

**Internal fixation for intra-articular distal humeral fractures in the elderly—results and causes of failure**

Sivardeen, Qasim Ajmi\*, Wafai, Holdsworth

*Homerton University Hospital, United Kingdom*

Fractures of the distal humerus are difficult to treat. In this study we aimed to review the results of Open Reduction and Internal Fixation (ORIF) of the distal humerus in elderly patients with intra-articular fractures, and compare the results with failed cases of ORIF referred for a revision operation.

Nine ORIFs in elderly patients were performed by one surgeon over a 4 year period. Mean age was 71, 7 were female, the dominant arm was affected in 5 cases, all fractures were classified as C3 via the AO classification. Two fractures were open. All fractures were treated by a double-plating technique via a posterior approach. All patients were followed up for a minimum of 2 years.

In total there were 7 patients who had failed ORIF referred for a revision. 1 patient had rheumatoid arthritis. The mean age was 73.5 and 5 of the patients were female. 3 had their dominant arm affected. All these cases were analysed to see if there were reasons that could be identified for failure.

The results revealed that all fractures in the ORIF group united. The mean Mayo score was 87.8, the mean arc of flexion/extension was 117° and the mean arc of pronation/supination was 177°. There was 1 superficial wound infection which resolved with antibiotics and 1 case of ulnar nerve compression which required decompression.

Review of the cases of failed ORIF showed that in all cases there were technical reasons why the fixation failed.

We believe excellent results can be gained when treating complex distal humeral fractures in the elderly by ORIF. It is important to plan the operation pre-operatively, gain the best exposure ideally with an olecranon osteotomy, use a double-plating technique and mobilise early. Not following these principles increases the risk of failure.

doi:10.1016/j.injury.2010.07.484

**2A.10****The number of instability markers is a significant predictor of outcome in distal radial fractures and can be used as a guide to devise a standardized management strategy for these fractures**Rahul Bhattacharyya<sup>a,\*</sup>, Bethan Sian Morgan<sup>a</sup>, Pavel Mukherjee<sup>b</sup>, Simon Royston<sup>a</sup><sup>a</sup> *Trauma and Orthopaedics Department, Northern General Hospital, Herries Road, Sheffield, S5 7AU, United Kingdom*<sup>b</sup> *Trauma and Orthopaedics Department, Rotherham District General Hospital, Moorgate Road, Rotherham, S60 2UD, United Kingdom*

E-mail addresses: [rahul09@doctors.org.uk](mailto:rahul09@doctors.org.uk) (R. Bhattacharyya), [dr.beth.sian.morgan@googlemail.com](mailto:dr.beth.sian.morgan@googlemail.com) (B.S. Morgan), [pavelmukherjee@googlemail.com](mailto:pavelmukherjee@googlemail.com) (P. Mukherjee), [simon.royston@sth.nhs.uk](mailto:simon.royston@sth.nhs.uk) (S. Royston).

**Introduction:** Distal radial fractures are one of the most common Orthopaedic injuries. An effective treatment strategy is needed to ensure good outcome and resource usage. It appeared that surgery was giving better results than manipulation alone in unstable fractures but there was no data to prove it. We felt that a standardized approach to management of distal radial fractures based on the number of instability markers would help in improving outcome.

ing a standardized management strategy.

**Methods:** Data was collected retrospectively over three months at the Northern General Hospital, Sheffield. Relevant instability markers identified through a literature review were: age >60, dorsal angulation >20°, intra-articular fracture, ulna fracture, dorsal comminution, radial shortening and osteoporosis. The number of instability markers, management and outcome were recorded for each patient. Outcomes were graded as “good” or “poor” based on complications, function achieved at discharge from follow-up and the length of follow-up required.

**Results:** 207 patients were included in our study. 119 patients had ≤3 instability markers (Group A) and 88 had ≥4 (Group B).

In Group A, 91% achieved “good” outcome regardless of treatment type, versus 66% in Group B ( $p < 0.001$ ).

In Group B, amongst patients who had surgery (29), 79% achieved “good” outcome, however those with manipulation alone (38), only 58% achieved “good” outcome ( $p = 0.03$ ).

**Conclusions:** We have found that 4 or more instability markers are globally associated with a poorer outcome. Patients with 4 or more markers who underwent surgery did uniformly better than those with manipulation alone. Whereas, in patients with 3 or less markers non-operative management yields equally good outcome. We plan to use this as a pilot study for future primary research.

doi:10.1016/j.injury.2010.07.485

**2A.11****Shear mechanical properties of repair grafts—how well do they match normal and torn human rotator cuff tendons?**

S. Chaudhury\*, C. Holland, F. Vollrath, A.J. Carr

*Oxford, UK*

**Introduction:** Rotator cuff tendon (RCT) repairs are associated with high failure rates. Attempts to circumvent and improve post-operative outcomes have resulted in increasing use of grafts to augment repairs. The only mechanical assessment of some RCT repair grafts to-date involved tensile testing alone, and included comparisons to canine infraspinatus. As the shoulder is subject to shear as well as uniaxial loading, we compared the response of repair grafts and human rotator cuff tendons to shearing mechanical stress using dynamic shear analysis (DSA), a novel technique to study material deformation.

**Materials and methods:** The shear properties of four RCT repair grafts were measured (Restore, GraftJacket, Zimmer Collagen Repair and SportsMesh). 79 torn RCT specimens were obtained from the edge of RCT tears during surgery from patients aged 22–89 years and compared to 18 matched intact controls. 3 mm punch biopsies were taken from the grafts and the tendons, and subjected to oscillatory deformation under compression. The bulk storage modulus ( $G'$ ) was calculated and used as an indicator of mechanical integrity.

**Results:** We report significant differences in the storage modulus of the different repair grafts ( $P < 0.05$ , one-way ANOVA). Zimmer collagen repair had the highest storage modulus, followed by SportMesh, with Restore patches demonstrating the lowest shear values. All tendons however had significantly lower shear values than normal and torn RCTs ( $P < 0.01$ , Dunn's multiple comparison test).

**Conclusion:** The large volume of failing RCT repairs demands a better understanding of the mechanical properties of repair grafts. Current RCT repair grafts display a wide variation in their shear mechanical properties. None of the studied repair patches have

shear mechanical properties which closely and how closely match human rotator cuff tendons. It is hoped that this study will offer additional information for surgeons when selecting appropriate RCT repair grafts.

doi:10.1016/j.injury.2010.07.486

## 2A.12

### Characterisation of differences in shear mechanical properties between torn and normal rotator cuff tendons

Salma Chaudhury<sup>a,\*</sup>, Chris Holland<sup>b</sup>, Fritz Vollrath<sup>b</sup>, Andrew Carr<sup>a</sup>

<sup>a</sup> Nuffield Orthopaedic Center, Oxford, United Kingdom

<sup>b</sup> University of Oxford, United Kingdom

**Background:** Improved understanding of the biomechanics of rotator cuff tendons may help reduce high re-rupture rates observed after rotator cuff repairs. This study aims to develop a novel method for quantitatively determining differences in the mechanical properties of intact healthy rotator cuff tendons in comparison to torn 'diseased' tendons. A common problem in the mechanical testing of small tendon samples is that stress risers at the clamp–tendon interface can obscure measurements. We present a novel solution which we have developed using Dynamic Shear Analysis (DSA).

**Methods:** Rotator cuff tendon specimens were obtained during shoulder surgery from 93 patients. There were 79 tears, which were classified according to the size of the tear and compared to 14 controls matched for age and sex. All 3 mm-sized biopsy samples were subjected to DSA using oscillatory deformation under compression. The storage modulus ( $G'$ ) was calculated and used as an indicator of mechanical integrity.

**Results:** We observed a number of significant differences between the moduli of normal and diseased rotator cuff tendons. Healthy tendons had a significantly higher modulus than torn tendons, indicating that torn tendons are mechanically weaker than normal tendons ( $p=0.0345$ , unpaired  $t$ -test). Further analysis of the modulus of different tear sizes showed that normal tendons had significantly higher mean shear modulus than tendons with massive tears ( $p<0.01$ , Bonferroni's multiple comparison test). Importantly, the measured moduli did not otherwise significantly correlate with age, sex, hand dominance, or length of preservation in formalin ( $p>0.05$  in all cases).

**Conclusions:** DSA allowed us to demonstrate in this case control study that samples from healthy rotator cuff tendons have a significantly higher modulus than samples taken from torn tendons.

doi:10.1016/j.injury.2010.07.487

## 2A.13

### Coracoclavicular suture anchor fixation for AC joint injuries and lateral end clavicle fractures

S. Giri\*, K. Katam, P.D. Sonsale

Good Hope Hospital, Sutton Coldfield, B75 7RR, United Kingdom

**Introduction:** Multiple options exist for treating acute acromioclavicular injuries and fractures of lateral end of clavicle. There is not much evidence to suggest the superiority of one method over the other. We present our experience in 23 consecutive patients using coracoclavicular fixation using Arthrex Tightrope fixation device.

**Patients and methods:** 23 consecutive patients with acute acromioclavicular injury (>Grade 3) and type 1 lateral clavicular

fractures were included. There were 19 males and 4 females with average age of 35 years (range 17–59 years). 20 had AC joint injury and 3 had lateral end clavicle fracture. All were operated by a single surgeon at mean of 6.5 days after injury (range 2–20 days). Coracoclavicular fixation using Arthrex tightrope device was used in all cases. All patients were reviewed at 2 weeks, 6 weeks and 6 months. Shoulder ROM, Oxford Shoulder score, radiological assessment and subjective scoring were recorded at 6 weeks and 6 months.

**Results:** 19 patients had full return of shoulder movement and 22 patients had >90% return of shoulder movements at last follow up. The mean Oxford shoulder score was 52.2 at 6 months (range 40–59). All patients were pain free and had returned to preinjury activity level at last follow up. There was no case of implant failure. On subjective scoring most patients reported good to excellent results.

Our results using the coracoclavicular suture anchor fixation for acute acromioclavicular suggest this as a reliable option with the added advantage of not needing a second operation for hardware removal.

doi:10.1016/j.injury.2010.07.488

## 2A.14

### Outcome following clavicular hook plate

C.R. Jackson\*, A.A. Faraj

Airedale General Hospital, Keighley, West Yorkshire

E-mail address: crjackson@doctors.org.uk (C.R. Jackson).

**Introduction:** Hook plates are used to treat acromioclavicular joint dislocations and lateral clavicle fractures. Our study looked at patient outcome following treatment with a Synthes clavicular hook plate.

**Method:** Medical notes review and telephone interview of patients treated with a clavicular hook plate between 2003 and 2009 at Airedale General Hospital. Modified Constant score calculated looking at pain, range of movement, power and functional level, and general comments recorded.

**Results:** Total of 15 patients treated with hook plates, unable to contact two patients, three notes unavailable. Of remaining ten patients (M:F, 7:3), six were for lateral clavicle fractures, three for ACJ dislocation and one not recorded. One plate was still in situ. Follow up ranged from 0 to 79 months, mean 22 months. Only complication was a fatigue fracture next to the plate prior to removal. Modified constant score, out of 80, had a mean of 78 (range 25–80). Patients reported problems with pain and reduced range of movement whilst the hook plate was in situ, with some pain remaining after removal, particularly affecting their sleep.

**Conclusion:** Hook plates are an effective way of treating ACJ dislocations and lateral clavicle fractures, however patients should be appropriately counselled of the likely discomfort whilst in situ which occasionally persists after removal.

doi:10.1016/j.injury.2010.07.489