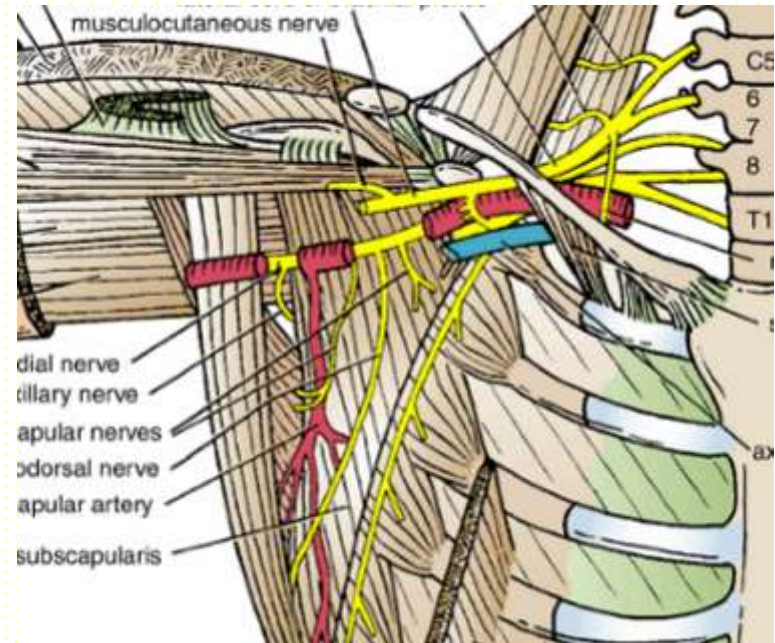
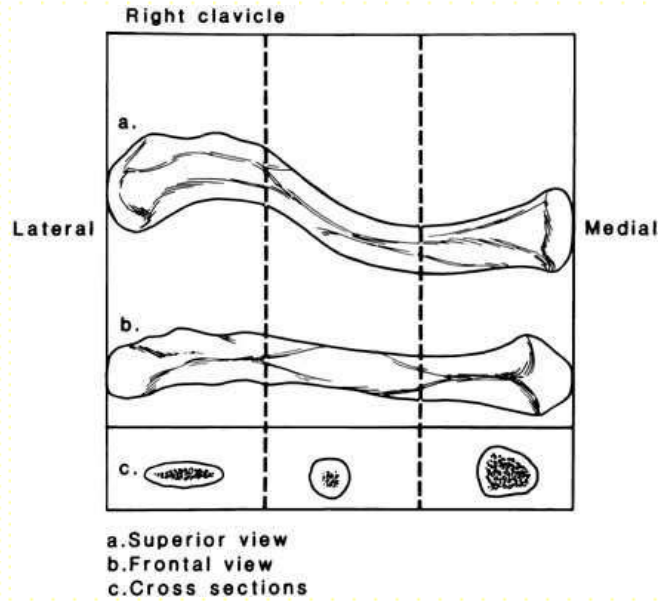




Complications of clavicle fracture

M.N. Naderi , MD

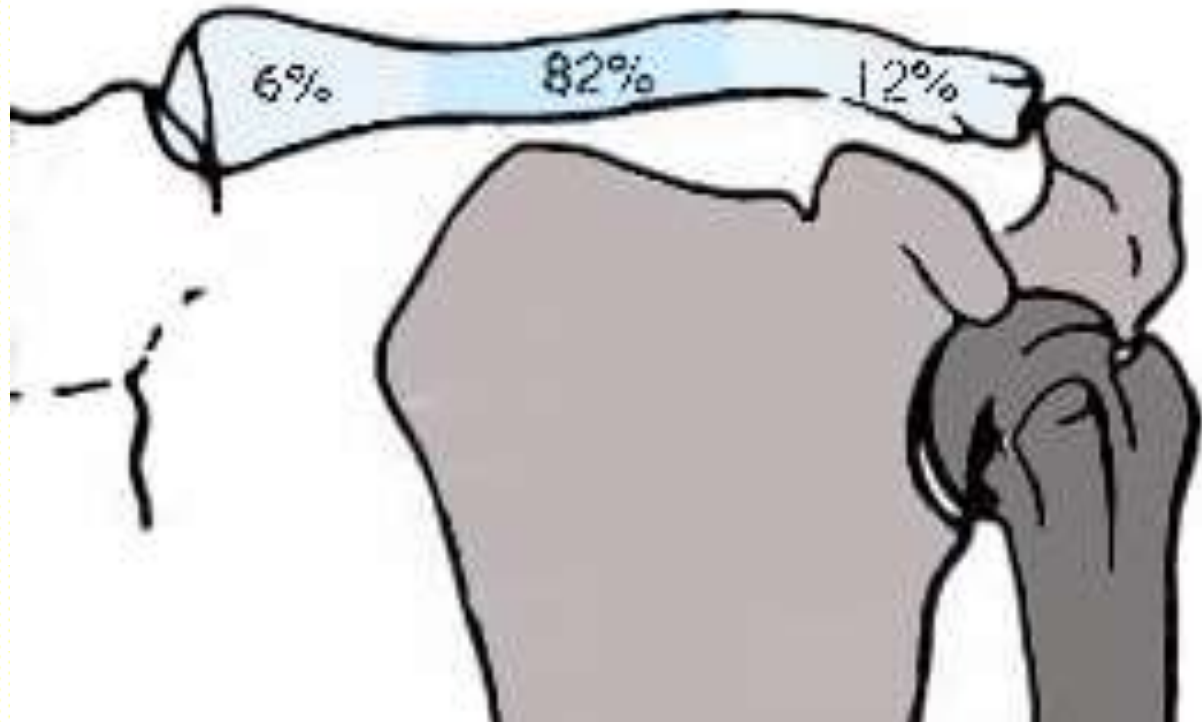
Anatomy



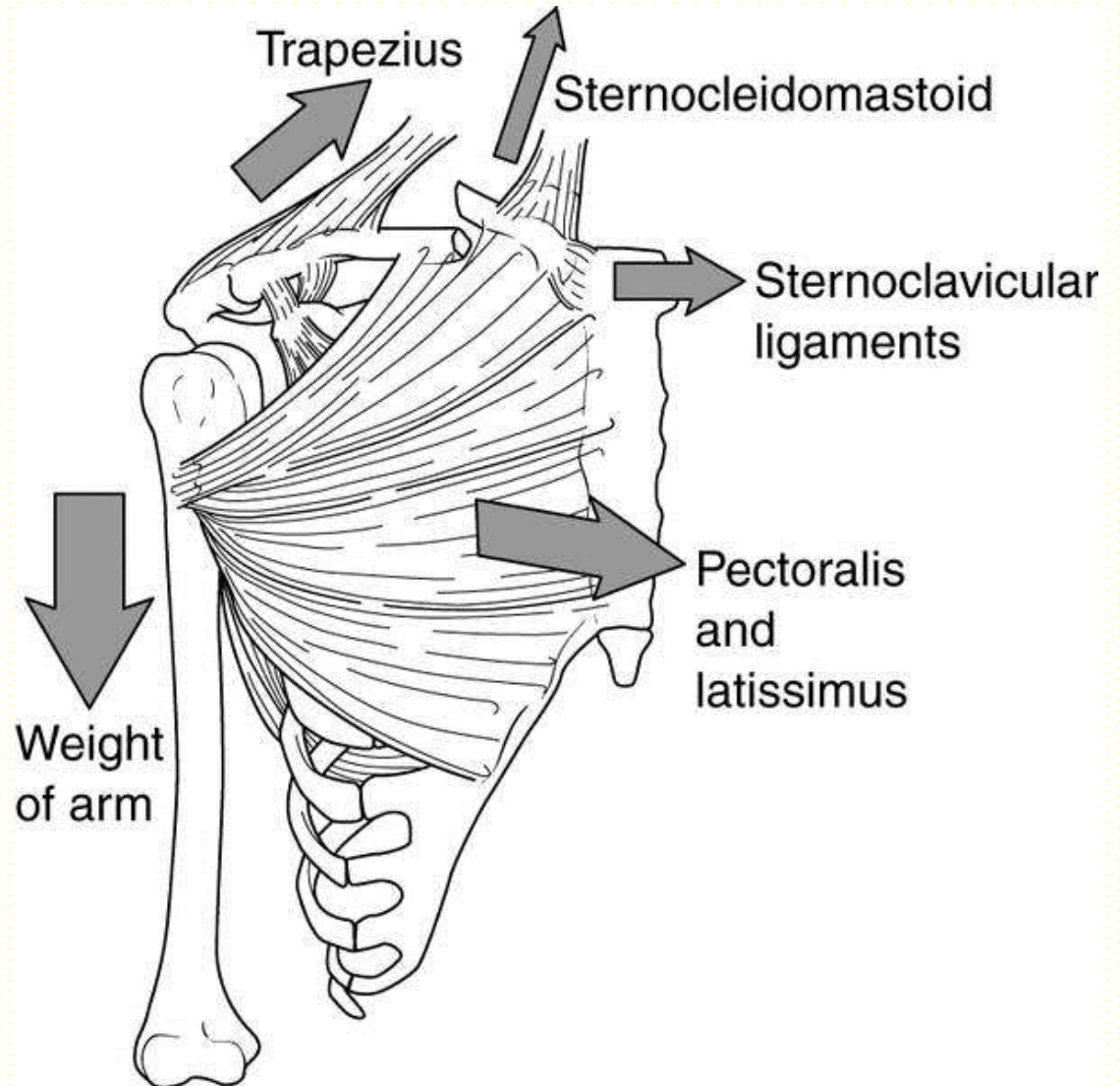
- S-shaped bone
- base for muscular attachments
- Strongly held with ligaments at both ends
- protects vital neurovascular structures
- cross-sectional anatomy changes along its course

Incidence

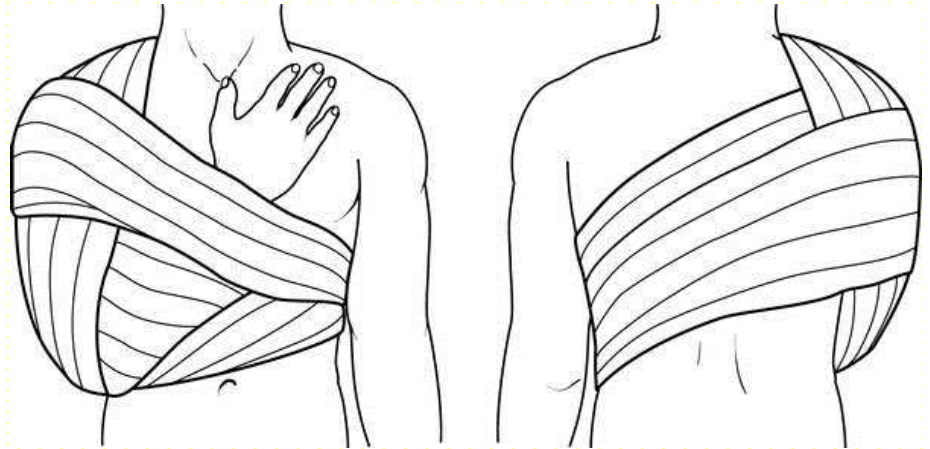
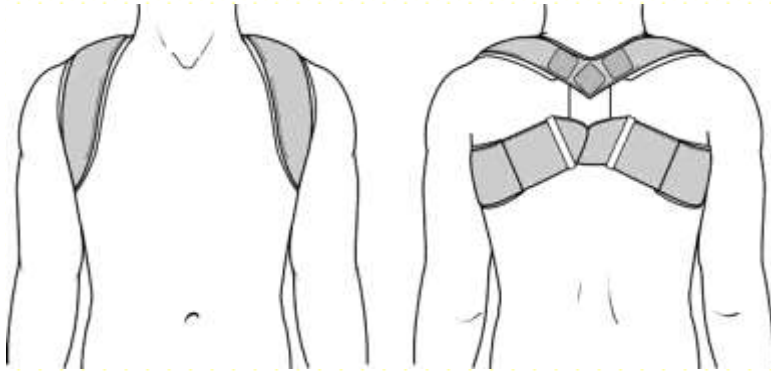
- 4% of all fractures and 35% to 43% of shoulder girdle injuries



Deforming forces



Nonoperative as an accepted method for treatment



■ Recent observations :

- nonunion of clavicle is more common than previously recognized
- malunion with shortening associated with shoulder dysfunction



primary operative treatment is becoming more commonplace

Wick et al. *Arch Orthop Trauma Surg* 2001;121(4):207-211

Canadian Orthopaedic Trauma Society. *J Bone Joint Surg Am.* 2007 Jan;89(1):1-10.

Thyagarajan et al. *Int J Shoulder Surg.* 2009 Apr-Jun; 3(2): 23–27.

Kelly et al. *J Pediatr Orthop* 2010;30:307–312)

Laura A. Et al. *Clin Orthop Relat Res* (2011) 469:3351–3355

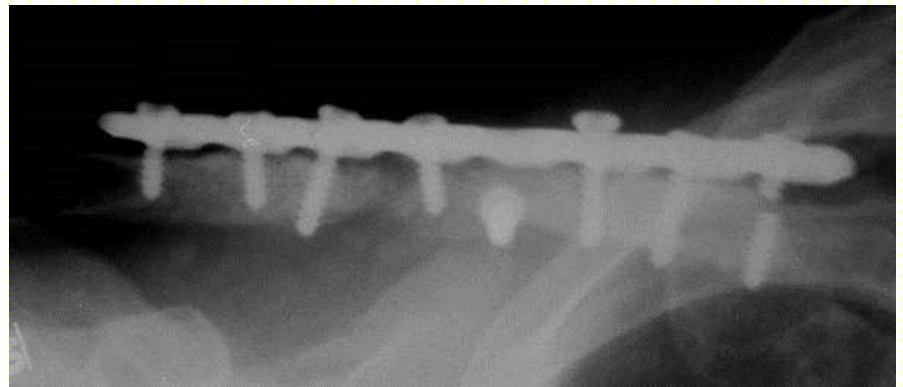
Complications

- **Infection**
- **Nonunion**
- **Malunion**
- **Neurovascular injuries**
 - **Acute**
 - **Chronic**
 - **Iatrogenic**
- **Refracture**
- **Scapular winging**

Indications and techniques of operative treatment are evolving

Infection

- Superficial infection rate of 4.4%
- Deep infection 2%

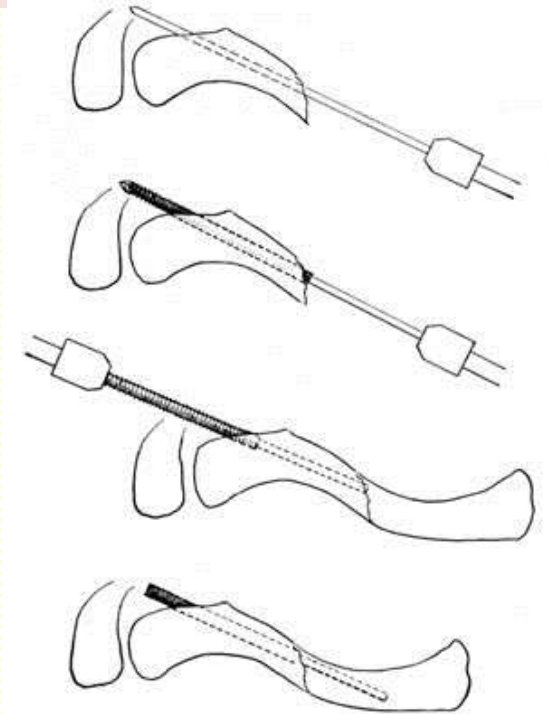


Infection

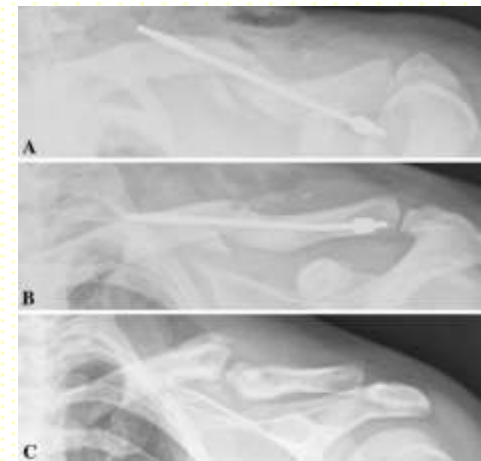


Courtesy to Dr. M. Tavakoli

Intramedullary Nail

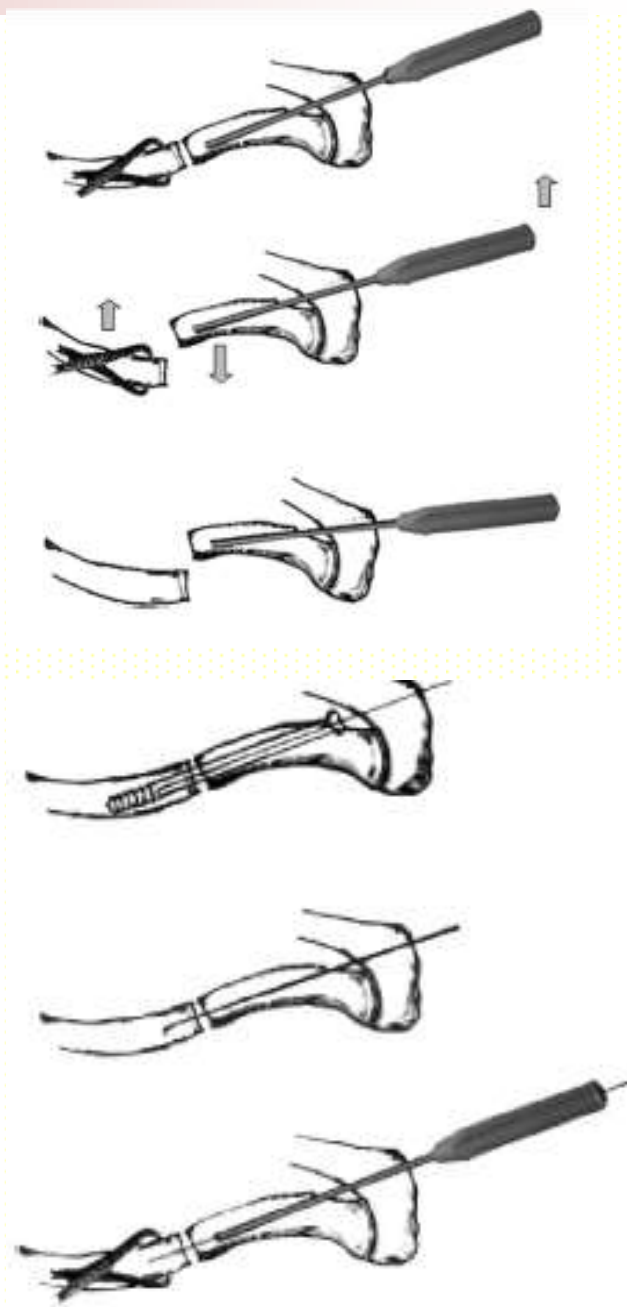
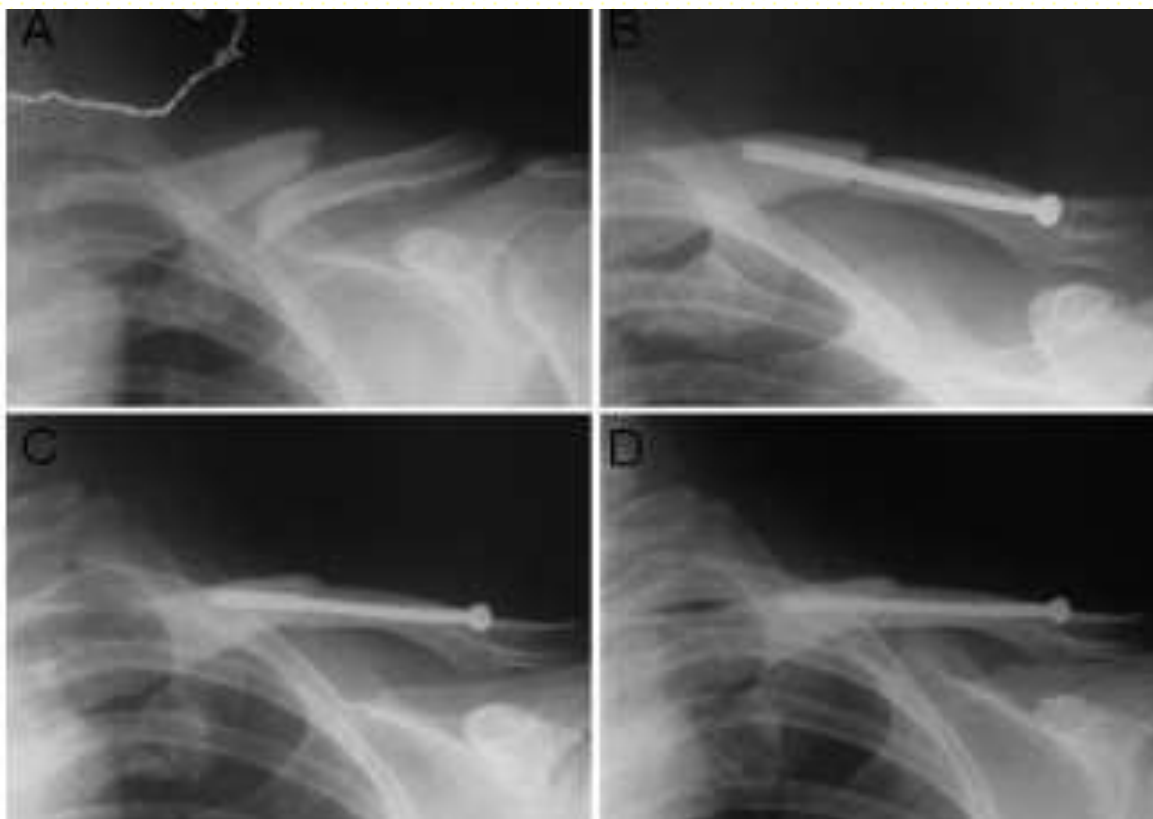


- **Less surgical dissection & soft tissue stripping**
- **less prominent hardware**
- **No rotational stability**
- **Nail breakage**
- **Nail migration**

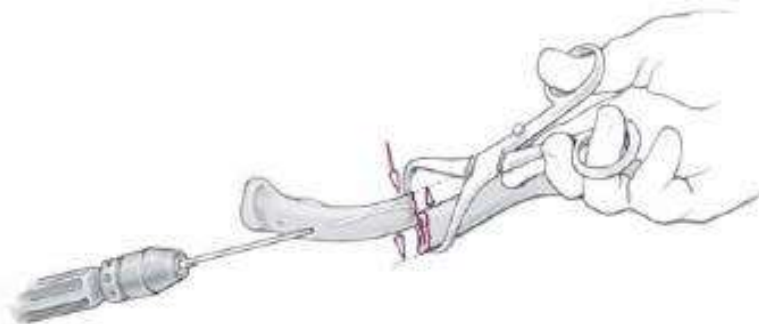


Christopher D. et al. Excessive Complications of Open Intramedullary Nailing of Midshaft Clavicle Fractures With the Rockwood Clavicle Pin. **Clin Orthop Relat Res (2011) 469:3364–3370**

**Chuang et al : Closed Reduction and Internal Fixation
for Acute Midshaft Clavicular Fractures Using
Cannulated Screws. *J Trauma*. 2006;60:1315–1321.**



TEN (from sternal side)



Klaus E. Rehm, Jonas Andermahr, Axel Jubel. Intramedullary Nailing of Midclavicular Fractures with an Elastic Titanium Nail. Operat Orthop Traumatol 2004 · Nr. 4





Not suitable for comminuted fx and old fx

Nonunion

lack of radiographic healing at 6 month

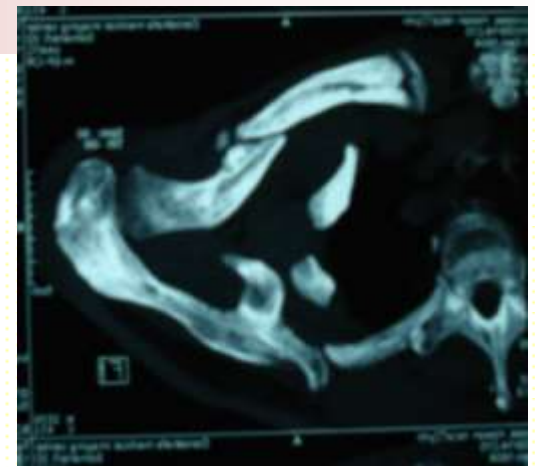


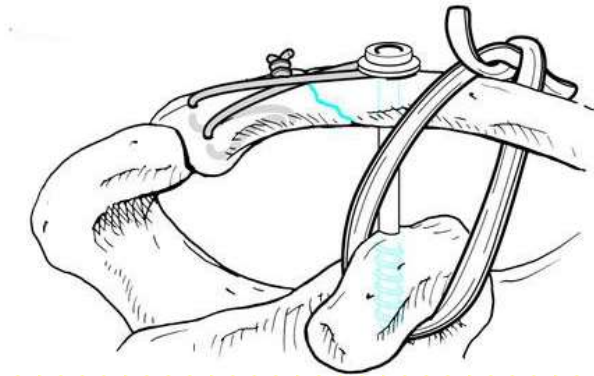
TABLE 36-1

Metaanalysis of Nonoperative Treatment, Intramedullary Pinning, and Plate Fixation for Displaced Midshaft Fractures of the Clavicle From Series Published in 1975 through 2005

Treatment Method	Percentage with Nonunion	Infections (Total)	Infections (Deep)	Fixation Failures
Nonoperative (n = 159)	15.1	0	0	0
Plating (n = 460)	2.2	4.6	2.4	2.2
Intramedullary pinning (n = 152)	2.0	6.6	0	3.9

Adapted from Zlowodzki M, Zelle BA, Cole PA, et al. Treatment of midshaft clavicle fractures: systemic review of 2144 fractures. *J Orthop Trauma* 2005;19:504–507.

- Lateral 1/3 more prone to nonunion if displaced and treated closed (50% incidence of nonunion)
- Most authors recommend operation for displaced distal clavicle fx



Factors associated with development of nonunion

Fracture shortening of ≥ 20 mm

Fracture displacement of >20 mm

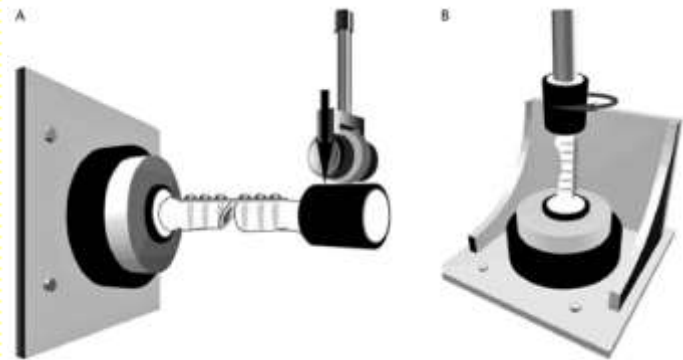
Increasing patient age

Increasing severity of trauma

Refracture



Use of reconstruction plate in clavicle fx ?

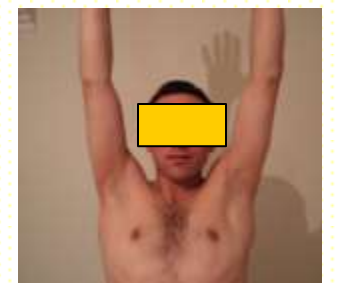
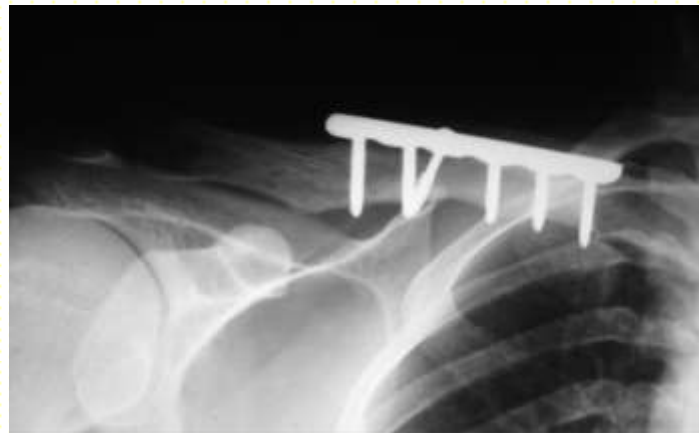


Darren S. Drosdowech, et al. **Biomechanical Analysis of Fixation of Middle Third Fractures of the Clavicle** . **J Orthop Trauma** 2011;25:39–43

■ Treatment of nonunion

□ Hypertrophic

□ Atrophic



Malunion

- weakness and rapid fatigability
- Narrowing of thoracic outlet
- periscapular aching



Cosmetic issues

TABLE 36-4 Cosmesis Following Operative versus Nonoperative Care

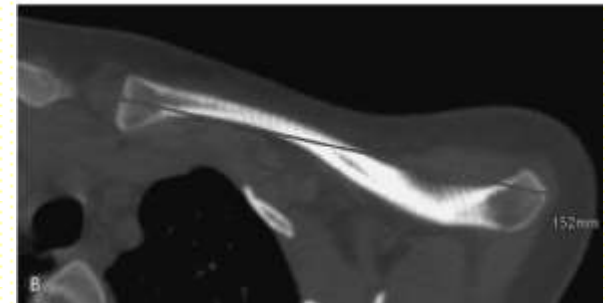
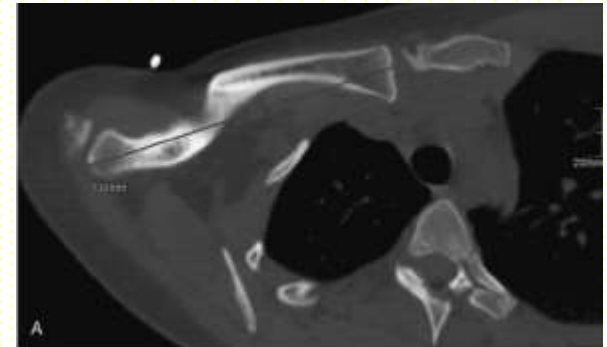
Complaint	Operative Care (n = 62)	Nonoperative Care (n = 49)	P Value
"Droopy" shoulder	0	10	0.001*
Bump/asymmetry	0	22	0.001*
Scar	3	0	0.253
Sensitive/painful fracture site	9	10	0.891
Hardware irritation/prominence	11	0	0.001*
Incisional numbness	18	0	0.001*
Satisfied with appearance of shoulder	52	26	0.001*

* $P < 0.05$.

Canadian Orthopaedic Trauma Society. Plate fixation versus nonoperative care for acute, displaced midshaft fractures of the clavicle. *J Bone Joint Surg* 2007;89A:1-11.

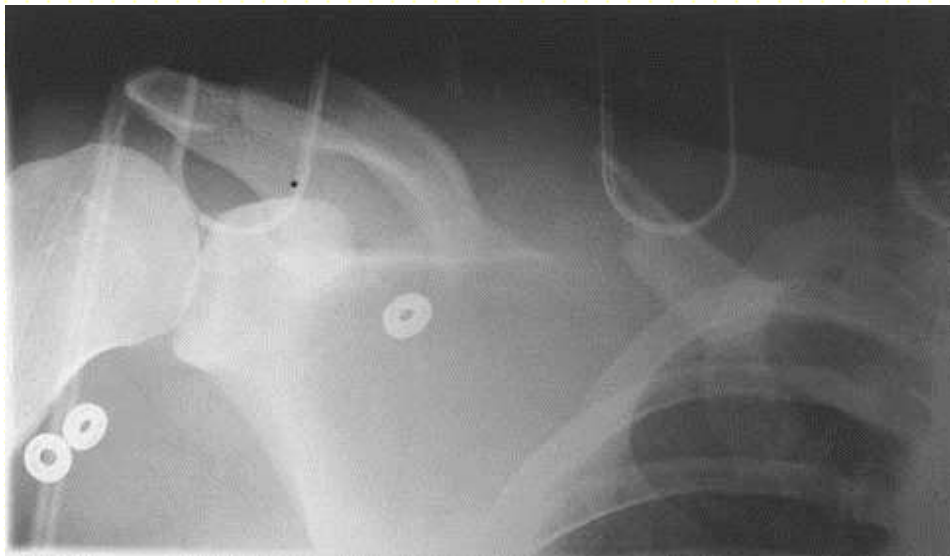
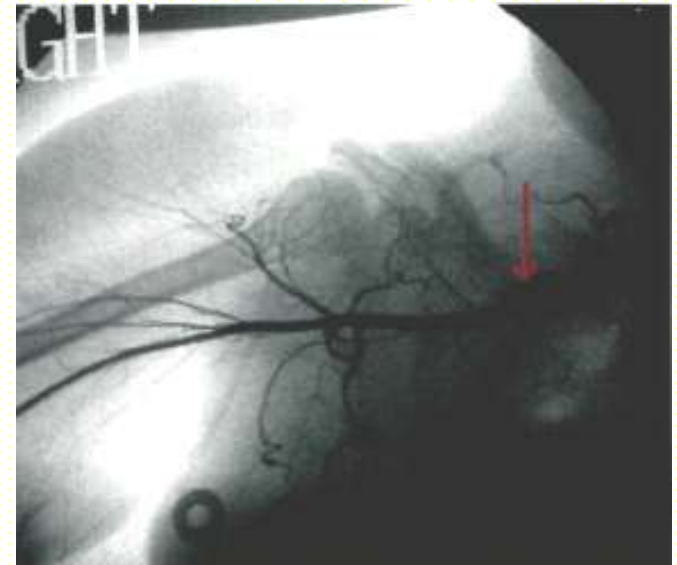
Smekal et al: Length Determination in Midshaft Clavicle Fractures: Validation of Measurement. J Orthop Trauma Vol 22, Aug 2008

- Determining proportional length differences by taking a posteroanterior thorax radiograph



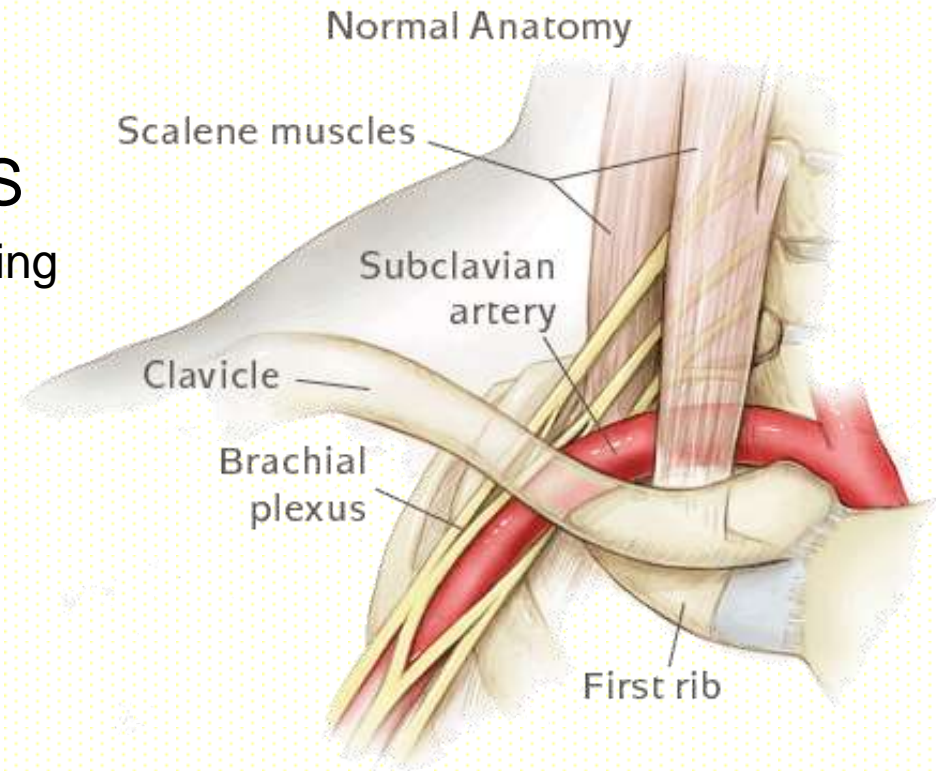
Neurovascular injuries

- **Acute injuries**
 - Rare
- **excessive traction**
 - *scapulothoracic dissociation*
 - High incidence of N/V injury



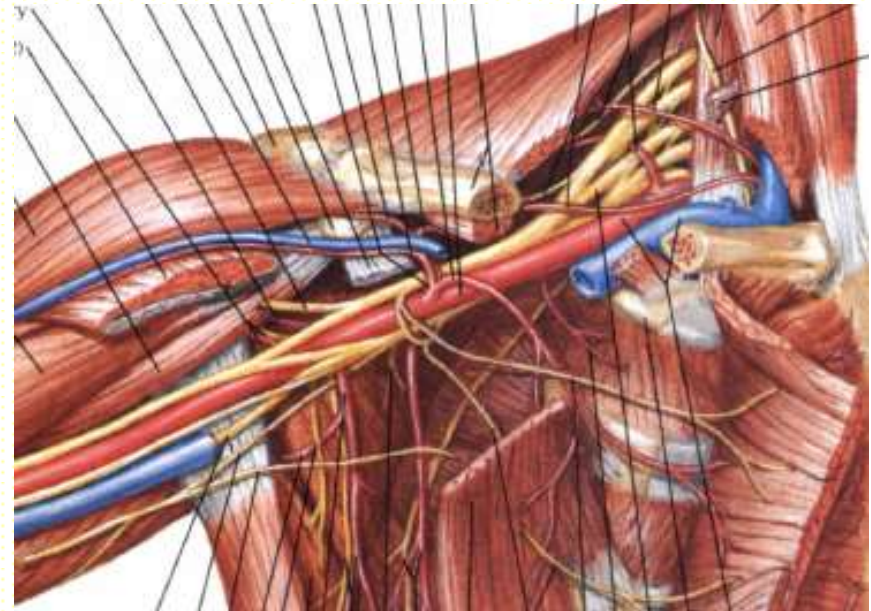
Neurovascular injuries

- **Delayed injuries**
- **clavicular malunion** → TOS
 - Common form of N/V injury following displaced clavicular fx

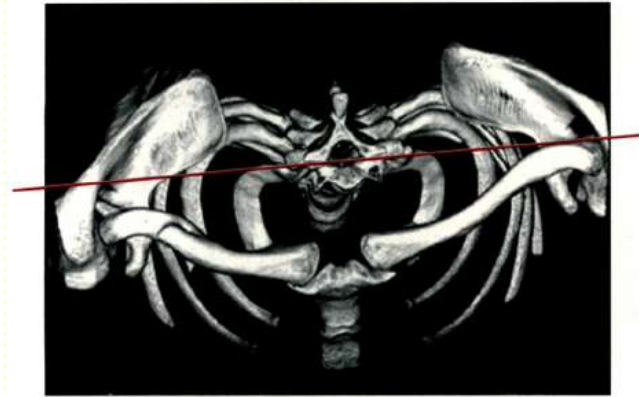


Neurovascular injuries

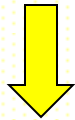
- **Iatrogenic injuries**
 - N/V penetration by drills or taps is very rare
- **Careful and meticulous technique**



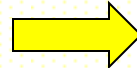
Scapular winging



Shortened clavicle



Scapula malposition



*periscapular
muscular fatigue pain*

Summary



- Patient expectations and injury patterns are changing
- Change in traditional treatment of clavicle fx
- New methods for intervention
 - **risks & complications**
- Patients selection of operation is important

Thank you for attention