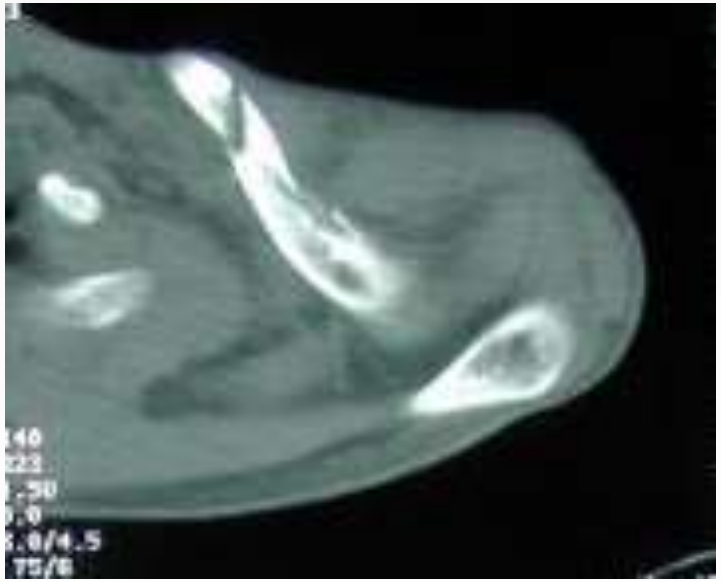
FRACTURES OF THE SCAPULA



Dr. Andreas Panagopoulos, MD, Ph.D.
Consultant in Orthopaedic Surgery & Sports Medicine
Olympion General Hospital , Patras, GR

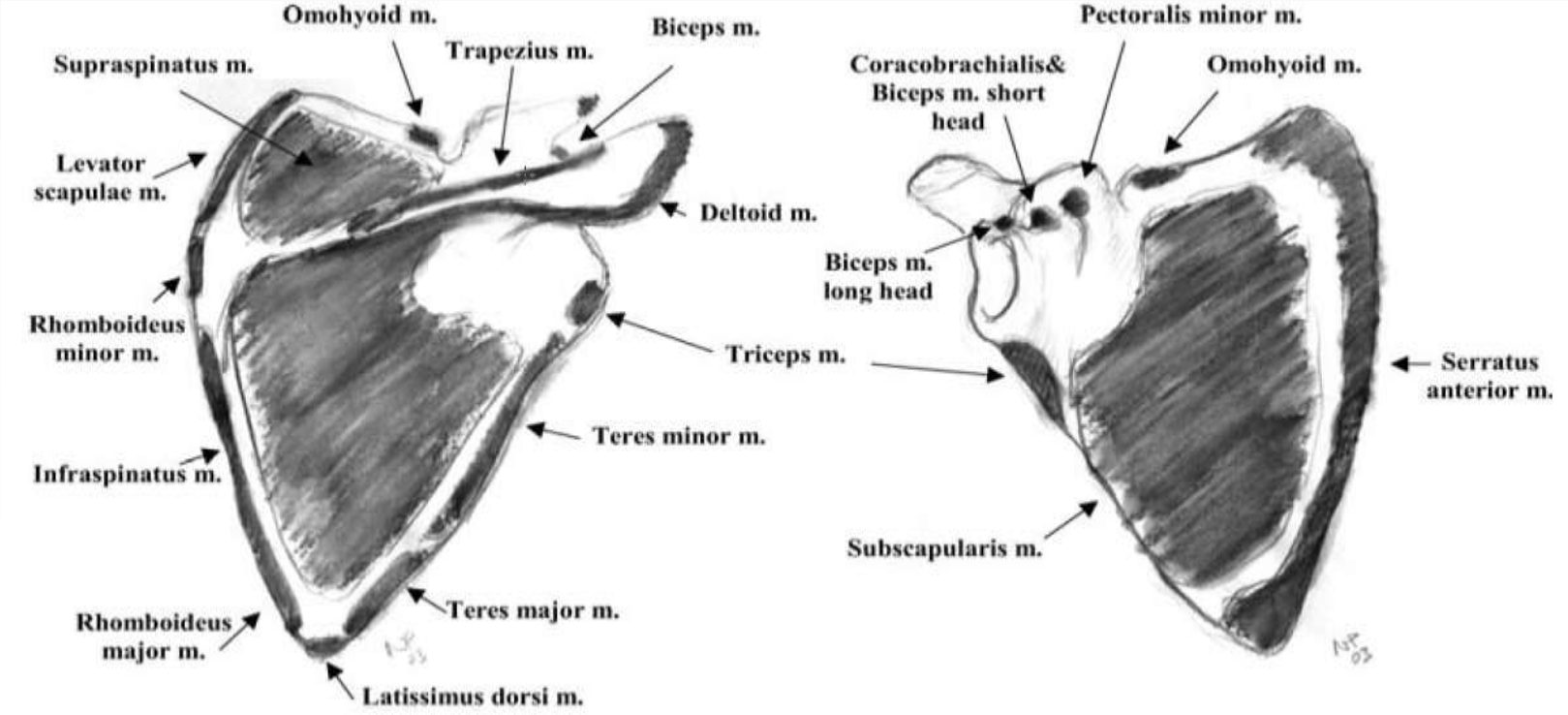
Epidemiology

- 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

Hardegger FH et al, JBJS Br, 1984
Ada JR, Miller MD, Clin Orthop 1991
Lantry J et al Injury ,2008

Anatomy

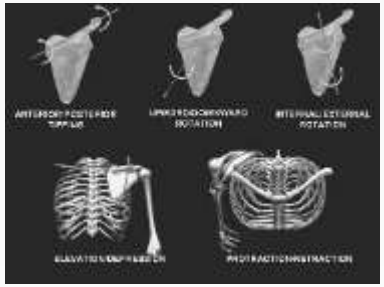
- The scapula serves as the attachment site for 18 muscles, linking it to the thorax, spine, and upper extremity.

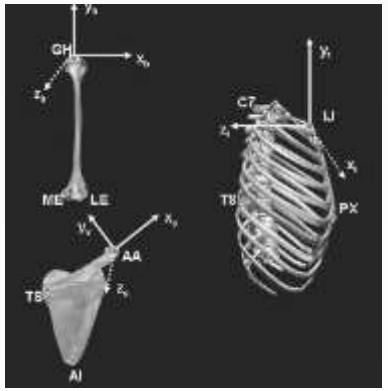


Butters KP. The scapula. In: The Shoulder. Vol 1. 1990:335-66. .

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



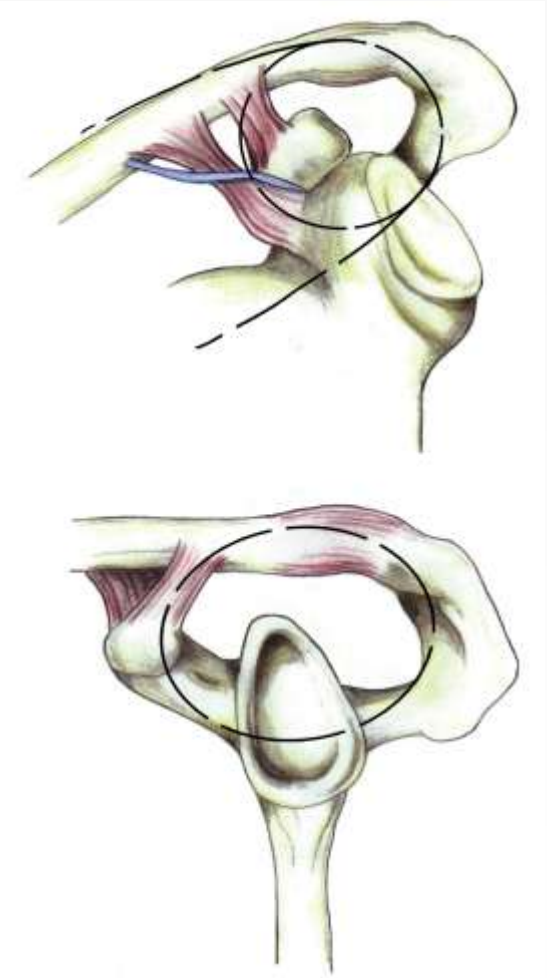


Myers P ET AL Scapular Position and Orientation in Throwing Athletes AJSM 2004

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.

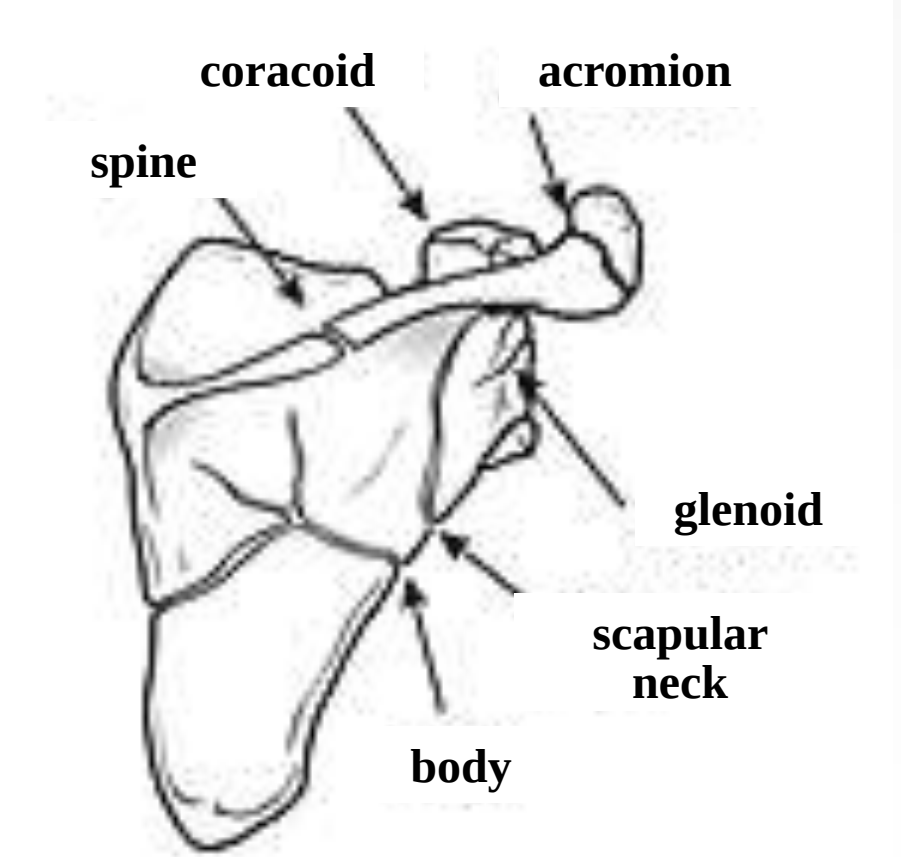
- Lesions to 2 of these structures allow for significant displacement at the individual site and the entire SSSC itself.



Goss TP. Double disruptions of the superior shoulder suspensory complex. JOT, 1993

Incidence (topography)

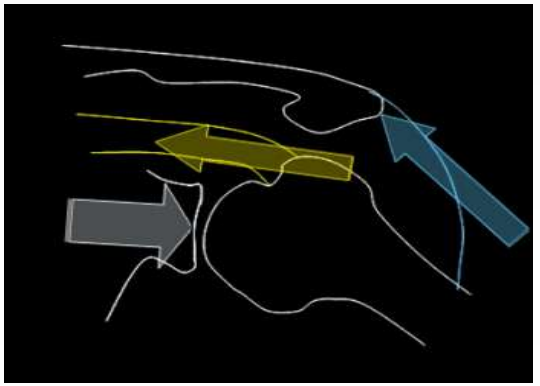
- 50% body and spine
- 25% scapular neck
- 10% glenoid rim - fossa
- 8% acromion
- 7% coracoid process



Ada JR, Miller MD. Scapular fractures: Analysis of 113 cases. Clin Orthop 1991;269:174-80.

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%

Associated injuries

- J Trauma. 2003 Dec;55(6):1145-7.

  Multiple trauma and scapula fractures: so what?

  Veysi VT, Mittal R, Agarwal S, Dosani A, Giannoudis PV

  Department of Trauma and Orthopaedics, St James' University Hospital, Leeds, United Kingdom.

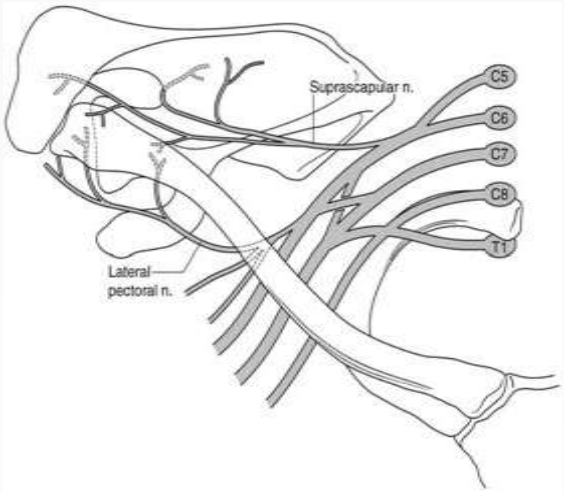
1,164 patients admitted with multiple trauma. Seventy-nine (6.8%) of the 1,164 sustained a scapula fracture, forming the study group.

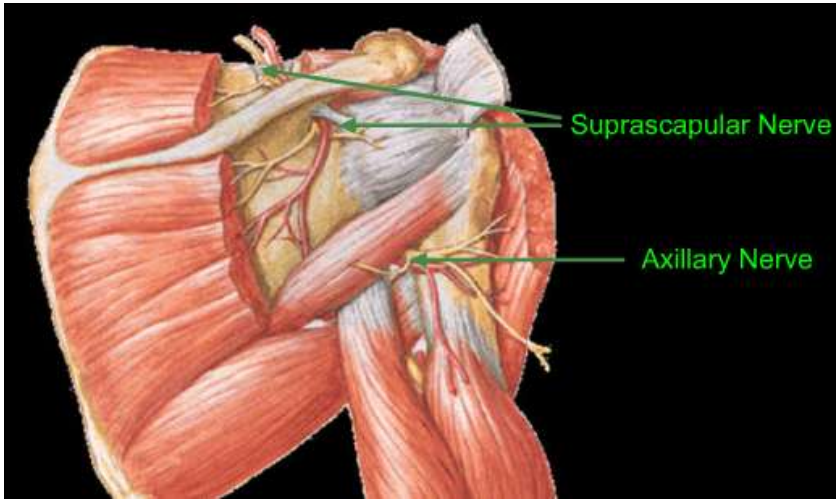
The **overall mortality** rate was 11.4% in patients with scapula fractures and 20% in those without scapula fractures (p = 0.1).

Clinical examination

- swelling, tenderness, crepitus, and ecchymosis over the scapular region

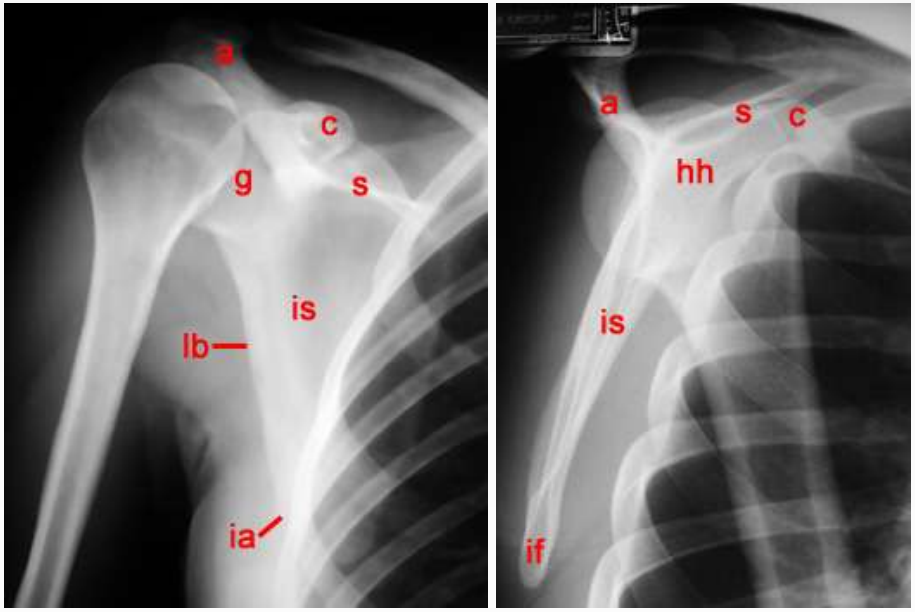
- careful neurovascular examination to rule out arterial injury or brachial plexopathy (5-10%).





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.

Ada JR, Miller MD. Scapular fractures: Analysis of 113 cases. Clin Orthop 1991
Nordqvist A, Petersson C. Fracture of the body, neck or spine of the scapula: A long-term follow-up study. Clin Orthop 1992

Treatment options

Table 1 Treatment strategies of scapular fractures

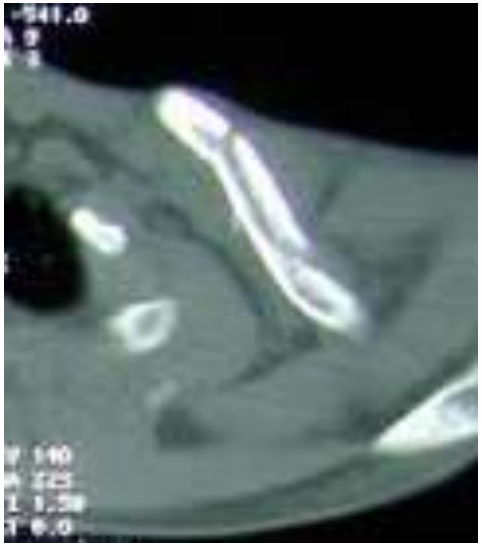
location of fracture	treatment	
fracture of the body	conservative treatment	
fracture of the glenoid neck		
– *isolated*	conservative treatment	
– *associated with clavicular fracture or AC-joint dislocation*	ORIF of one or both bones	
fracture of the glenoid		
– *Type I*	ORIF	– fragment involving 1/4 of the glenoid fossa – persistent subluxation – unstable reduction
– *Type II*	ORIF	
– *Type III*	ORIF	– intra-articular step-off of 5 mm and greater
– *Type IV*	ORIF	– displaced fracture
– *Type V*	ORIF	– displaced fracture
acromion fracture		
– *undisplaced*	conservative	
– *displaced fracture*	ORIF	
coracoid fracture		
– *isolated*	conservative	
– *associated with acromio-coracoid dislocation*	ORIF	

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

Treatment

Conservative treatment

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



Body of the scapula (50%)

Treatment

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

1: Kaminsky SB, Pierce VD.

Nonunion of a scapula body fracture in a high school football player.
Am J Orthop. 2002 Aug;31(8):456-7.
PMID: 12216967 [PubMed - indexed for MEDLINE]

2: Ferraz IC, Papadimitriou NG, Sotereanos DG.

Scapular body nonunion: a case report.
J Shoulder Elbow Surg. 2002 Jan-Feb;11(1):98-100. No abstract available.
PMID: 11845159 [PubMed - indexed for MEDLINE]

3: Michael D, Fazal MA, Cohen B.

Nonunion of a fracture of the body of the scapula: case report and literature review.
J Shoulder Elbow Surg. 2001 Jul-Aug;10(4):385-6. No abstract available.
PMID: 11517372 [PubMed - indexed for MEDLINE]

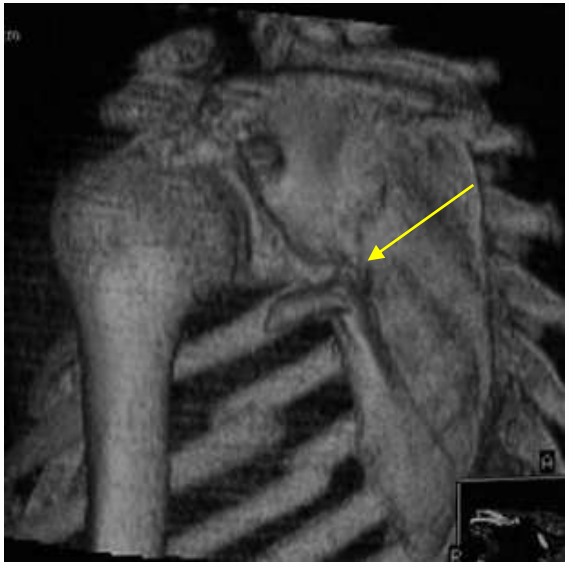
…We were unable to find any instances of symptomatic non-union of the scapular body in our review of more than 600 scapular fractures that were reported in the literature….

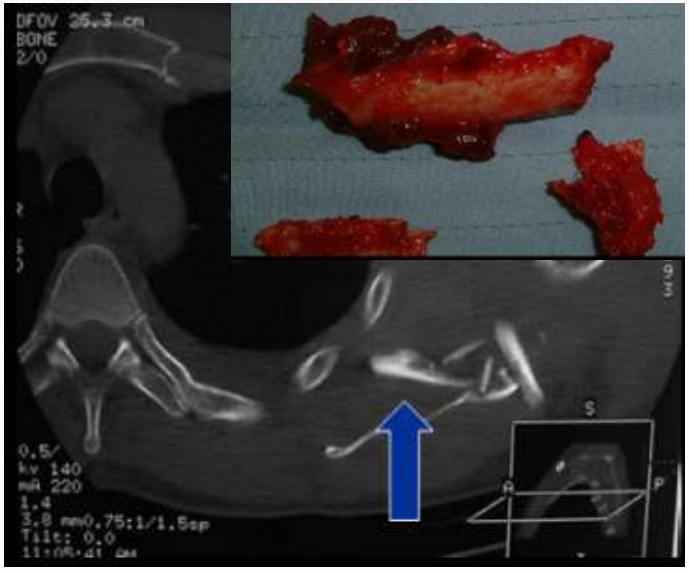
Treatment

Body of the scapula (50%)

Operative treatment

- spikes



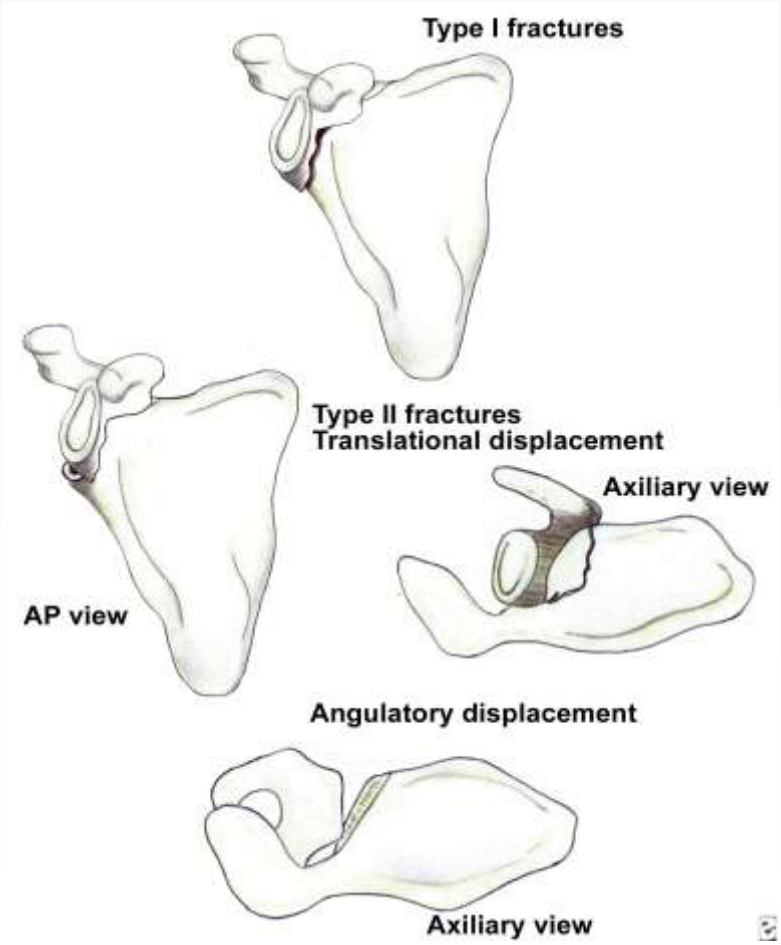


Treatment

Fractures of the neck (25%)

? operative treatment when…

translational displacement ≥ 1 cm and/or angulatory displacement ≥ 40° 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 Kantons and Regionalspital, Switzerland

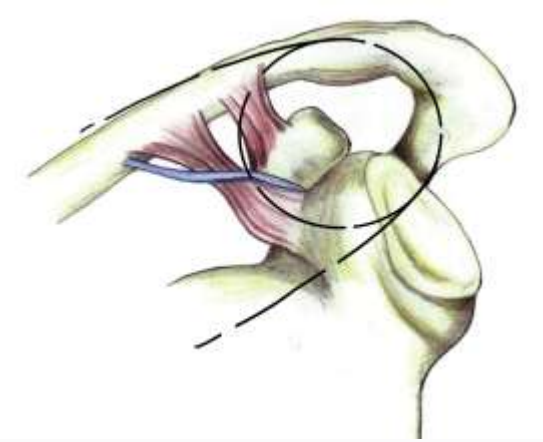
In ipsilateral mid-clavicular and scapular-neck fractures, the mechanical stability of the suspensory structures is disrupted and muscle forces and the weight of the arm pull the glenoid fragment distally and anteromedially. To prevent late deformity we recommend internal fixation of the fractured clavicle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

Herscovici D Jr, et al. *J Bone Joint Surg* [Br]. May 1992

Floating shoulder

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

KS Leung and TP Lam
J Bone Joint Surg Am. 1993;75:1015-1018.



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

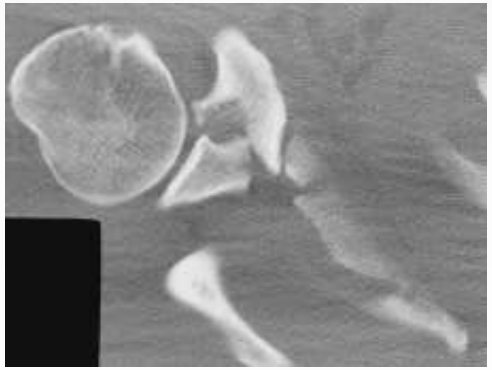
Floating shoulder

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

J Bone Joint Surgery, June 2000

Floating shoulder

THE JOURNAL OF BONE & JOINT SURGERY (Br)

The floating shoulder

A MULTICENTRE STUDY

A. van Noort, R. L. te Slaa, R. K. Marti, C. van der Werken

From Reinier de Graaf Hospital, Delft, The Netherlands

J Bone Joint Surg [Br] 2001;83-B:795-8.

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

THE FLOATING SHOULDER: A BIOMECHANICAL BASIS FOR CLASSIFICATION AND MANAGEMENT

BY GERALD R. WILLIAMS JR., MD, JOHN NARANIA, MD, JOHN KLIMKIEWICZ, MD, ANDREW KARDUNA, PHD, JOSEPH P. IANNOTTI, MD, PHD, AND MATTHEW RAMSEY, MD

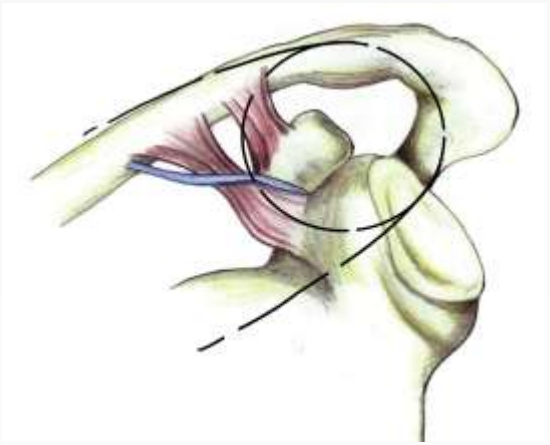
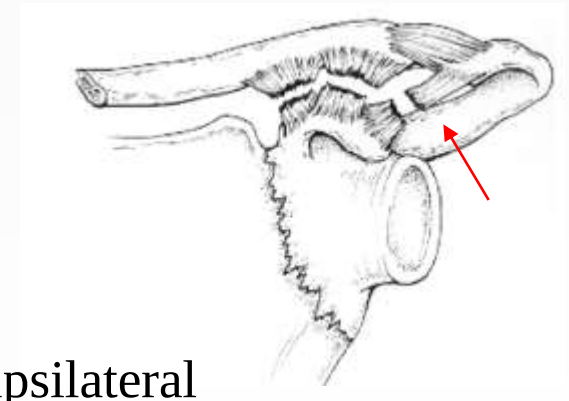


TABLE I Fractures or Equivalent Ligamentous Injuries Necessary to Produce Floating Shoulder

Fracture	Ligamentous Injury
Coracoid base	Coracoclavicular and coracoacromial
Clavicular shaft	Coracoclavicular and acromioclavicular capsular
Scapular spine (or acromion)	Coracoacromial and acromioclavicular capsular



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.

THE JOURNAL OF BONE & JOINT SURGERY · JBJS.ORG
VOLUME 83-A · NUMBER 8 · AUGUST 2001

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

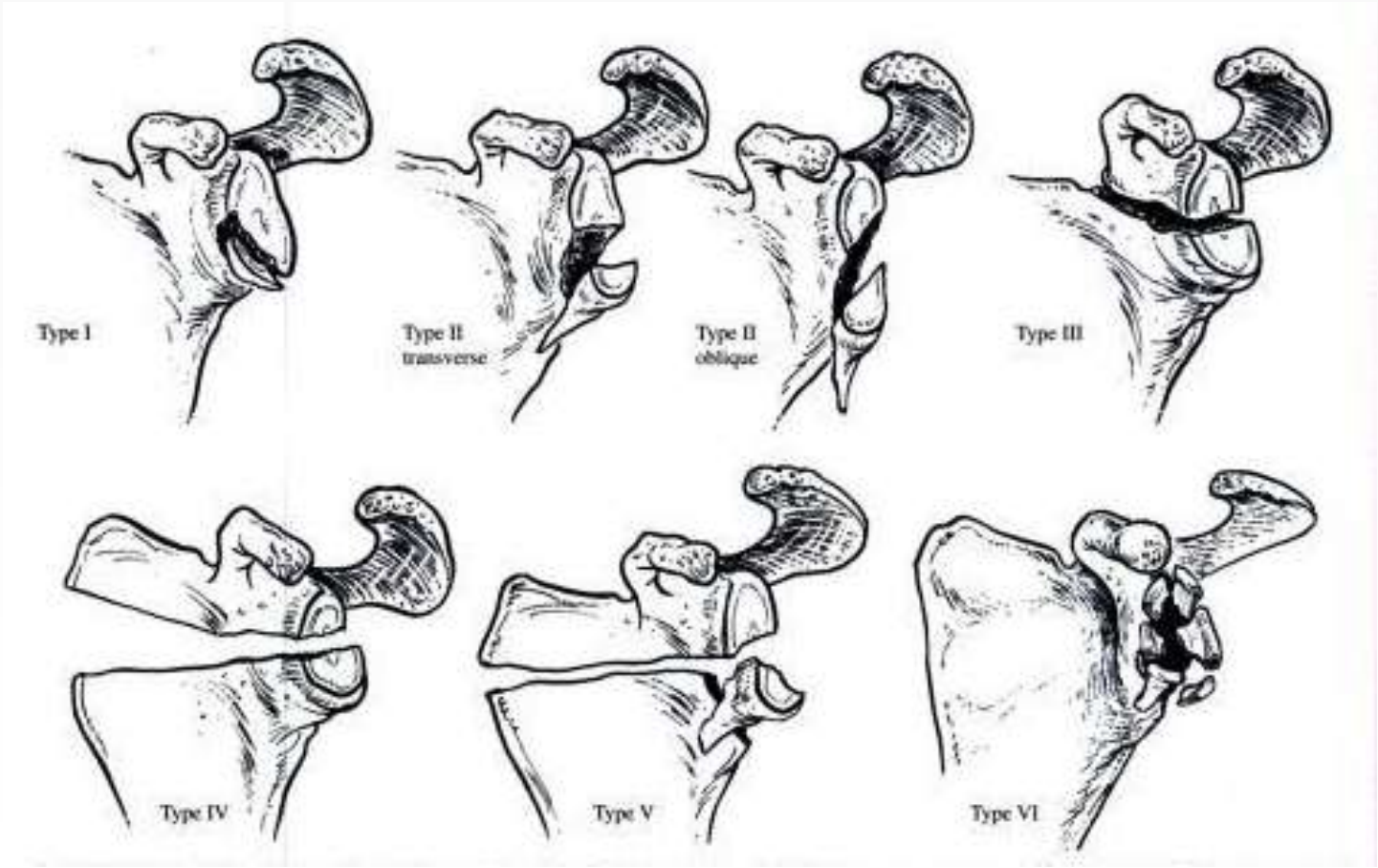
Investigation performed at the Carolinas Medical Center, Charlotte, North Carolina

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

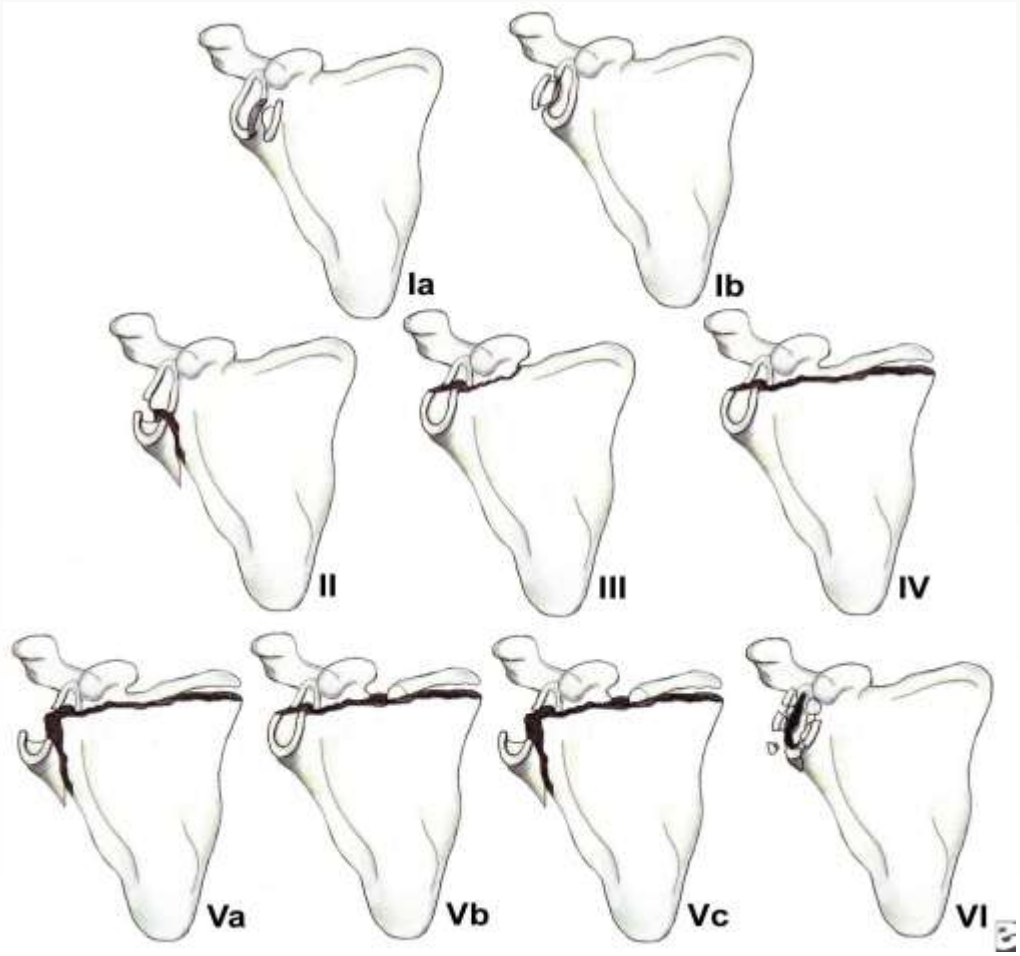
Ideberg Classification - study of 300 consecutive cases



Ideberg R. *Fractures of the scapula involving the glenoid fossa. In: Bateman JE, Welsh RP, eds. Surgery of the shoulder. Philadelphia: Decker, 1984:63-6.*

Fractures of the glenoid rim - fossa

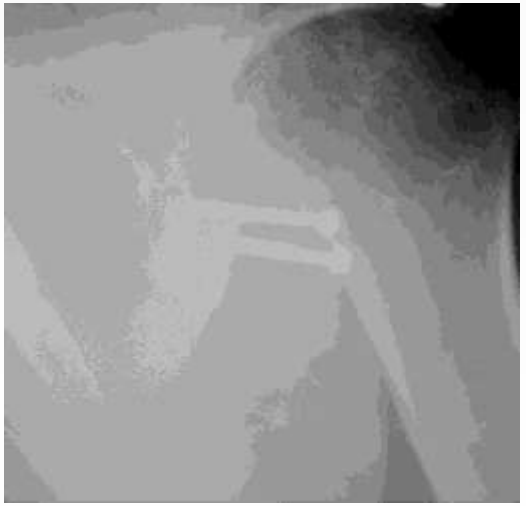
modified Ideberg classification (Goss)



Goss TP. Scapular Fractures and Dislocations: Diagnosis and Treatment. *J Am Acad Orthop Surg*. Jan 1995

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

McLaughlin HL. Trauma. WB Saunders, Philadelphia 1959. Rowe CR. Fractures of the scapula. Surg Clin North Am 1963; 43: 1565 – 1571
Neer CS II. Fractures. In: Rockwood CA, Green DP (eds). Shoulder Reconstruction. WB Saunders, Philadelphia 1990; p 412
Rockwood CA. Management of fractures of the scapula. J Bone Joint Surg 1986; 10: 219

Fractures of the glenoid rim - fossa

Type II

- usually fixation to avoid inferior dislocation of the shoulder

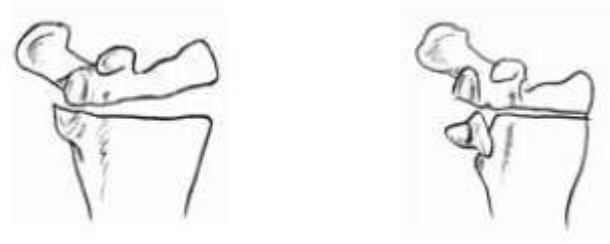
Fractures of the glenoid rim - fossa

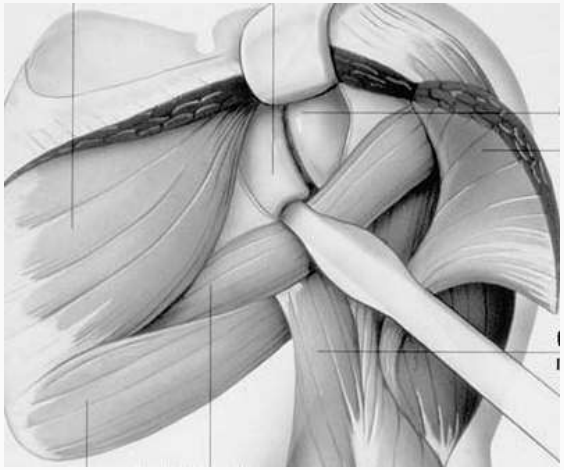
Type III

- coracoid fracture or AC joint separation
- fixation:
  * if > 5mm step off or
  * > 40^{o} angulation

Fractures of the glenoid rim - fossa

Type IV-V





- Usually require internal fixation, especially when the glenoid is displaced laterally

Open reduction and internal fixation of displaced intra-articular fractures of the glenoid fossa

BF Kavanagh, JK Bradway and RH Cofield
J Bone Joint Surg Am. 1993;75:479-484.

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 osteoarthrosis 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.

THE JOURNAL OF BONE & JOINT SURGERY (BR)

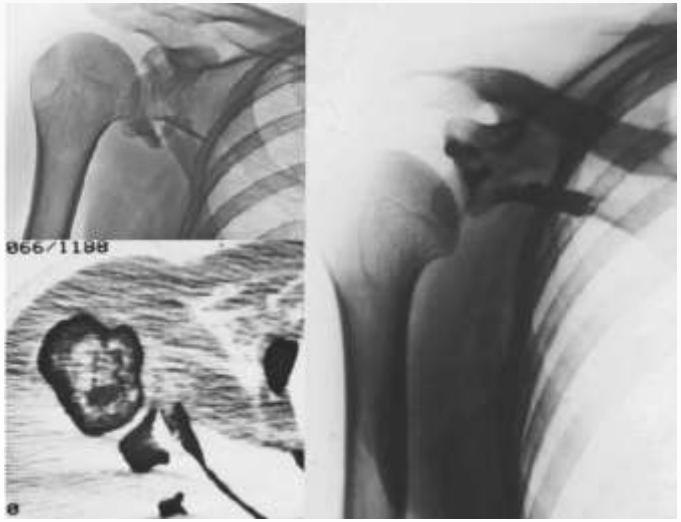
Fractures of the glenoid treated by operation

A 5- TO 23-YEAR FOLLOW-UP OF 22 CASES

P. Schandelmaier, M. Blauth, C. Schneider, C. Krettek

From the Leopold-Franzens Universität, Innsbruck, Austria

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 polytrauma, brachial plexus injury, and the general condition of the patient should be taken into consideration when undertaking operative treatment. The Ideberg classification[18] is useful when planning the surgical approach. If the postoperative course is uneventful, excellent and good results can be expected.



Fractures of the coracoid

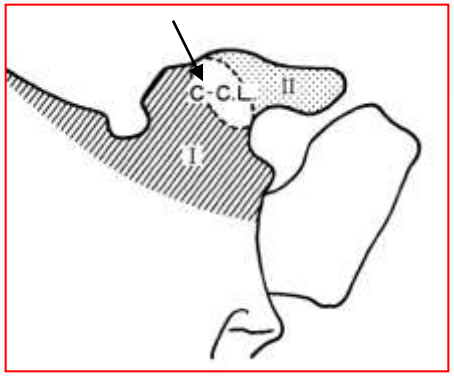
FRACTURES OF THE CORACOID PROCESS

KIYOHISA OGAWA, ATSUSHI YOSHIDA, MASAAKI TAKAHASHI, MICHIMASA UI

J Bone Joint Surg [Br] 1996;78-B:17-9.

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

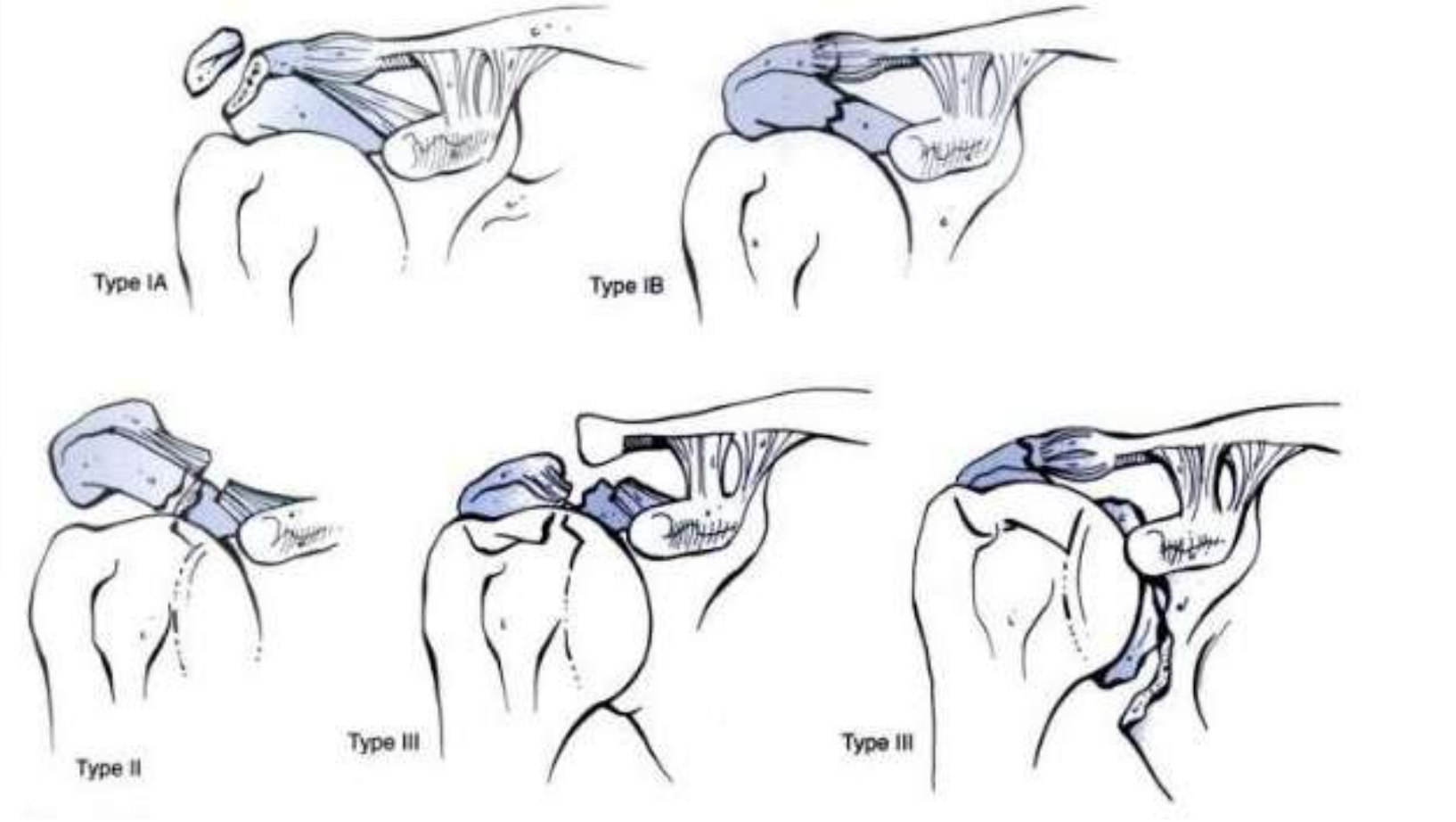
	Number
Acromioclavicular dislocation	39
Fracture of the superior scapular margin	24
Laceration or abrasion over deltoid	15
Clavicular fracture	14
Lateral end 12	
Shaft 1	
Segmental 1	
Acromial fracture	13
Fracture of the scapular spine	5
Rotator-cuff tear	3
Anterior shoulder dislocation	3
Glenoid rim fracture	2
Proximal humeral fracture	2



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

Fractures of the acromion

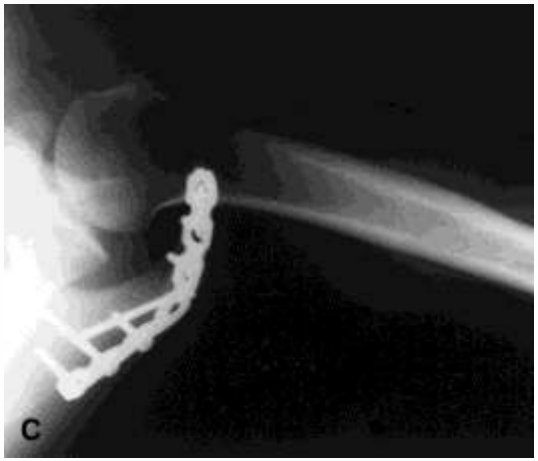
Ταξινόμηση Kuhn



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?

1: Arthroscopy. 2006 May;22(5):569.e1-6.

Arthroscopic treatment of glenoid fractures.

Bauer T, Abadie O, Hardy P.

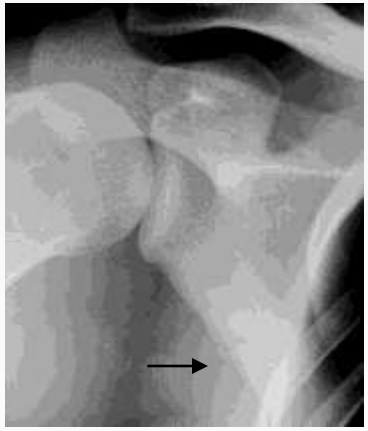
Service de Chirurgie Orthopédique et Traumatologique, Faculté de Médecine Paris Ile-de-France Ouest, Hôpital Ambroise Paré, Boulogne, France.

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

Lantry JM, Roberts CS, Giannoudis PV.

Operative treatment of scapular fractures: A systematic review.

Injury. 2008 Mar;39(3):271-83. Epub 2007 Oct 4.
PMID: 17919636 [PubMed - in process]

- 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

ESSKA 2000 APOSSM Travelling Fellowship Tour

24th March-13th April 2008

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