prosthetic design may be influenced, especially in patients with inflammatory arthropathy. However, readers of 360 should be wary that series such as these tend to under-report the overall incidence of complications due to reporting biases.

### **Diagnosis of osteochondritis dissecans**

■ Osteochondritis dissecans of the capitellum in young people is thought to occur as a result of repetitive microtrauma and therefore has a relatively insidious onset. As such, it is often late to be diagnosed and the sensitivity and specificity of radiological investigations is not perfect. This is particularly

true when it comes to the diagnosis of unstable lesions and loose bodies. The differentiation of stable *versus* unstable lesions is important due to the differences in management and for prognostication. This study from **Amsterdam (The Netherlands)** looks retrospectively at a large number of patients who have undergone arthroscopic treatment for an osteochondritis dissecans lesion over a six-year period between 2008 and 2014.<sup>7</sup> The arthroscopies were performed by a single author and provided the benchmark for the diagnosis in this study. All of the cases in this prognostic study had undergone variable preoperative imaging, usually a plain film radiograph in combination with cross-sectional imaging in the form of a CT scan or an MRI scan. In this study, the only cases included were those that had undergone all three investigations, so that direct comparison of modalities was possible. The severity of the lesion was also graded using three different scoring lesions, in order to permit assessment of the sensitivity of each investigation for less severe, more subtle lesions. During the study period, 106 patients underwent elbow arthroscopy due to symptomatic osteochondritis dissecans of the capitellum, of which 25 had plain-film radiographs, CT, and MRI scans. These patients (mean age 17 years) were thus included in the study. In six of these patients, the preoperative plain film radiograph did not reveal the lesion. At arthroscopy in 20 patients, at least one loose body was found, indicating an unstable lesion; these were seen on 11 plain film radiographs, 18 CT scans, and 13 MRI scans. The radiological grading on plain film did not correlate with the grading on either CT or MRI. The sensitivity of each technique for determining if the lesion was unstable was calculated as 55% for plain film radiographs, 90% for CT, and 65% for MRI. The lesions were visible on the sagittal slices of all CT scans performed and 88% of MRIs. The authors therefore conclude that despite the radiation dose, a CT is the best modality to detect a lesion and determine its stability, which is an interesting finding as, here at 360, we had assumed this accolade would belong to MRI.

### **Reverse shoulder arthroplasty after cuff repair**

■ It is not an infrequent occurrence to be faced with a patient in-clinic who is of advanced years, has some early osteoarthritis, and has a rotator cuff tear. As surgeons, we should be mindful of what the future holds for our patients. Such a patient may require a shoulder arthroplasty at some stage, so are we burning any bridges or potentially jeopardizing the outcome if we attempt a rotator cuff repair? There is very little in the literature to guide or inform decision making for the shoulder surgeon

facing this dilemma. This group from **New York, New York (USA)** sought to answer the question with a retrospective case-control analysis of data from their database.<sup>8</sup> Patients with a history of rotator cuff repair undergoing reverse total shoulder arthroplasty between 2000 and 2015 and who had a minimum of two years' follow-up were eligible for inclusion in this study. These patients were matched with a control group matched by age and sex, all of whom had undergone reverse arthroplasty over the same period with no previous rotator cuff repair. The study group therefore consisted of 45 patients and the control group 135 on a 1:3 basis. Only primary reverse arthroplasties were included and all surgeries were performed by one of six surgeons at a single institute. The mean age was 69 years and 60% of patients were female. The mean American Shoulder and Elbow Surgeons (ASES) score improved from 43 to 76 at two years postoperatively and to 67 at five years. There was

a statistically significant difference between the groups in terms of the outcomes at two years, but there was significantly greater improvement in the control group with a higher baseline. When the baseline ASES scores were matched, there was no difference in score improvement. Therefore, the authors conclude that previous cuff repair does not appear to adversely affect the early outcomes of reverse shoulder arthroplasty.

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## Spine

**X-ref** For other Roundups in this issue that cross-reference with Spine see: *Children's orthopaedics Roundups 3 & 4.*

### Aortic position and curve severity in scoliosis

■ At the forefront of every spinal surgeon's mind is the potential for significant complications. As all will be aware, the range of complications includes not just the usual surgical complications but also significant spinal injury, blindness, and aortic injury. With instrumentation of adolescent idiopathic scoliosis, pedicle screw insertion at the apex of a thoracic curve is, perhaps, the most technically challenging due to vertebral rotation and smaller pedicle size. This difficulty in position is likely to increase the risks of pedicle breach with the screws. In the event of a left-sided lateral breach, the aorta is at risk with the potential for fatal haemorrhage, pseudoaneurysm formation, aortic dissection, or infection. The authors of this study from **Kuala Lumpur (Malaysia)** investigated the relationship between curve magnitude in Lenke 1 and 2 adolescent idiopathic scoliosis and the distance and position of the aorta from the vertebra.<sup>1</sup> The study focuses on the anatomy of 39 patients who had undergone preoperative CT scans, with various radiological parameters being measured to analyze the relationship between the spine (in particular the apex vertebrae) and the aorta. The

key findings were a moderate to strong positive correlation between the observed aortic-vertebral distance and the Cobb angle from the T8 to T12 vertebrae, as well as for the apical vertebra. Moreover, the distance between the pedicle entry point to the wall of the aorta was particularly small in the thoracic region, with a mean observed value of less than 30 mm. These results show that the larger the spinal curvature, the greater the distance from the aorta to the apical vertebral wall, which may be of some reassurance to the surgeon when attempting insertion of a difficult apical screw on the concavity of the curve. This is a valuable, albeit somewhat counterintuitive, observation. One should always take the utmost care in placement of pedicle screws, but it is somewhat surprising that the risk of aortic injury is actually highest in those patients with smaller deformities.

### Urinary N-telopeptide and pseudarthrosis X-ref

■ Reportedly, up to 30% of patients go on to develop a persistent nonunion following anterior cervical discectomy and fusion (ACDF). The authors of this study from **New York, New York (USA)** investigated whether markers of bone turnover can predict which patients will go on to develop a nonunion.<sup>2</sup> The team selected urinary N-telopeptide (uNTX), as their marker, which is a fragment of type 1 collagen, is produced by osteoclastic

bone resorption, and is renally cleared. This was a diagnostic cohort study where the authors aimed to establish the diagnostic accuracy of uNTX for predicting successful fusion in patients undergoing ACDF. The authors of this study report the outcomes of 69 patients, all of whom underwent 1 to 4 level ACDF surgery. Fusion was assessed by dynamic radiographs and a nonunion was defined for the purposes of the study as > 1 mm movement between flexion/extension radiographs. As would be expected, fusion rates increased with time post-surgery: 37.3%, 70.9%, and 95.3% at six months, one year, and two years, respectively. Preoperative uNTX was greater in the fusion group compared with the nonunion group at six months and one year, but there were no apparent differences in the two groups at two years. There were no differences between fusion and nonfusion groups in terms of proportions of smokers, immunomodulatory agents, corpectomies, or fusion levels. Multivariate regression analysis demonstrated uNTX to be an independent predictor of fusion. The authors conclude that preoperative uNTX was greater in patients with successful ACDF compared with patients without a fusion at six months and one year. This raises the possibility of whether pharmacological agents, such as parathyroid hormone, can be used to optimize fusion in patients predicted to have a low fusion potential immediately postoperatively.