





## Clavicle Fractures Alistair Irwin Jan 2010



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#### **Fractures of the Clavicle**

L.A. Kashif Khan, Timothy J. Bradnock, Caroline Scott and C. Michael Robinson J Bone Joint Surg Am. 2009;91:447-460. doi:10.2106/JBJS.H.00034

#### Acromioclavicular and Sternoclavicular Injuries and Clavicular, Glenoid, and Scapular Fractures

Michael S. Bahk, John E. Kuhn, Leesa M. Galatz, Patrick M. Connor and Gerald R. Williams, Jr. J Bone Joint Surg Am. 2009;91:2492-2510.



#### Edwin Smith Papyrus 17<sup>th</sup> Century BC

#### • A fracture of the Collar Bone

• If thou examinest a man having a break in his collar-bone (and) thou shouldst find his collar-bone short and separated from its fellow.

Thou shouldst say concerning him : "One having a break in his collar-bone. An ailment which I will treat."

Thou shouldst place him prostrate on back, with something folded between his two shoulder-blades; thou shouldst spread out with his two shoulders in order to stretch apart his collar-bone until that break falls into its place.

Thou shouldst make for him two splints of linen, (and) thou shouldst apply one of them both on the inside of his upper arm. thou shouldst bind it with yarn, (and) treat it afterward with honey every day, until he recovers.





FIG. 1.-a, The splint; b, axillary pads; c, bandages; d, dorsal pad.



FIG. 3.-Splint applied. Back view,





#### A METHOD OF TREATING FRACTURE OF THE CLAVICLE

BY GEORGE W. HAWLEY, M.D., F.A.C.S., BRIDGEPORT, CONNECTICUT

From the Orthopaedic and Fracture Service of the Bridgeport Hospital







#### CONSERVATIVE TREATMENT OF FRACTURE OF THE CLAVICLE

BY MAJOR BERNARD D. PACKER

Medical Corps, Army of the United States

From the Fort Belvoir Station Hospital, Fort Belvoir, Virginia



The purpose of this paper is to present a simple, practical method for the treatment of fractured clavicles. The procedure includes the injection of a local anaesthetic into the fracture site, the reduction of the fracture by manipulation of the fragments and general positioning of the shoulders, and the maintenance of the reduction by immobilization in a light plaster cast. This treatment permits the complete freedom of both arms. It also allows the soldier to wear a uniform over the appliance, and to return to his unit on a temporary limited-service basis.

Treatment of the fractured clavicle has run the gamut from extreme conservatism, with complete bed rest and sandbags, to the method of internal fixation with Kirschner wire, described by Murray. The latter method is not without some disconcerting complications.



#### Classification

Fractures and Ligamentous Injuries of the Clavicle and Its Articulation

FRED L. ALLMAN, JR. J Bone Joint Surg Am. 1967;49:774-784.

#### Fracture of the Clavicle

Fractures of the clavicle may be divided into three groups: Group I, fractures of the middle third, the most frequent site <sup>18</sup>; Group II, fractures distal to the coracoclavicular ligament, where non-union is frequent <sup>9</sup>; and Group III, fractures of the proximal end of the clavicle, where displacement and non-union are rare.

## Neer lat 1/3 fractures Type 1



# Type II A



# Type IIB



# Type III

- Lateral to ligamentous complex, ACJ articular surface involved
- Higher rate of symptomatic nonunion / post-traumatic OA of ACJ



### Midshaft #

- Neer in 1960 non-union rate of 0.1% in 2235 #'s treated conservatively
   Vs 2 in 45 #'s treated operatively
- Rowe in 1968 found a non-union rate 4 x higher (3.2% vs 0.8%) in those treated operatively

## Midshaft #

- Hence
  - "Not only does open reduction make nonunion more likely, but also in some patients the scar produced can be more unsightly than the bony prominence"

Campbell's Operative Orthopaedics p2986

#### Ununited fractures of the clavicle

RM Wilkins and RM Johnston J Bone Joint Surg Am. 1983;65:773-778.

 33 nonunions predilection to for displacement + comminution = high energy injuries

#### Non-union of the clavicle. Associated complications and surgical management

JB Jupiter and RD Leffert J Bone Joint Surg Am. 1987;69:753-760.

#### 23 non-unions degree of displacement highest predictor of nonunion

#### CLOSED TREATMENT OF DISPLACED MIDDLE-THIRD FRACTURES OF THE CLAVICLE GIVES POOR RESULTS

J Bone Joint Surg [Br] 1997;79-B:537-9.

JAMES M. HILL, MICHAEL H. McGUIRE, LYNN A. CROSBY

242 fractures – 66 completely displaced. Shortening
 >20mm highly significant chance of non-union

#### **Estimating the Risk of Nonunion Following Nonoperative Treatment of a Clavicular Fracture**

C. Michael Robinson, Charles M. Court-Brown, Margaret M. McQueen and Alison E. Wakefield J Bone Joint Surg Am. 2004;86:1359-1365.

- 868 clavicle fractures 6% non-union rate
- Higher rate in elderly / women / comminuted or displaced fractures

Nonoperative Treatment Compared with Plate Fixation of Displaced Midshaft Clavicular Fractures. A Multicenter, Randomized Clinical Trial

Canadian Orthopaedic Trauma Society J Bone Joint Surg Am. 2007;89:1-10. doi:10.2106/JBJS.F.00020

- Prospective study nonop vs plate fixation
  132 displaced fractures
- Improved function + patient satisfaction at 1 year with low complication rates



## Midshaft #

- Absolute indications for surgery (Rockwood p1054)
  - Open injury
  - Impending skin disruption + irreducible
  - Vascular compromise
  - Progressive neurology
  - Scapulothoracic dissociation
  - Shortening > 20mm

## Midshaft #

- Relative indications for surgery (Rockwood p1054)
  - Displacement > 20mm
  - Neurological disorder
  - Multitrauma
  - Floating shoulder
  - Cosmesis ?
  - Bilateral fractures

#### **Fractures of the Clavicle**

L.A. Kashif Khan, Timothy J. Bradnock, Caroline Scott and C. Michael Robinson J Bone Joint Surg Am. 2009;91:447-460. doi:10.2106/JBJS.H.00034

- However Feb 2009 review of 177 papers
  - 'Nonoperative treatment of displaced shaft fractures may be associated with a higher rate of nonunion and functional deficits than previously reported. However, it remains difficult to predict which patients will have these complications.'
  - 'Since a satisfactory functional outcome may be obtained after operative treatment of a clavicular nonunion or malunion, there is currently considerable debate about the benefits of primary operative treatment of these injuries.'

### Medial 1/3 fractures

- Rare 2 9%
- High energy injury 19% mortality
- Normally treated non-operatively unless open fracture
- Non-union rate 15%

### Medial 1/3 fractures



#### Fig. 1

Classification of medial clavicular fractures. (Reprinted, with permission, from: Throckmorton T, Kuhn JE. Fractures of the medial end of the clavicle. J Shoulder Elbow Surg. 2007;16:49-54.)





 "Closed reduction is generally successful if performed early. The reduction of a posterior dislocation of the SC joint must be performed carefully as the clavicular head could be providing a tamponade of a torn vessel."



### Lateral 1/3 fractures

- Older age group
- 25% of clavicle fractures
- Noted by both Neer + Allman to have a higher rate of non-union than midshaft clavicles. (18% - 40%)
- Hence a variety of fixation developed for displaced fractures





Din 4





TABLE II	Calculated Probability of a Nonunion at Twenty-four
	Weeks After a Lateral-End Clavicular Fracture, Based
	on Age and Displacement in a Series of 263 Patients <sup>9</sup>

	Probability of a Nonunion	
Age (yr)	Not Displaced	Displaced
20	1%	16%
30	3%	21%
40	5%	27%
50	6%	37%
60	10%	44%
70	17%	52%

•However high complication rates documented with surgery

Primary Nonoperative Treatment of Displaced Lateral Fractures of the Clavicle

C. Michael Robinson and David A. Cairns J Bone Joint Surg Am. 2004;86:778-782.

- 127 displaced lateral clavicle fractures treated non-operativley
- ~30% rate of non-union but only 14% painful requiring fixation
- No difference in functional outcome scores for non-union vs united fractures.

Our results indicate that early nonoperative treatment is a Safe and effective alternative to open reduction and internal fixation for the majority of closed displaced fractures of the lateral end of the clavicle with no soft-tissue compromise

We believe that a policy of nonoperative treatment can be applied successfully to the majority of fractures of the lateral end of the clavicle in middle-aged and elderly individuals.
### ACJ injuries

Rockwood classification





### Clavicle fractures summary

- Common injury vast majority do well with conservative treatment
- Consider surgery if midshaft
  - Displaced
  - Shortened
  - comminuted
- Lateral 1/3 clavicle fractures
  - Treat on case by case basis
  - Discuss operative treatment in functionally high demand pts if displaced



### **Scapula Fractures**



Rare – 1% of all fractures and 5% of shoulder fractures
Up to 95% associated with other injuries



Fig. 7 Frequency of scapular fractures. (Reprinted from: Goss TP. Fractures of



Fig. 6 Superior shoulder suspensory complex A, AP view of the bone-soft-tissue ring and superior and inferior bone struts. B, Lateral view of the bone-soft-tissue ring.

## -Single breaks in the ring are stable however double breaks are inherently unstable



Fig. 7 Types of traumatic ring/strut disruptions. Single disruptions of the bonesoft-tissue ring may be a break (A) or a ligament disruption (B). Double disruptions of the bone-soft-tissue ring may be a double-ligament disruption (C), a double break (D), or a combination of a bone break and a ligament disruption (E). Other double disruptions may be a break of both struts (F) or a break of one strut and a ring disruption (G).





### **Glenoid Fractures**

Ideberg classification



### Rim fracture



- Treat if unstable
  - ->25% articular surface
  - Evidence of instability
  - Displacement > 10mm



### Glenoid Fossa #





- Operative fixation indicated if
  - >5mm articular stepoff
  - Instability
  - Fragments so displaced that non-union is likely to occur

Scapular Fractures and Dislocations: Diagnosis and Treatment

Thomas P. Goss, MD

J Am Acad Orthop Surg 1995;3:22-33

### Scapula neck fractures



Fig. 8

Scapular neck fractures most commonly occur medial to the coracoid (line B) and uncommonly lateral to the coracoid (line A). (Reprinted, with permission, from: Goss TP. Fractures of the glenoid neck. J Shoulder Elbow Surg. 1994;3:42-52.)

- Fractures lateral to coracoid = unstable but rare
- Fractures medial = stable due to ligamentous attachments

#### -Type II if > 1cm displacement or > 40 degrees angulation



Fig. 4 Classification of fractures of the glenoid neck. Type I includes all minimally displaced fractures. Type II includes all significantly displaced fractures (either translational or angulatory displacement).









### **Coracoid Fractures**



#### FRACTURES OF THE CORACOID PROCESS

K. S. EYRES, A. BROOKS, D. STANLEY

From the Northern General Hospital, Sheffield, England

J Bone Joint Surg [Br] 1995;77-B:425-8.



Fig. 6

Classification of coracoid fractures: type I, tip or epiphyseal fracture; type 2, mid-process; type 3, basal fracture; type 4, superior body of scapula involved; type 5, extension into the glenoid fossa. The suffix A or B can be used to record the presence or absence of damage to the clavicle or its ligamentous connections to the scapula.

- If displaced usually due to double break in ring



### Scapulothoracic Dissociation

- 'Closed traumatic forequarter amputation'
- Associated injuries common
- Treat fractures if unstable



### Scapula fractures Summary

- Rare injuries
- Other serious life threatening injuries common
- Rim fractures treat if shoulder unstable
- Fossa fractures treat if displacement
- Neck fractures treat if > 40 degrees or > 1 cm displacement



# Surgical Approaches to the Humerus







### Surgical Exposures of the Humerus Zlotolow et al. J Am Acad Orthop Surg.2006; 14: 754-765

#### Radial nerve 20cm prox. medially +14cm laterally



A


## **Medial Approach**

#### Complex non-union of the humeral diaphysis. Treatment with a medial approach, an anterior plate, and a vascularized fibular graft

JB Jupiter J Bone Joint Surg Am. 1990;72:701-707.



### Anterolateral approach (Henry)



# Good exposure of midshaft + proximal humerus

- Extension of deltopectoral approach
- Proximally internervous plane between
  - axilary nerve to deltoid + pectoral nerves to pec. major
  - Deltoid + musculocutaneous to biceps
  - Interval between biceps + brachialis
    developed Radial nerve protected
- Difficult to extend to distal humerus due to lat. antebrachial cutaneous nerve + radial nerve

# Identify radial nerve distally and follow proximally as exposure continues









#### Video

#### **Posterior approach**



- Good exposure to mid + distal humerus including elbow joint.
- Limited proximally by axillary nerve + deltoid
  - Triceps splitting
    - Long + lateral head interval
  - Paratricipital
    - Lateral head + lat. intermuscular septum
    - Less bleeding / muscle trauma / deinnervation + greater exposure

#### Alternative Operative Exposures of the Posterior Aspect of the Humeral Diaphysis. With Reference to the Radial Nerve

MICHELLE GERWIN, ROBERT N. HOTCHKISS and ANDREW J. WEILAND J Bone Joint Surg Am. 1996;78:1690-5.



Comparison of the extent of exposure possible with the posterior triceps-splitting approach (A), the posterior triceps-splitting approach with mobilization of the radial nerve (B), and the modified posterior approach with elevation of the medial and lateral heads of the triceps (C).







#### R – radial nerve A – profundus brachii artery



#### Video

