FRACTURES OF THE SCAPULA

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Olympion General Hospital, Patras, GR
Epidemiology

- 1% of all orthopaedic fractures
- 3% of shoulder girdle injuries
- 5% of shoulder fractures
- more common in men (70%)
- mean age 35-45 years old
Anatomy

- The scapula serves as the attachment site for 18 muscles, linking it to the thorax, spine, and upper extremity.

Biomechanics

- High degree of mobility upwardly/downwardly, internally/externally rotate, elevate/depress, and protract/retract on the trunk
- Coordinated upward rotation for maintaining sufficient subacromial space as the humerus is elevated to approximately 90°
- Poor position and movement of the scapula can lead to alterations to the relationship between length and tension of each muscle

Myers P ET AL Scapular Position and Orientation in Throwing Athletes AJSM 2004
Anatomy

- The Superior Shoulder Suspensory Complex (SSSC) is a bony–soft tissue ring made up by the glenoid, coracoid, and acromion processes, as well as the distal clavicle, the AC joint, and CC ligaments.

- Lesions to 2 of these structures allow for significant displacement at the individual site and the entire SSSC itself.

Goss TP. Double disruptions of the superior shoulder suspensory complex. JOT, 1993
Incidence (topography)

- 50% body and spine
- 25% scapular neck
- 10% glenoid rim - fossa
- 8% acromion
- 7% coracoid process

Mechanism of injury

- 60% high energy injury (RTA)
- 20% fall from height
- Indirect trauma (fall with the outstretched hand which drives the humeral head against the glenoid)
Associated injuries

- Rib fractures  25-45%
- Pulmonary injury  15-55%
- Humeral fractures  12%
- Skull fractures  25%
- CNS deficits  5%
- Major vascular injury  11%
- Splenic rupture  8%

Scapular fractures
1,164 patients admitted with multiple trauma. Seventy-nine (6.8%) of the 1,164 sustained a scapula fracture, forming the study group.

The **overall mortality** rate was 11.4% in patients with scapula fractures and 20% in those without scapula fractures (p = 0.1).
Clinical examination

- swelling, tenderness, crepitus, and ecchymosis over the scapular region
- careful neurovascular examination to rule out arterial injury or brachial plexopathy (5-10%).
Radiological examination

- **AP and Y view**

- **CT scan**
  (glenoid #)

Missed # at the initial supine chest radiograph:
- lateral aspect is not included on the film
- technical artifacts (labels or EKG leads)
- subcutaneous emphysema
- pulmonary contusion
Treatment options

- The earliest description of treating scapula fractures was published in 1805 in Desault’s treatise on fractures.

- 90% are not significant displaced so, conservative treatment is a reasonable option, but….

Ada & Miller did a follow-up of 16 such patients treated nonoperatively, of whom 50% had pain, 40% had exertional weakness, and 20% had decreased motion at a minimum of 15 months' follow-up.

Nordqvist and Petersson analyzed 68 patients with a mean 14-year follow-up and found that 50% of patients with residual deformity had shoulder symptoms.

## Treatment options

### Table 1  
Treatment strategies of scapular fractures

<table>
<thead>
<tr>
<th>Location of Fracture</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fracture of the body</td>
<td>Conservative treatment</td>
</tr>
<tr>
<td>Fracture of the glenoid neck</td>
<td></td>
</tr>
<tr>
<td>- Isolated</td>
<td>Conservative treatment</td>
</tr>
<tr>
<td>- Associated with clavicular fracture or AC joint dislocation</td>
<td>ORIF of one or both bones</td>
</tr>
<tr>
<td>Fracture of the glenoid</td>
<td></td>
</tr>
<tr>
<td>- Type I</td>
<td>ORIF</td>
</tr>
<tr>
<td>- Type II</td>
<td>ORIF</td>
</tr>
<tr>
<td>- Type III</td>
<td>ORIF</td>
</tr>
<tr>
<td>- Type IV</td>
<td>ORIF</td>
</tr>
<tr>
<td>- Type V</td>
<td>ORIF</td>
</tr>
<tr>
<td>Acromion fracture</td>
<td></td>
</tr>
<tr>
<td>- Undisplaced</td>
<td>Conservative</td>
</tr>
<tr>
<td>- Displaced fracture</td>
<td>ORIF</td>
</tr>
<tr>
<td>Coracoid fracture</td>
<td></td>
</tr>
<tr>
<td>- Isolated</td>
<td>Conservative</td>
</tr>
<tr>
<td>- Associated with acromion-coracoid dislocation</td>
<td>ORIF</td>
</tr>
</tbody>
</table>

Nau T, Petras N, Vescei N. Fractures of the scapula-classification and treatment principles, Osteotrauma Care 2004
Treatment

Conservative treatment
- pain control
- ice
- sling immobilization
- early passive ROM

Body of the scapula (50%)
Non-Union of the Scapular Body

A Case Report*

BY RANJAN GUPTA, M.D., JERRY SHER, M.D., GERALD R. WILLIAMS, JR., M.D., AND JOSEPH P. IANNOTTI, M.D., PH.D., PHILADELPHIA, PENNSYLVANIA

...We were unable to find any instances of symptomatic non-union of the scapular body in our review of more than 600 scapular fractures that were reported in the literature....
Treatment

Operative treatment
- spikes

Body of the scapula (50%)
Fractures of the neck (25%)

? operative treatment when...

translational displacement $\geq 1\, \text{cm}$ and/or angulatory displacement $\geq 40^\circ$ in either the transverse or coronal plane.
Floating shoulder

THE FLOATING SHOULDER: IPSILATERAL CLAVICLE AND SCAPULAR NECK FRACTURES

DOLFI HERSCOVICI JR, ALBERIC G. T. W. FIENNES, M. ALLGÖWER, THOMAS P. RÜEDI

From Rätisches Kanton and Regionalspital, Switzerland

In ipsilateral mid-clavicular and scapular-neck fractures, the mechanical stability of the suspensory structures is disrupted and muscle forces and the weight of the arm pull the glenoid fragment distally and anteromedially. To prevent late deformity we recommend internal fixation of the fractured clavicle by a plate and screws. We treated seven patients with this unusual injury; all achieved an excellent functional result without deformity.

Floating shoulder

Open reduction and internal fixation of ipsilateral fractures of the scapular neck and clavicle

KS Leung and TP Lam

The results in the current series appear superior to those that have been reported for patients in whom either the scapular or the clavicular fracture was fixed alone.

14/15 patients good/excellent result
Floating shoulder

Nonoperative Treatment of Ipsilateral Fractures of the Scapula and Clavicle

BY SCOTT G. EDWARDS, M.D.†, A. PAIGE WHITTLE, M.D.†, AND GEORGE W. WOOD, II, M.D.†

Investigation performed at the Department of Orthopaedic Surgery, University of Tennessee-Campbell Clinic, Memphis, Tennessee

Twenty patients, 11 clavicular fractures were displaced 10 mm or more, and 5 scapular fractures were displaced more than 5 mm.

Nonoperative treatment of floating shoulder injuries, especially those with less than 5 mm of fracture displacement, can achieve satisfactory results that are probably equal or superior to those reported after operative treatment, without the risk of operative complications.
Floating shoulder

The floating shoulder

A MULTICENTRE STUDY
A. van Noort, R. L. te Slaa, R. K. Marti, C. van der Werken
From Reinier de GraafHospital, Delft, The Netherlands


46 patients, 35 fup, 31 had initially been treated conservatively and four by operation. The mean Constant score for the 28 patients treated conservatively was 76 and for the seven treated operatively it was 71 at a mean follow-up of 35 months. **In six of the 28 patients treated conservatively the glenoid was dislocated caudally at the end of treatment; they had a score of 42.** In the 22 patients without this dislocation the score was 85. We conclude that this rare injury is not inherently unstable and, in the absence of caudal dislocation of the glenoid, conservative treatment gives a good functional outcome.
Floating shoulder

Despite the limitations of our study, it is clear that ipsilateral fractures of the clavicular shaft and the scapular neck do not cause a floating shoulder without additional disruption of the coracoacromial and acromioclavicular capsular ligaments.
Floating shoulder

THE FLOATING SHOULDER: CLINICAL AND FUNCTIONAL RESULTS

BY KENNETH A. EGOL, MD, PATRICK M. CONNOR, MD, MADHAV A. KARUNAKAR, MD, STEPHEN H. SIMS, MD, MICHAEL J. BOSSE, MD, AND JAMES F. KELLAM, MD

Investigation performed at the Carolinas Medical Center, Charlotte, North Carolina

19 patients with (floating shoulder) were retrospectively evaluated. The treatment was nonoperative in 12 patients and operative in 7.

Conclusions: Good results may be seen both with and without operative treatment. Therefore, we cannot universally recommend operative treatment for a double disruption of the superior suspensory shoulder complex. Treatment must be individualized for each patient.
Fractures of the glenoid rim - fossa

**Ideberg Classification**  - study of 300 consecutive cases

Fractures of the glenoid rim - fossa

modified Ideberg classification (Goss)

Fractures of the glenoid rim - fossa

Type I

- anterior (Ia) or posterior (Ib) rim
- different from the osseous Bankart in ASD
- fixation:
  * if > 1/4 of the fossa (Rockwood)
  * persistent subluxation
  * unstable reduction

Fractures of the glenoid rim - fossa

Type II

- usually fixation to avoid inferior dislocation of the shoulder
Fractures of the glenoid rim - fossa

Type III

- coracoid fracture or AC joint separation
- fixation:
  * if > 5mm step off or
  * > 40° angulation
Fractures of the glenoid rim - fossa

Type IV-V

- Usually require internal fixation, especially when the glenoid is displaced laterally
ABSTRACT: Ten displaced intra-articular fractures of the glenoid fossa were treated with open reduction and internal fixation between 1980 and 1987. Nine patients were available for evaluation at an average of four years (range, two to ten years) after the operation. Eight patients had mild or no symptoms and little or no restriction of the motion of the shoulder. There were no infections or malunions. The only complication was heterotopic ossification in one patient. Radiographic evaluation showed no evidence of traumatic osteoarthritis in any patient. Open reduction and internal fixation is a useful and safe technique for the treatment of selected, displaced fractures of the glenoid fossa, and it can restore excellent function of the shoulder.
Open reduction and fixation can give good results for patients with displacement of the glenoid fossa as with other articular fractures. Additional factors such as poly-trauma, brachial plexus injury, and the general condition of the patient should be taken into consideration when undertaking operative treatment. The Ideberg classification is useful when planning the surgical approach. If the post-operative course is uneventful, excellent and good results can be expected.
Fractures of the coracoid

Table I. Associated injuries in 67 patients with fractures of the coracoid process

<table>
<thead>
<tr>
<th>Injury</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acromioclavicular dislocation</td>
<td>39</td>
</tr>
<tr>
<td>Fracture of the superior scapular margin</td>
<td>24</td>
</tr>
<tr>
<td>Laceration or abrasion over deltid</td>
<td>15</td>
</tr>
<tr>
<td>Clavicular fracture</td>
<td>14</td>
</tr>
<tr>
<td>Lateral end</td>
<td>12</td>
</tr>
<tr>
<td>Shaft</td>
<td>1</td>
</tr>
<tr>
<td>Segmental</td>
<td>1</td>
</tr>
<tr>
<td>Acromial fracture</td>
<td>13</td>
</tr>
<tr>
<td>Fracture of the scapular spine</td>
<td>5</td>
</tr>
<tr>
<td>Rotator-cuff tear</td>
<td>3</td>
</tr>
<tr>
<td>Anterior shoulder dislocation</td>
<td>3</td>
</tr>
<tr>
<td>Glenoid rim fracture</td>
<td>2</td>
</tr>
<tr>
<td>Proximal humeral fracture</td>
<td>2</td>
</tr>
</tbody>
</table>

Treatment was usually by open reduction and fixation for type-I fractures and conservative methods for type-II.
Fractures of the acromion

Ταξινόμηση Kuhn

Kuhn JE et al. Fractures of the acromion process: a proposed classification system. JOT 1994
Fractures of the acromion

- Most fractures are treated conservatively
- Large fragments – weak deltoid?
- Occlusion of the subacromial space
Role of arthroscopy?

Arthroscopic treatment of glenoid fractures.

Bauer T, Abadie O, Hardy P.

Service de Chirurgie Orthopédique et Traumatologique, Faculté de Médecine Paris Ile-de-France Ouest, Hôpital Ambroise Paré, Boulogne, France.

The patient was placed in the lateral decubitus position. The arthroscope was introduced through the posterior approach. The probe hook was introduced through a working cannula through the anterosuperior portal performed in an inside-out technique. The mobilization possibilities of the osteochondral fragments were then assessed. The use of a shaver was always necessary to clean the fracture site and evacuate clots. A nonabsorbable suture was passed through the labrum and the capsule tissue of the displaced articular fragment in its superior edge. The first suture was used as a traction stitch and allowed replacing the fragment in its original position and maintaining it during the placement of others sutures. A hole was made in the anterosuperior edge of the nonfractured glenoid and then a long drill was passed backward according to the transglenoid suture technique of Caspari or Morgan. Stitches were passed through the glenoid to the infraspinatus fossa. When articular congruity was judged satisfactory, the stitches were tied on the fascia of the infraspinatus muscle. The patients were immobilized in a sling for 3 weeks.
Stress fractures

**Clinical Images**

Scapular stress fracture in a professional cricketer and a review of the literature

Stress fracture of base of the acromion

N Roy, M G Smith, L G H Jacobs

Ann Rheum Dis 2002;61:944-945
243 cases (17 articles)

- Most common fractures of the neck and fossa, posterior approach, 25% concomitant injury to clavicle and AC ligaments

- Infection (4.2%), stiffness and implant failure

- 85% good-excellent results after mean 50 months postop
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