Midshaft Clavicle Fracture Operate or Not

3nd MEDITERRANEAN TRAUMA CONFERENCE

Larnaca, Cyprus

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Clavicle bone

Why is so important bone

Anatomy and biomechanics

- **S - shaped bone**

- Is the only bony connection of the arm to the sternum and axial skeleton with a Strut and a Suspensory function

- Protraction, Retraction, Depression and Rotation

Epidemiology

4% of adult fractures

35%- 44% of all shoulder girdle fractures

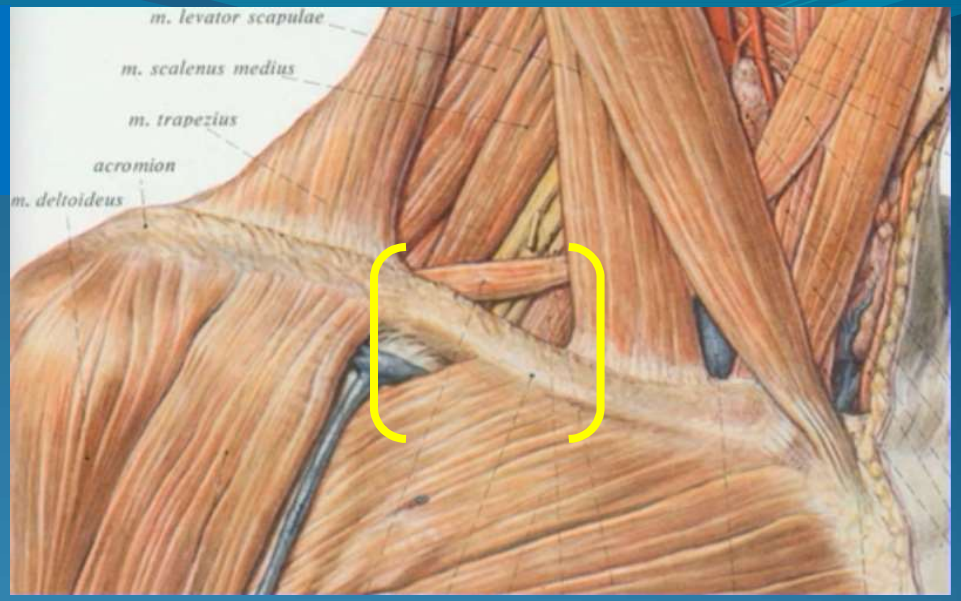
Lateral 15-20 %

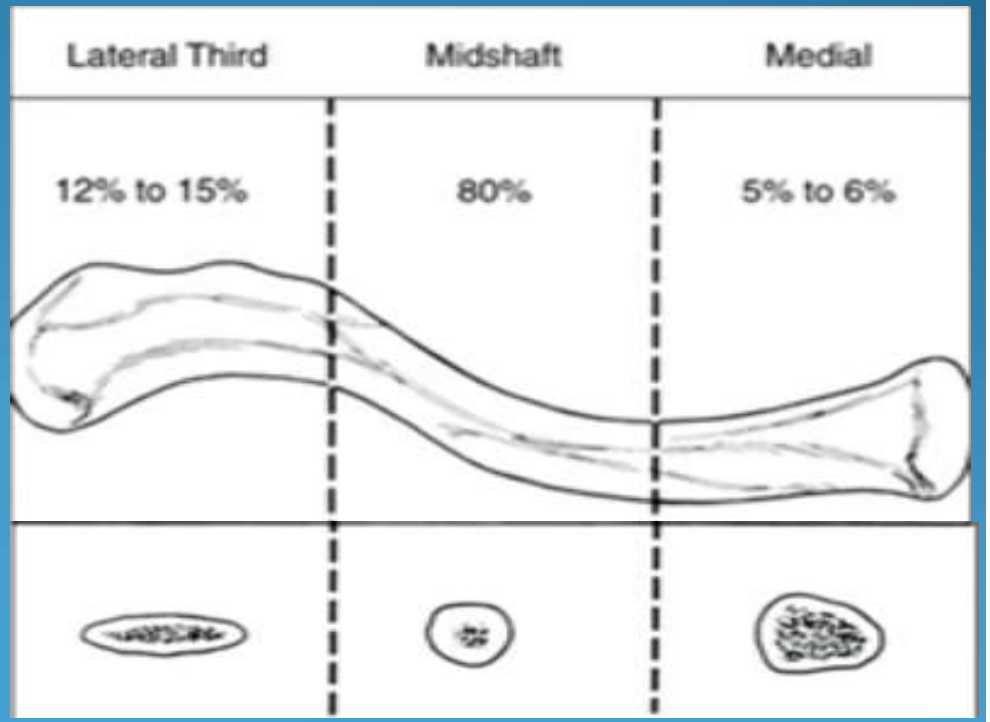
Middle 1/3 80-85 %

Medial 0-5 %

Incidence

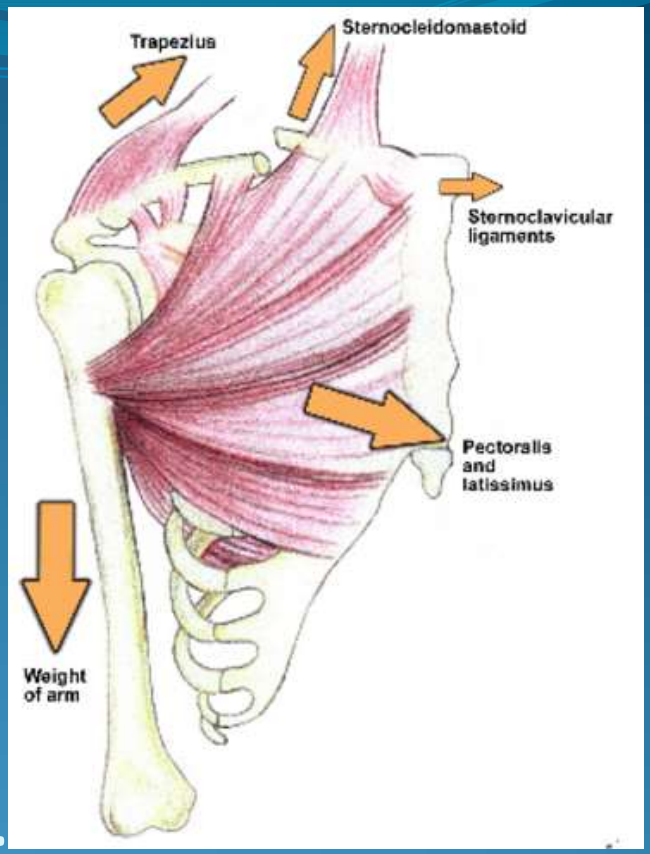
2/100,000 of population/ y





Medial clavicular fragment

elevated by Sternocleidomastoid



Distal clavicular fragment

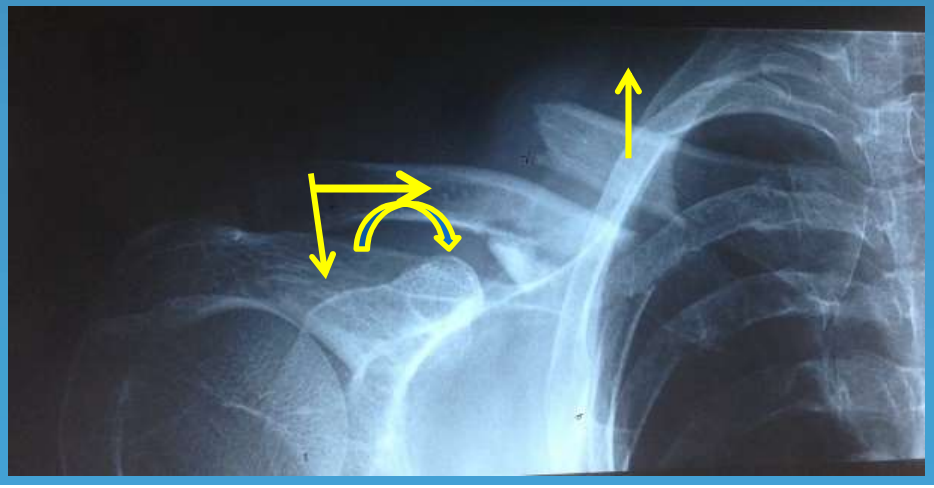
pulled inferiorly by Deltoid

+ weight of arm

displaced medially by Pectoralis M.

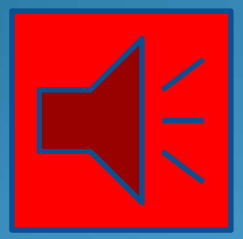
+

anterior translated



Goal of clavicle fracture Treatment

Achieve bony union while Minimizing Dysfunction, Morbidity and Cosmetic deformity



Are all Clavicle Fractures the same?

Do all Clavicle Fractures Behave the same?

Midshaft clavicle fracture

Non-displaced or minimally displaced

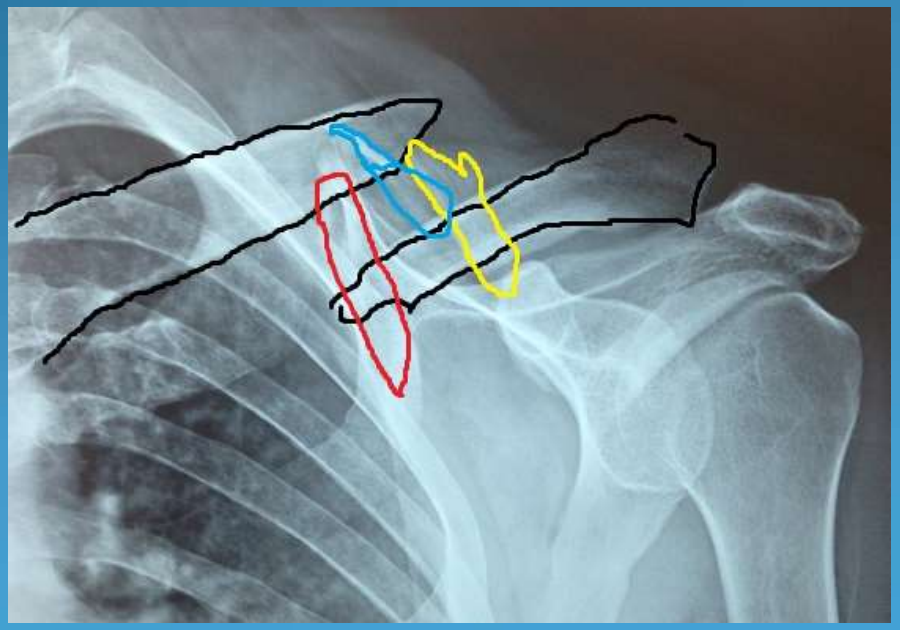
Non-operative treatment

Sling

or Figure of 8 bandage

Treatment ??

39y,male, skiing inj.

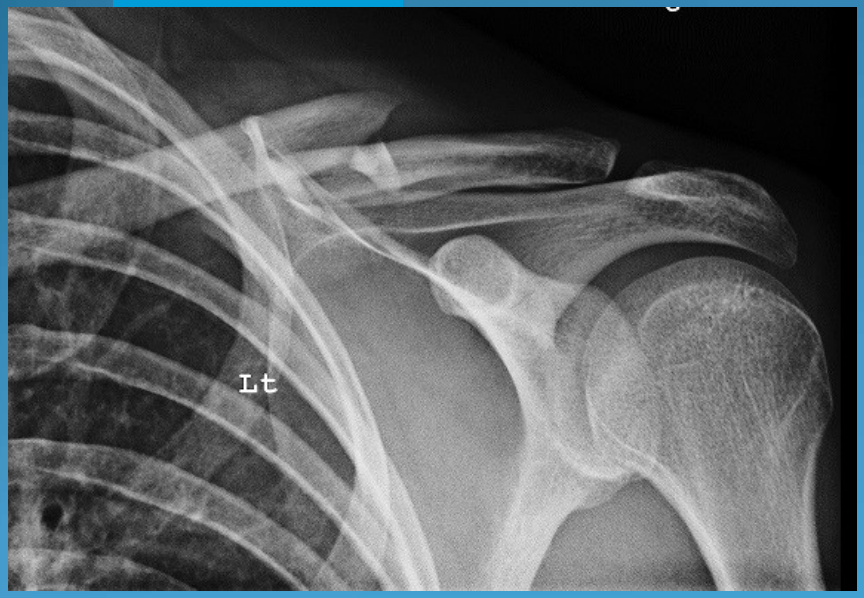


Midshaft Clavicle fracture

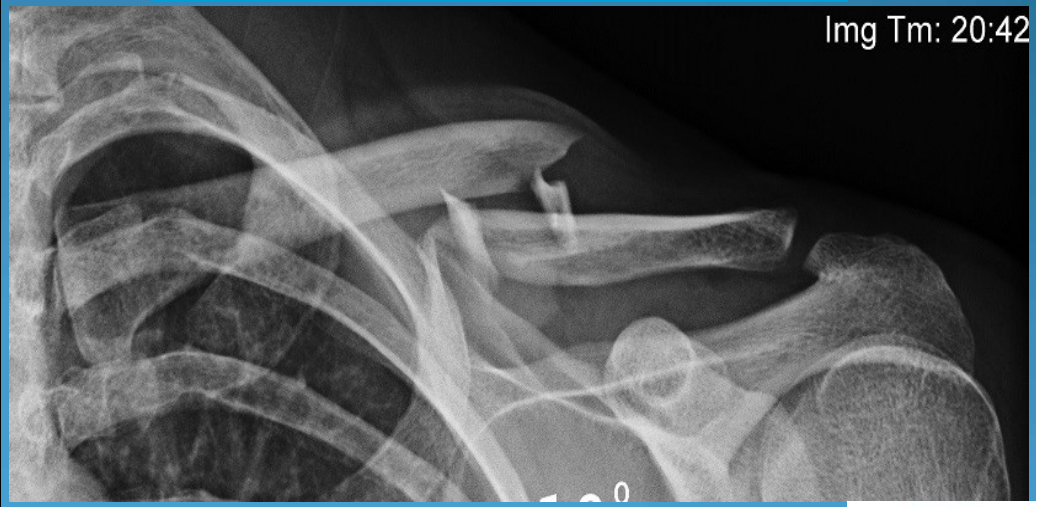
Radiographic evaluation

25y,male, bicycle injury

AP view



30⁰ cephalic tilt , AP view
(Z type fracture)



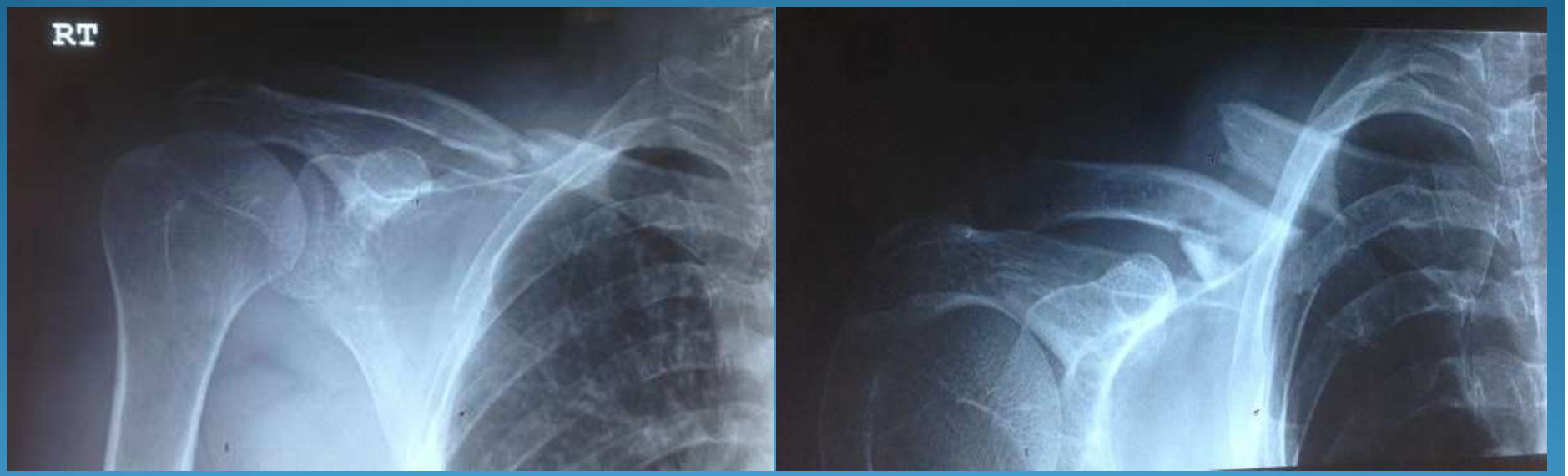
Midshaft Clavicle fracture

Radiographic evaluation

59 y, female, RTA

1st Day

7th Day



60% of pts with High Energy Injury ***sustain 100% displacement***

John Riehl et. al, Can J Surg 2014 jun.57(3)

Controversy

NONUNION OF THE CLAVICLE

Charles S. Neer II, M.D., New York

Classic article, 1960

- Non union thought to be rare for mid-shaft 0.1%
- Malunion not discussed
- Open treatment most common cause of nonunion, 4,6%

It is interesting that of 2,235 patients with middle-third fractures treated by closed methods in our clinic, only 3 (0.1%) had failure of union. On the other hand, of 45 patients treated by immediate open reduction, 2 (4.6%) had failure of bone union. These facts indicate that the most important causal factor in nonunion of fractures of the middle third has been improper open surgery. Local tissue dam-

Non operative management treatment of choice

Controversy

An atlas of anatomy and treatment of midclavicular fractures. Clin Orthop. Relat. Res.

Classic article, 1968 Carter R. Rowe,M.D

..... with closed treatment non union rarely occurs (4/566).

Non operative management treatment of choice

WILL MY CLAVICLE ***HEAL*** AND ***FUNCTION*** WELL ?

Historically most papers have looked at healing rates

Function has only been recently analyzed

The etiolology and management of clavicular fractures has changed a lot in the last 20 years

- **High energy + complex injuries are more than in past**

The chances to reduce anatomically a *displaced clavicle* fracture conservatively is slim

Three possible non operative outcomes

1. Asymptomatic Malunion
2. Symptomatic Malunion
3. Nonunion

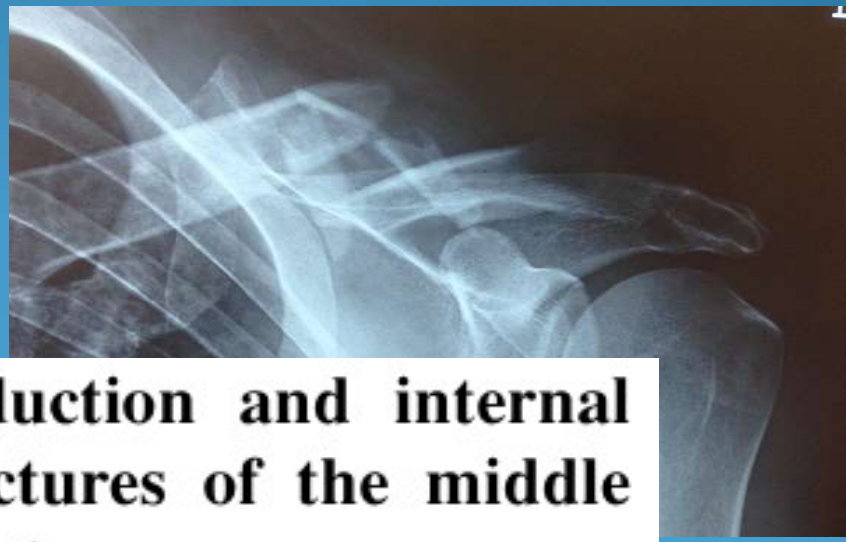
CLOSED TREATMENT OF DISPLACED MIDDLE-THIRD FRACTURES OF THE CLAVICLE GIVES POOR RESULTS

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

JBJS Br, 1997

- 15% developed nonunion(8/52)
- **31% pts** reported ***unsatisfactory results*** regardless the healing **(16/52)**
- *Increased risk of nonunion with initial shortening*

  > or =2 cm



We now recommend open reduction and internal fixation of severely displaced fractures of the middle third of the clavicle in adult patients.

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

By C. Michael Robinson, BMedSci, FRCSEd(Orth), Charles M. Court-Brown, MD, FRCSEd(Orth), Margaret M. McQueen, MD, FRCSEd(Orth), and Alison E. Wakefield, MSc, MCSP

JBJS VOLUME 88-A Number 7. JULY 2004

Significantly increased only by :

Advancing age

Female gender

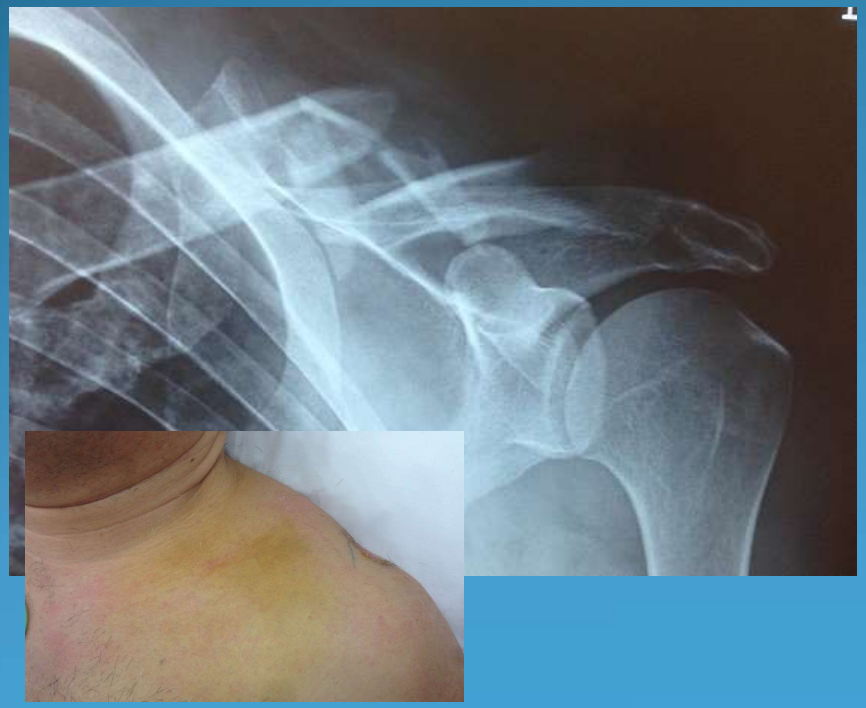
Complete displacement of the fracture

Presence of comminution

Prognostic index

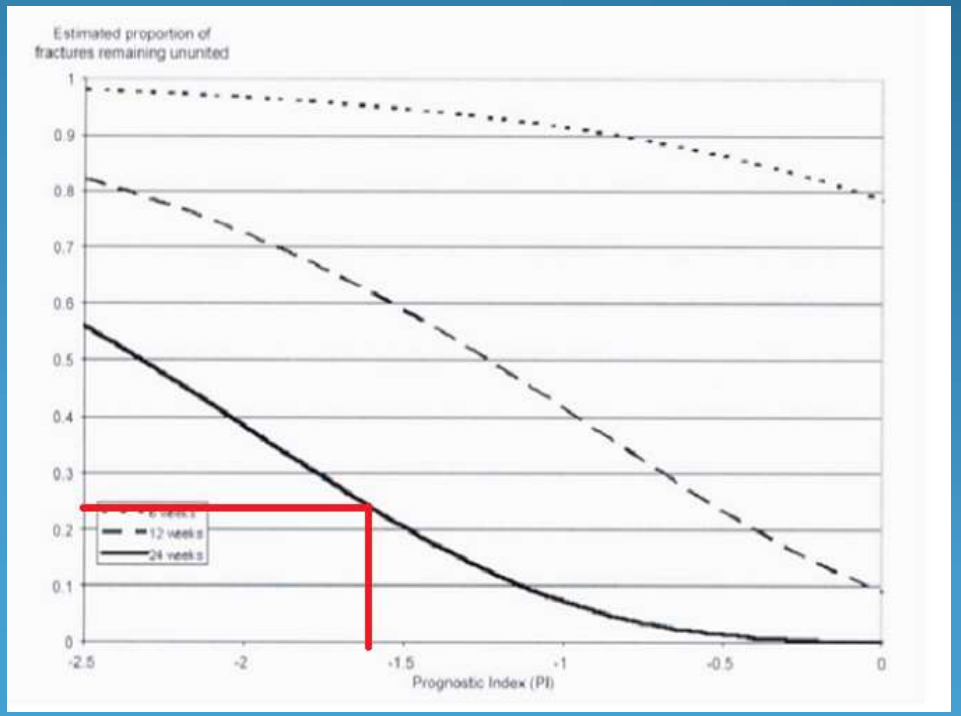
[-0,85 x (1 if displaced or 0 if undisplaced)]+[-0.36x (1 if female or 0 if male)] +[-0.37x(1 if comminuted or 0 if non comminuted fr.)]+[-0.01x(age of patient in years)]

Displaced , Male, Comminuted, 39 y



Prognostic index: -1,61

Estimated nonunion: 24%



Deficits following Nonoperative treatment of displaced clavicle fractures

McKee, Pedersen, Jones ***JBJS Am 2006***

- Patient- based and Surgeon based Outcome questionnaire

(measured with DASH, Constant score)

50% Satisfied

50% Partially satisfied or Dissatisfied

- Objective shoulder muscle-strength testing

81% for max flexion, 75% for endurance of flexion

Up to 30% demonstrated residual strength deficits in shoulder

Symptomatic Malunion

66y male, manual worker, Nonoperative treatment

Left Shoulder injury 16 yrs ago

Symptomatic Malunion

Non operative treatment

Incidence 15-20%

- Decrease the size of thoracic skeleton
- **Shoulder shrinks**, shifts down
- Weakness of the shoulder
- Easy fatigueability
- Pain with repetitive work
- Paraesthesia with overhead activity

Winging due to Scapular malposition

Rockwood and Green's, 2015

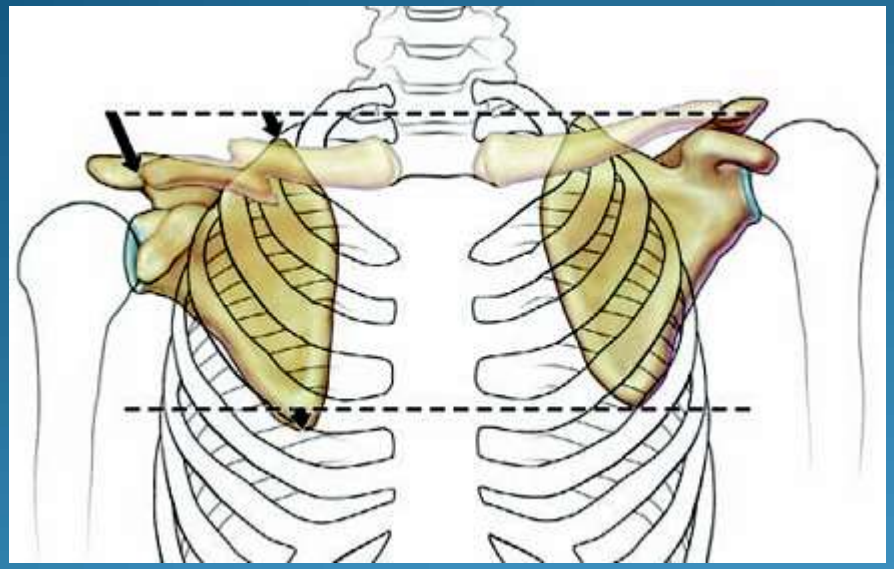
Symptomatic Malunion or Nonunion

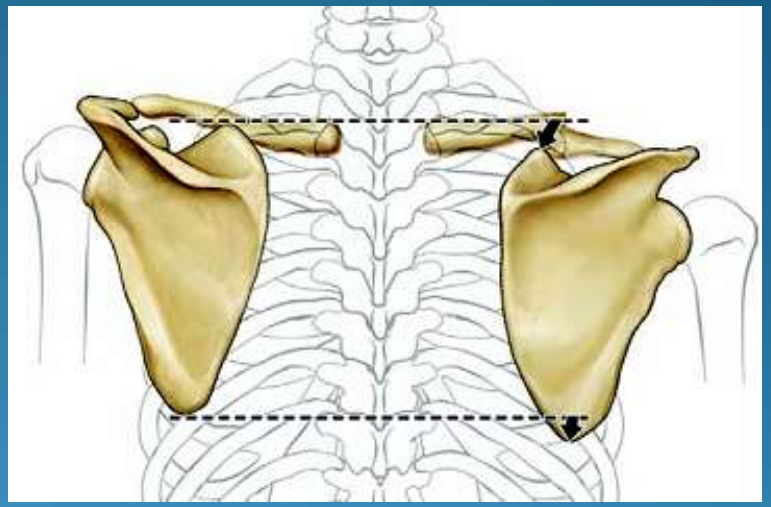
*PROTRACTED Shoulder

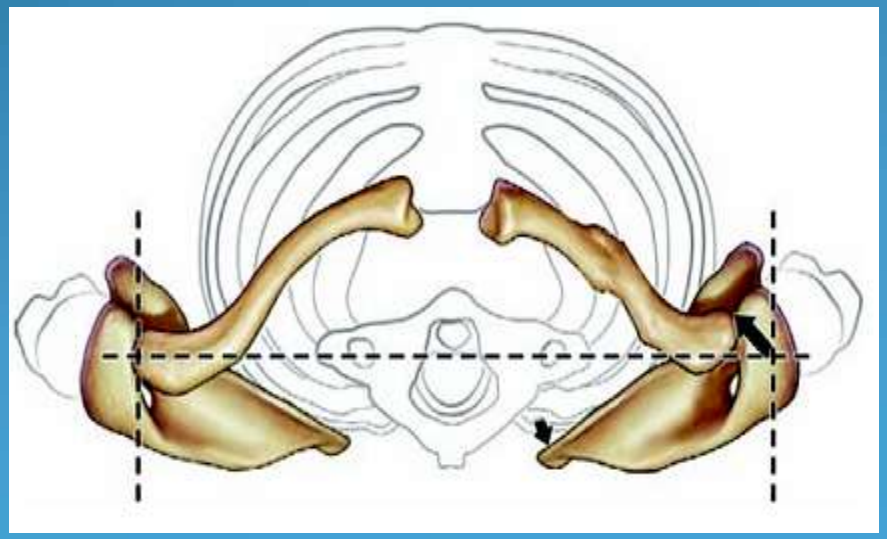
*Increase anterior version of scapula

Winging due to Scapular malposition

Non operative treatment, Ristevski et al,JSES,2013







Scapular dyskinesis following Displaced fractures of the middle clavicle J Shoulder Elbow S (2015)

E. Shields et al,

- 37 % of patients(1/3Pts)
- Female> males
- These pts had more pain
- Worse functional shoulder scores

..... Surgical fixation reduces pts risk of developing dyskinesis of the scapula

Cosmesis deformity

Nonoperative Treatment Compared with Plate Fixation of Displaced Midshaft Clavicular Fractures

A Multicenter, Randomized Clinical Trial

By the Canadian Orthopaedic Trauma Society

JBJS Am. 2007

Landmark paper

Canadian Orthopaedic Trauma Society
JBJS Am. 2007

Randomized prospective trial 132 pts, > 1year follow- up

Non-operative group 49/111 pts

Mean time to radiographic Union : 7 months (28,4 w)

COMPLICATIONS: 31 (63%)

Nonunion 7+1* /49 (16%)

Symptomatic Malunion 9/49 (18,5%)

Reflex Sympathetic dystrophy 1

Transient brachial plexus symptoms 7

Canadian Orthopaedic Trauma Society
JBJS Am. 2007

Randomized prospective trial 132 pts

Operative group 62/ 111 pts

Mean time to radiographic Union : 4 months (16,4 w)

COMPLICATIONS: 23 (37%)

Nonunions 2/62 (0,032%)

Malunion 0/62(none)

Local irritation and plate removal 5

Wound infection 3

Transient brachial plexus symptoms 8

Early hardware failure 1

Canadian Orthopaedic Society **CONCLUSION**

Early primary plate fixation of completely displaced midshaft clavicular fractures

results in:

.Decreased nonunion rate(2/62 versus 7/49)

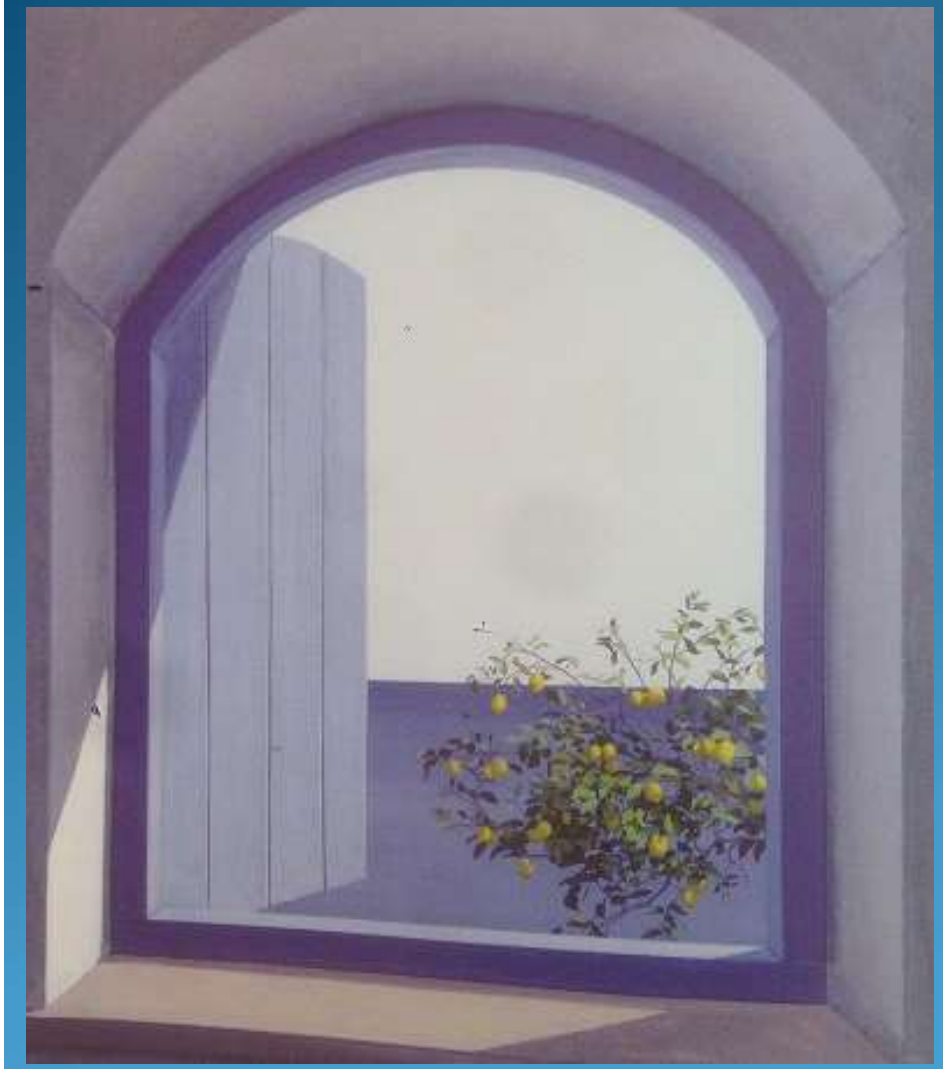
.Decreased sympt. malunion (0/62 versus 9/49)

. Improvement of Shoulder function scores

.Earlier return to function

With improved implants, prophylactic antibiotics, and better soft-tissue handling, plate fixation has been a reliable and reproducible technique.

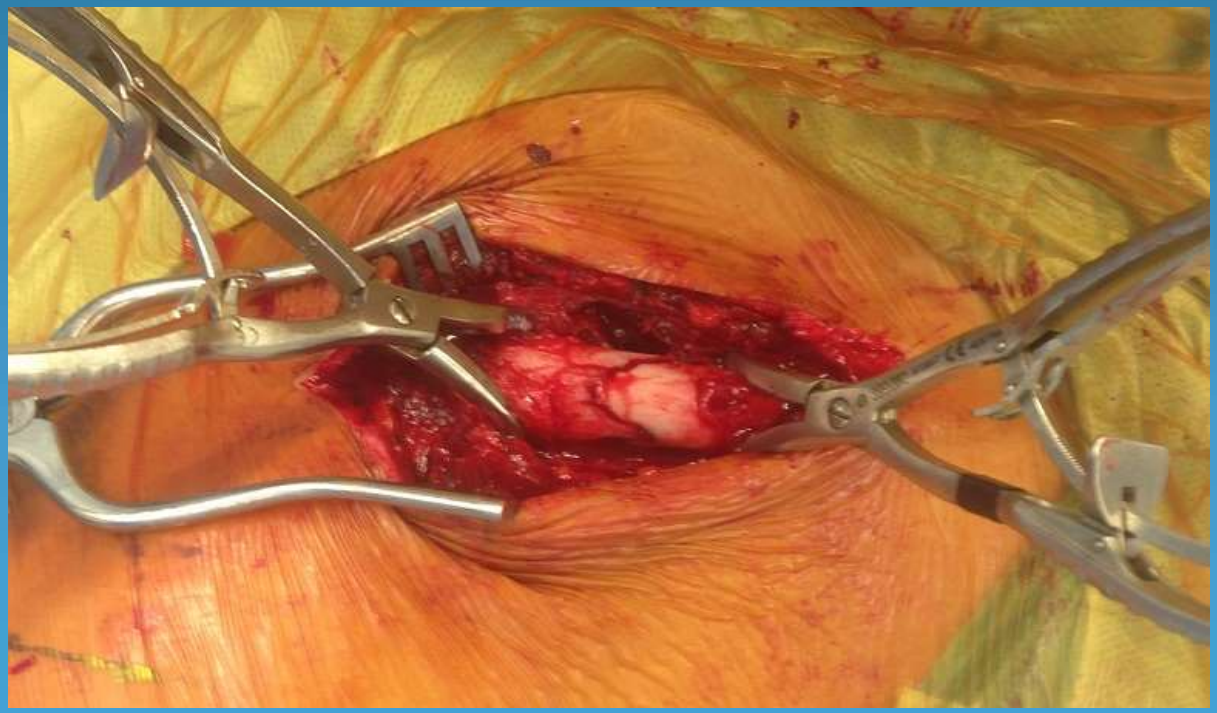
OPEN SEASON



Goals of Clavicle Operation

(Plate fixation or Intramedullar nailing)

- Correct Length and Rotation of fragments
- Avoidance Malunion/Nonunion/Cosmesis def.
- Early return to function and work



Indications(urgent) for Operation

- **OPEN displaced** clavicle fracture
- **NEUROVASCULAR** injury
- **FLOATING** shoulder with **displaced clavicle** and an **unstable scapula fracture**
- Serious SKIN tenting due to severe displacement
- **Multiple trauma** with requirement for early arm use
- **FLAIL chest** where breathing is compromised when drooping of the shoulder on damaged area

Indications(relative) for Operation

High demand, Active, Healthy, >16yrs -60 yrs

- **Fracture specific**

  Severe displacement >100%

  Comminution(> 2 fragments)or segmental fractures and

  Shortening more than 2cm

- **Patient factors**

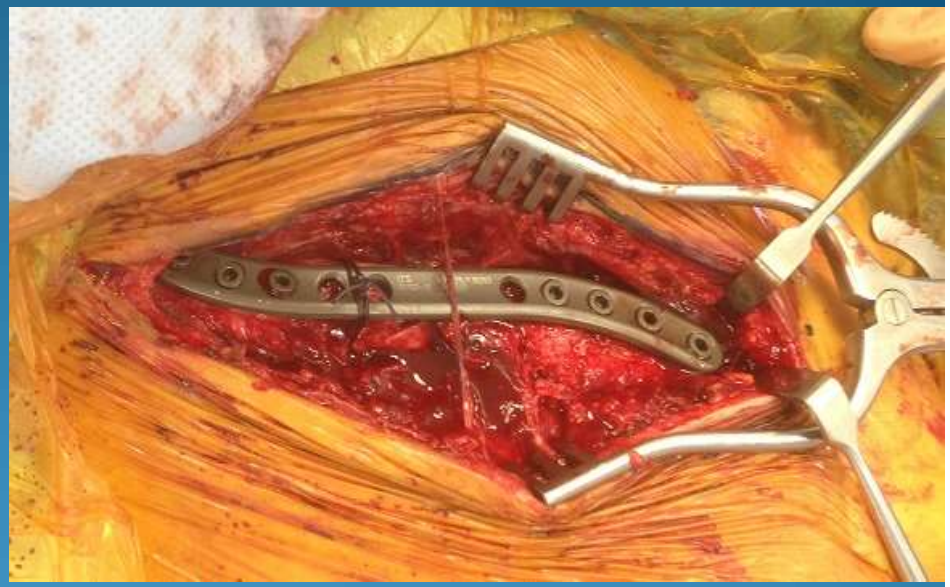
  Unable to tolerate closed immobilization such as neurologic problems(parkinsonism, seizure)

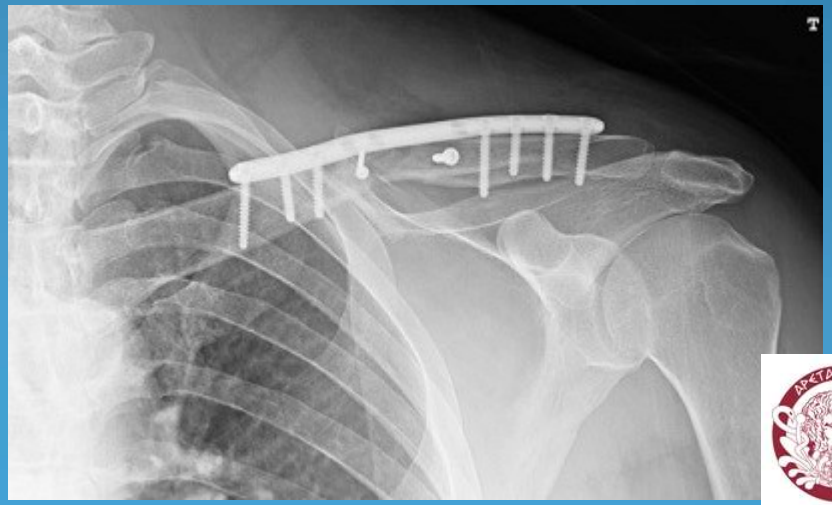
  Patient motivation for rapid return of function(sports, job)

Contraindications for Operation

- Open fractures without soft tissue cover
- Active INFECTION in operative area
- Non compliant pts and SUBSTANCE abuse
- Skin Burns over the fracture side
- Previous soft tissue irradiation in operative area
- Elderly pts with sedentary life style

Plate fixation surgical technique (Left clavicle)





Complications of Operation

Rate of and Risk Factors for Reoperations After Open Reduction and Internal Fixation of Midshaft Clavicle Fractures

Leroux et al JBJS Am. 2014

- 25% out of 1350 pts required reoperation

Most common :

- Implant removal 254 (19%)
- Nonunion 35/1350 (2,6%)
- Deep infection 35/1350 (2,6%)
- Malunion 15/1350 (1,1%)
- Pneumothorax 16/1350 (1.2%)
- Brachial plexus and suclavian vessel injury ,<5

Summary- Conclusion Midshaft clavicle fracture

Non-displaced or Minimally Displaced

Conservative treatment

Sling

or Figure of 8 bandage

Bone Joint J 2015;97-B:1562
Acta Orthop Scand 1987 ; 58: 71

Summary-Conclusion

Pts with **Displaced** midshaft clavicle fractures:

- Operative treatment has superior results in selected cases
- We don't support routinely operation for all fractures
- Clavicle deformity (especially shortening, >15mm) leads to measureable loss of strength
- Pts have a higher risk of sustaining Nonunion(15%) and Symptomatic Malunion(15-20%) if the fracture is treated conservatively.

Conclusion

Treatment should be individualized with consideration of age , activity job and expectations of treatment

Operative treatment is reserved for active, healthy pts with completely displaced fractures and obvious clinical deformity

Patient and Surgeon should decide together (joint decision) how to treat a *displaced* clavicular fracture discussing the risk factors of conservative treatment and the risks/benefits of surgery

Thank you

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