

ROUNDUP³⁶⁰

Shoulder & Elbow

Suture anchors are still the gold standard

■ Suture anchors have been the gold standard in arthroscopic rotator cuff repairs for many years. However, other techniques have started to become increasingly popular, such as transosseous repairs, but little biomechanical or clinical evidence currently supports the use of one technique over another. A research team in **Chicago (USA)** set about testing the biomechanical performance of transosseous anchor equivalent repair (TOE), transosseous repair (TO) and two alternative arthroscopic transosseous repairs with simple (AT) or an X suture (ATX) configuration. The investigation was performed on cadaveric shoulders with a standardised supraspinatus tear. A total of 28 cadavers were randomised to one of the four repair groups and testing performed in 60° of abduction. A comprehensive regime including preload-phase cyclical loading and pull-out to failure tests were performed on each specimen, paying particular attention to elongation during the testing period. The researchers found that the TOE repair maintained higher loads to failure (558N) when compared with the TO (325), AT (291) and ATX (388), with similar stiffness between the groups.¹ The authors have comprehensively demonstrated that in cadavers at least, the anchorless repair techniques have significantly poorer biomechanical properties than their sutureless equivalents.

Infection and revision: revision elbow arthroplasty

■ In a short but informative paper, a surgical team in **Yishun (Singapore)** have tackled one of the trickiest problems in arthroplasty; that of unexpected infection. Although relatively rare, the research team were able to track the outcomes of 213 revision elbow arthroplasties. Routine intra-operative cultures revealed 16 (7.5%) unexpected positive culture results. In the majority of cases a *Staphylococcus epidermidis* or *propionibacterium* was cultured, and in only one case was rapid loosening consistent with acute infection at a minimum two years of follow-up. In combination with the intra-operative clinical findings, ten elbows were treated as contaminants and long-term antibiotics were not started. This was successful in nine out of ten cases who remained infection free by two years' follow-up.² It is always difficult to know what course of action to take with unexpectedly positive culture results. It appears in this case that the cultures seen in 7.5% of patients can be effectively treated with a short course of antibiotics the vast majority of the time, and that subsequent surgery is required only very occasionally. The authors have effectively answered a rare but important question.

Elbow replacements have variable success

■ Outcomes in arthroplasty are a current political hot topic, and within the UK, hip and knee arthroplasty surgeons are starting to be held

accountable for their own results with a variety of outcome measures publicly available. Determining how patients are best managed and what the predictors of a good outcome are is much more difficult in the case of less commonly performed procedures, such as elbow arthroplasty. An analysis of the Scottish Arthroplasty Project from surgeons in **Dunfermline (UK)** aimed to establish the important baseline demographic and outcome data for patients undergoing total elbow replacement (TER). The authors were able to include the results of 1146 TERs performed over an 18-year period in their epidemiological study. A combination of the arthroplasty register itself and the hospital episode statistics (part of the healthcare billing process in the UK) were used to establish the annual incidence, outcomes and demographics of patients undergoing TER. In addition, the researchers aimed to establish the effect of surgeon volume on outcomes in TER. During the 18-year period of the study, 1146 primary TER procedures were performed, giving an annual incidence of 1.4 per 105 population per year, with a peak incidence in octogenarian patients. As would be expected, by far the most common demographic was for inflammatory arthropathy (79%), followed by trauma (12%) and osteoarthritis (9%). However, throughout the period of study a significant fall in the number of procedures undertaken for inflammatory arthropathy was seen. Although the overall ten-year

survivorship was 90%, there were significantly better outcomes seen in patients operated on by surgeons performing more than ten cases per year.³ The authors venture that given the better outcomes with higher volume surgeons, a strong argument could be made for a managed clinic network for TER. This does seem sensible, especially as the effect of better treatment for inflammatory arthropathies appears to be a fall in the incidence of TER as an intervention.

Sliding knots: weaker than they seem

■ In the world of arthroscopic cuff repair there is often little margin for error, and due to relatively high failure rates, particularly in arthropathic tendons, surgeons look to maximise strength in each part of the repair. There is ample evidence to show that the suture-tendon interface is a common, if not the most common, site of failure of an arthroscopic rotator cuff repair. A basic science research group in **Birmingham (USA)** set out to examine the theory that pulling a sliding knot through tissue to be repaired may weaken the tendon suture interface. Using a sheep model of infraspinatus tendons, 32 samples were randomised to one of four sutures: static, sliding, static mattress and sliding mattress. The researchers used an arthroscopic simulator to place the knots using No. 2 identical high strength sutures. The samples were then placed on a calibrated testing rig and cyclically loaded including load to failure. The researchers investigated the effect of

the sliding knot on cyclic elongation, displacement and ultimate load. There were no significant differences seen between the simple static and sliding sutures. However, when a mattress suture is used the sliding suture has a significantly lower breaking strength (70 N versus 116 N) although both had lower peak to peak displacements.⁴ We were slightly surprised when this paper came across the news desk at 360 to read that the effects of a sliding knot on the repair strength had not previously been quantified. Having spent some time on PubMed we can confirm these findings are indeed new. The biomechanical findings are easy to understand, however, the clinical relevance is more difficult to extrapolate. We would venture that perhaps consideration should be given to the static knots in patients with severely arthropathic or degenerative cuff tissue if the surgeon wishes to use a mattress suture at the time of repair in light of these findings.

Neurologic cuff pain and the suprascapular nerve

■ There is plenty of research to support the hypothesis that a portion of the pain experienced by patients with rotator cuff tears may be neurogenic in origin. The suprascapular nerve is known to contain sensory fibres and there are a number of papers demonstrating that rotator cuff tear (at least in cadaveric studies) results in tethering and traction on the suprascapular nerve. The most logical site for any potential traction injury is the suprascapular notch where the nerve is intimately related to the bone and at risk of injury. Researchers at the Massachusetts Institute of Technology, **Cambridge (USA)**, theorised that should neuropathic pain be related to cuff arthropathy it is critically important to understand the relationships of the suprascapular nerve (SSN) and in particular its relationships during both in normal anatomy, pathology and following surgical treatment. The research team used a dual fluoroscopic approach to track

the course and motion of the SSN in a cadaveric model while applying simulated rotator cuff forces and dynamic shoulder motion; a highly evolved simulation. Their results are quite startling. Having established the normal anatomy, a simulated combined supraspinatus and infraspinatus tear was created resulting in displacement of the SSN medially 3.5 mm at the spinoglenoid notch, where impingement and traction injury become more likely. An anatomic repair of the cuff footprint restored the course of the SSN and moved it further laterally again. The research team were also able to evaluate the effects of a transverse scapular ligament release which resulted in movement of the SSN superiorly and posteriorly out of the suprascapular notch.⁵ This study is interesting on many levels. We found the methodology fascinating; a dynamic model such as this with simulated muscle loads, dynamic motion and accurate 3D mapping of the anatomic course of a nerve has many applications in orthopaedic basic science. This paper certainly adds weight to the argument that neuropathic pain may be responsible for a portion (large or small) of patients with experience of cuff tears, by providing a believable mechanism and explanation that fits with the treatment effects.

Lies, damn lies and statistics

■ The black art of statistics is well known to be as much art as science. Ten minutes spent with a comprehensive statistics package like SPSS will convince any cynical scientist that small, seemingly arbitrary decisions with even the most elementary of analyses can have a profound effect on the results. Researchers from **Boston (USA)** have investigated the effects of different (all valid) statistical methods for estimating clavicular fracture nonunions. Reasoning that time to union is a

variable and suspect outcome measure, and given the lack of consensus on its definition and an inconsistency in evaluation times, combined with high rates of missing data, this is likely to have a profound impact on the results of each statistical method. The researchers re-evaluated the data from a published multicentre trial, comparing operative and non-operative treatments of clavicular fractures to evaluate these effects in a clinical setting. The research team evaluated



the effects of time to union as measured by mean, median, chi-squared statistic and Kaplan-Meier curves in a number of different scenarios; intention to treat, intention to treat with exclusion of loss to follow-up, as treated analysis, and four different strategies for imputing missing data. The results were quite startling. While the comparative statistics consistently demonstrated a shorter time to union in the operatively treated cohort, this is where the consensus ended between statistical analyses. The mean, median and time to union varied by up to 17% and there were statistically significant differences in the odds ratios, chi-squared values and the number needed to treat (8% to 62%) for the union versus nonunion analysis.⁶ The authors of this well thought out paper must be applauded not only for a fantastic analysis but also for their comprehensive presentation of their results. We would comment no further than to paraphrase the authors' conclusions that: different strategies for handling missing data influences discrete (categorical) data more profoundly than continuous data.

Osteoarthritis: bacterially mediated?

■ The precise aetiology of osteoarthritis is unknown. Although there is a wealth of scientific data and millions have been spent on some extremely advanced scientific studies, the cause still eludes modern medicine. Researchers in **Reading (UK)** have investigated the potential role for *Propionibacterium acnes* in the pathogenesis of shoulder osteoarthritis. Reasoning that the finding of *P. acnes* in revision shoulder replacement was relatively common without signs of infection, the authors wondered if this infection could predate the joint replacement. Noting that *P. acnes* is not dreadfully easy to culture (it requires extended incubation), the authors performed 55 serial shoulder aspirates prior to surgery on patients listed for shoulder arthroplasty. The aspirates were cultured specifically for *P. acnes* and care was taken to reduce the risks of contamination.⁷ Remarkably, the research team were able to isolate *P. acnes* in 23 (42%) specimens. While an extremely interesting finding, we are uncertain that the evidence presented supports the authors' recommendation of four weeks of prophylactic antibiotics. The authors also suggest that this finding of high rates of *P. acnes* implicates it in the pathogenesis of osteoarthritis. While a fascinating hypothesis, we would again inject a note of caution. There is no proof of causation here, only an interesting observation.

One or two stages? Infected shoulder revision

■ The single-stage revision for infection offers an attractive option in all forms of arthroplasty, with only a single operation required, thus avoiding the disability and soft-tissue stiffness associated with the use of an antibiotic-coated spacer. Conventional wisdom (mainly from the hip arthroplasty world) holds that this is a safe strategy. The use of a two-stage procedure has the highest 'cure rate' for infection, however, newer research challenges this

preconception with large series of revisions for infection performed in a single stage with subsequent parenteral antibiotics yielding similar cure rates. In the younger world of total shoulder replacement (TSR) there is not this depth of experience on which to draw, as infected revision is, thankfully, a very unusual procedure to have to undertake. The surgical team in **Hamburg (Germany)** have been using a single-stage approach for their infected TSRs and have undertaken a retrospective review (Level IV evidence) of 35 patients who were managed using this technique. The headline result is an impressive nearly five-year follow-up

with a 94% infection free survival, although only 26 of the 35 were available for final follow-up. In this series the most common infections were Staph Epidermidis and Propionibacterium acnes, with treatment requiring ten days of hospital inpatient stay, and patients achieving a mean Constant-Murley score of 43. The best functional results were achieved with the use of the reverse prosthesis for revision.⁸ It certainly appears that the results of single-stage revision, based on the data presented, are impressive with no excess resistant infection burden and the advantages of a single operation benefitting the patients concerned.

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