Anterior Shoulder Dislocation associated with Greater Tuberosity Fracture – Current Concepts

Andreas Panagopoulos, MD, PhD
Anatomy

- The greater tuberosity is situated lateral to the head and lesser tuberosity

- Its upper surface is rounded and marked by three flat impressions (RC insertion)
Anatomy

- Anterior facet = Supraspinatus
- Middle facet = Infraspinatus
- Inferior facet = Teres minor
Anatomy

Humeral Insertion of the Supraspinatus and Infraspinatus. New Anatomical Findings Regarding the Footprint of the Rotator Cuff

Tomoyuki Mochizuki, Hiroyuki Sugaya, Mari Uomizu, Kazuhiko Maeda, Keisuke Matsuki, Ichiro Sekiya, Takeshi Muneta and Keiichi Akita

…..our findings that the infraspinatus occupied about half of the highest impression on the greater tuberosity, which has been believed to be the footprint of the supraspinatus, support the concept that the infraspinatus may contribute more to shoulder abduction than previously believed
Classification

Neer CS II, JBJS Am 1970
Neer CS II, JESS 2001

- Part instead of segment
- Displacement > 1 cm?
- Angulation > 45°
Epidemiology

- Isolated GT = 17% - 21% of proximal humeral fractures
- 15%-30% are associated with anterior dislocation
- More common in men than in women (ratio 2:1)
Epidemiology

Redislocation of the Shoulder During the First Six Weeks After a Primary Anterior Dislocation: Risk Factors and Results of Treatment

C. M. Robinson, M. Kelly and A. E. Wakefield

- GT fractures in 15%
- Increased risk of re-dislocation in patients with both glenoid rim and GT fracture
GT fractures 10% (257 patients)

... fracture of the GT when the primary dislocation occurred was associated with a better prognosis with respect to recurrence (p < 0.001).
The greater tuberosity is on average $8 \pm 3.2$ mm below the top of the articular segment

..... even small amounts of displacement can affect shoulder function$^1$

$^1$Green A et al, JSES 2003
The GT was osteotomised and stabilised to represent malunion with combinations of superior and posterior displacements of 1 cm or less.

The abduction deltoid force was significantly increased by **16%** and **27%** by superior displacements of 0.5 cm and 1 cm, respectively, while combined superior and posterior displacement of 1 cm gave an increase in force of **29%**.
Mechanism of injury

Isolated fractures of the greater tuberosity of the proximal humerus

Andrew Green, MD, and Joseph Izzi, Jr, MD, Providence, RI

J Shoulder Elbow Surg
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- Direct impaction as might occur during a fall directly on the shoulder or with hyperabduction and impaction of the greater tuberosity against the acromion or superior glenoid.

- Avulsion injuries commonly occur in association with anterior dislocation

- Forceful pull by the rotator cuff can also avulse the GT
Mechanism of injury

Mechanism of injury and morphology of the greater tuberosity fracture

JSES 2006

Christian Bahrs, MD,a Erich Lingensfelder, MD,b Franziska Fischer, MD,c Eduard M. Walters, MD,c and Michael Schnabel, MD,c Marburg, Germany, and Clinton, MO

- 103 patients, 59 with anterior dislocation, 25% inferior displacement of the GT.

- ...shearing against the glenoid rim with concomitant impression or depression seems to be a more convincing mechanism
Clinical examination

- Arm in slight abduction and external rotation
- Shoulder is "squared off" (loss of deltoid contour)
- Humeral head is palpable anteriorly
- Patient resists abduction and internal rotation
Associated injuries

- Axillary neuropathy is the most common nerve injury

- Infraclavicular brachial plexus injuries
  Among the 31 cases of infraclavicular brachial plexus injury that were reviewed by Leffert and Seddon, 14 involved greater tuberosity fracture; 12 of these were anterior fracture-dislocations.

- Vascular injuries
Associated injuries

Nerve injury after greater tuberosity fracture dislocation
Garg, Ashima; McQueen, Margaret M.; Court-Brown, Charles M.

- Looking at all 47 fractures, the maximum pre-reduction GT fracture displacement varied from 20 to 32 mm and averaged 11 mm, and after reduction the displacement varied from 1 to 20 mm for an average of 3 mm.

- There were 16 nerve injuries: 10 axillary, 3 brachial plexus, 1 median, and 1 ulnar. Three injuries did not recover. 34% risk of nerve injury with only a 81.2% recovery rate.
Radiological examination

- AP view
- Axillary view
- CT, MRI, US
Radiological examination

- AP views in external and internal rotation, AP views in neutral rotation with 15° of cephalic or caudal tilt, lateral outlet view, axillary view

- Increased accuracy of minimally displaced (≤5 mm) GT fractures with the AP view in external rotation.

- The AP view in external rotation, evaluated last, altered treatment in 15% of cases
Radiological examination
Fractures were overlooked in 58 of the 99 shoulders (59%) that had been initially examined at other clinics.

The smaller the fragment, the higher the rate of missed diagnosis ($p < 0.05$).
Nondisplaced greater tuberosity fractures are treated nonoperatively. The majority of impacted fractures have no displacement and, after a short period of immobilization, can be treated with rehabilitation that includes early range-of-motion exercises.

Impacted non-displaced greater tuberosity fractures are more stable than a reduced greater tuberosity fracture-dislocation.
We evaluated the radiographs and function in 135 patients after non-operative treatment of minimally displaced (1—5 mm) fractures of the greater tuberosity.

97% of the evaluated patients had good or excellent results. Patients with a displacement of more than 3 mm had slightly worse results.

Conclusion: We recommend non-operative treatment in all patients with minimally displaced fractures of the greater tuberosity, as most obtain very good results.
In nine patients (17%) we had a minimal loss of reduction (<5 mm) to superior, but there was no significant influence on shoulder function.

In comparison of the results of the surgical study group and the nonoperative control group, patients with reduction and fixation of greater tuberosity fractures had significantly better results on shoulder function than did those with conservative treatment (p < 0.05).

CONCLUSION……..Reduction and fixation of those fractures is recommended because patients with nonoperative treatment showed significantly worse results.
Treatment

Small series of **13-17 patients** with good to excellent results after operative treatment

1 cm Neer, Flatow

0.5 cm Bigliani, Iannotti

0.3 cm Park

GT fractures associated with glenohumeral dislocation show a much higher frequency of labral lesions than those with verified nondislocation.

Treatment

Anterior Traumatic Shoulder Dislocation Associated With Displaced Greater Tuberosity Fracture: The Necessity of Operative Treatment

Panayiotis Dimakopoulos, MD, Andreas Panagopoulos, MD, PhD, George Kasimatis, MD, Spiros A. Syggelos, MD, and Elias Lambiris, MD

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- **34 patients** with a GT fracture and anterior shoulder dislocation

- Average age was 52.8 years
  - young men (n = 19; average age, 44.7 years)
  - old women (n = 15; average age, 62.3 years)

- Mean follow-up period was 4.8 years (range, 2.0 to 10 years).
Treatment

The mean postreduction displacement of the GT was 1.6 cm (range, 1.3–2.9 cm)

In 16 of 36 (44%) cases, there was a rotator cuff tear
Treatment

Transosseous Suture Fixation of Proximal Humeral Fractures

By Panayiotis Dimakopoulos, MD, Andreas Panagopoulos, MD, PhD, and Georgios Kasimatis, MD

Investigation performed at the Shoulder and Elbow Unit, Orthopaedic Department, Patras University Hospital, Patras, Greece

Surgical technique for 2-part GT fractures
Treatment

- There was no case of recurrent dislocation of the shoulder.
- The average Constant-Murley score of the affected shoulder was **88.4 points** (range, 40.0 to 100.0 points), whereas the functional score, unadjusted for age or sex as a percentage of the unaffected shoulder, was **93.2%**.
Treatment

- 17 neglected cases [5 from our area and 12 referrals] were treated nonoperatively with sling and physiotherapy

- During surgical exploration, 12 (70.5%) of these patients had moderate or large rotator cuff tears
Conclusions

- Different philosophy due to the nature of the injury
- Radiological control with x-rays in external rotation
- Transosseous suturing (avoidance of metal fixation)
- Evaluation and repair of the RC tear
- Supervised rehabilitation program