ACROMIOCLAVICULAR JOINT
STERNOCLAVICULAR JOINT INJURIES
CLAVICLE FRACTURES
UT HEALTH SPORTS MED 2024

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UT Health San Antonio Orthopaedics

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DISCLOSURES

Consultant Zimmer Biomet
Trauma

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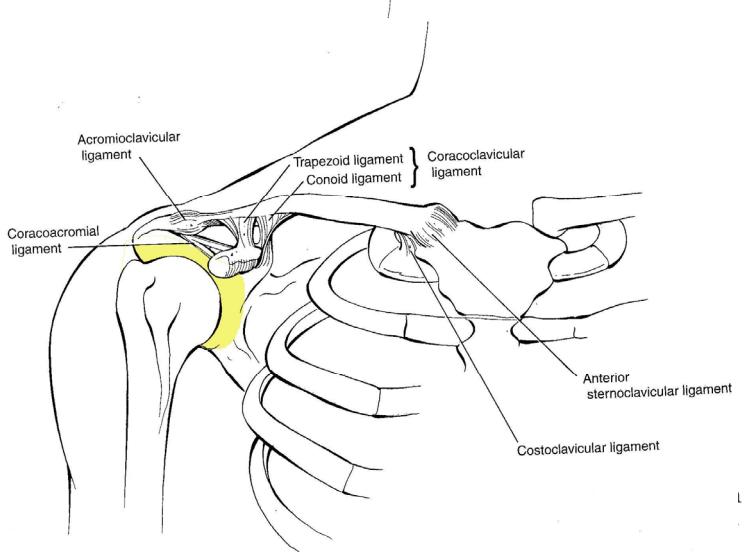
SHOULDER OR SHOULDER JOINTS?



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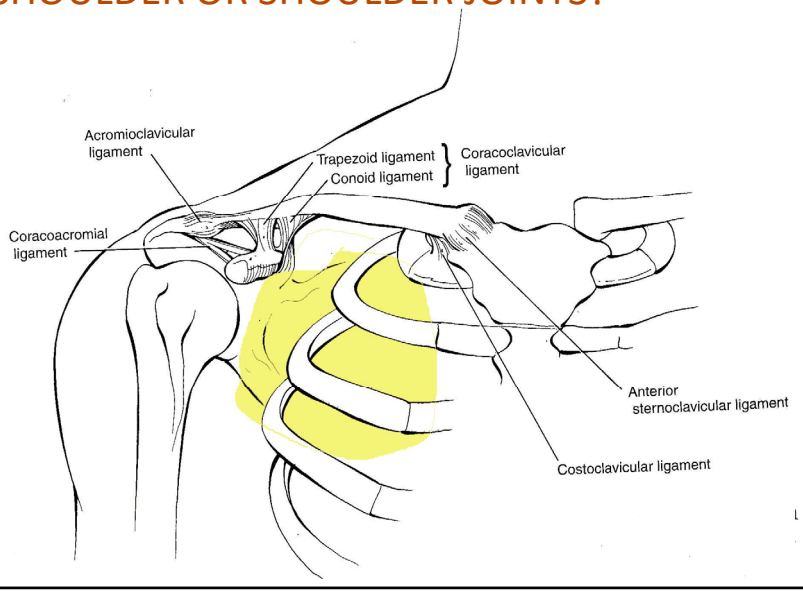
SHOULDER OR SHOULDER JOINTS?



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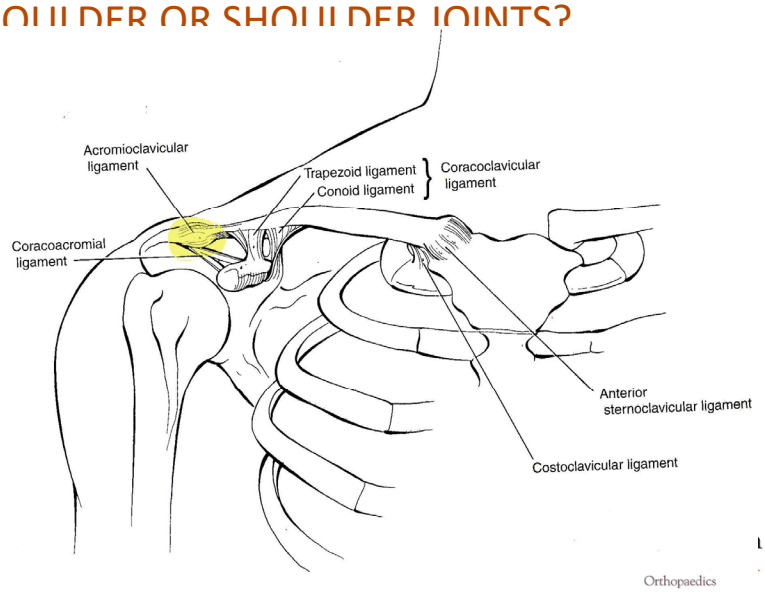
SHOULDER OR SHOULDER JOINTS?



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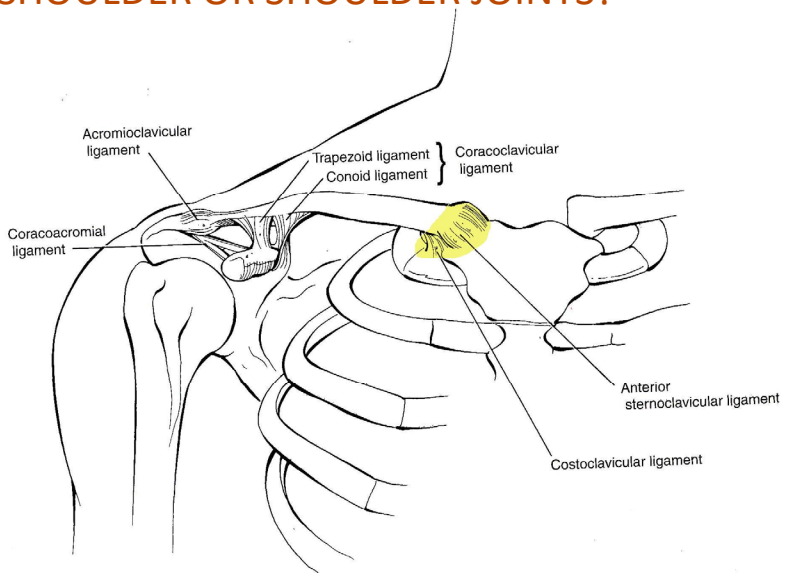
SHOULDER OR SHOULDER JOINTS?



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AC JOINT INJURIES

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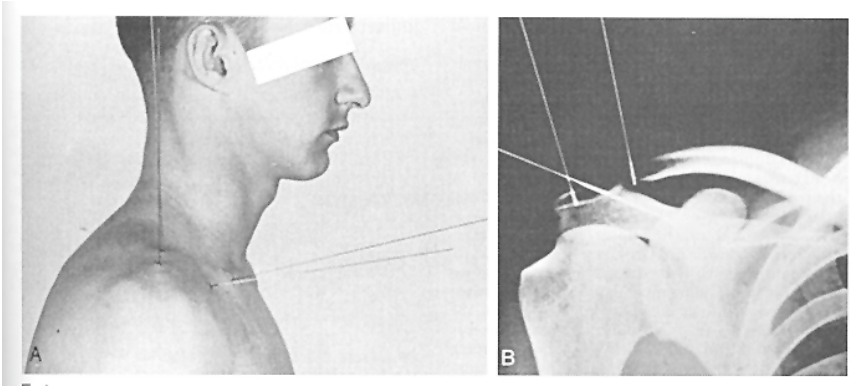
Minimal Motion At AC Joint



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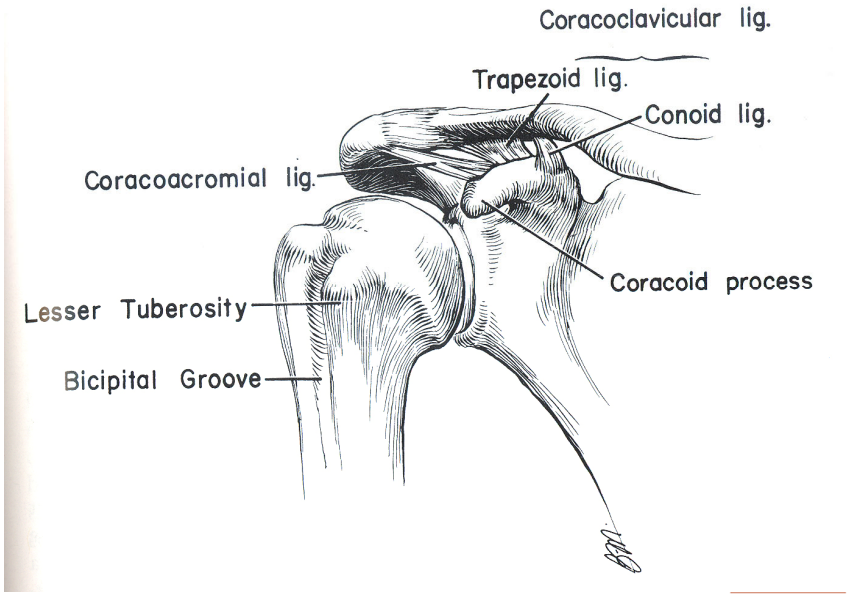

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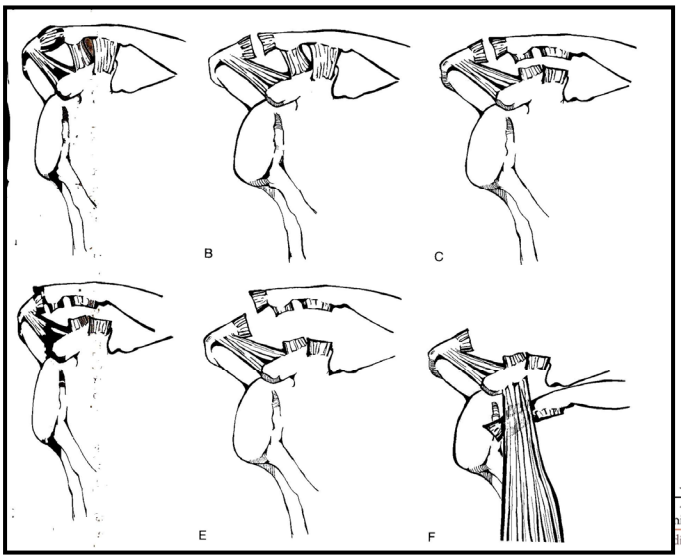
Rockwood Classification



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CC Distance

Normal CC 11-13mm

Krul, Tokish et al
<19 mm Non op reasonable

- 20 most failed
- ROCKWOOD TYPE 3B (axial instability)

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Nonoperative Tx

Adhesive strapping
Sling
Harness
Figure – of – Eight
Traction
Casts

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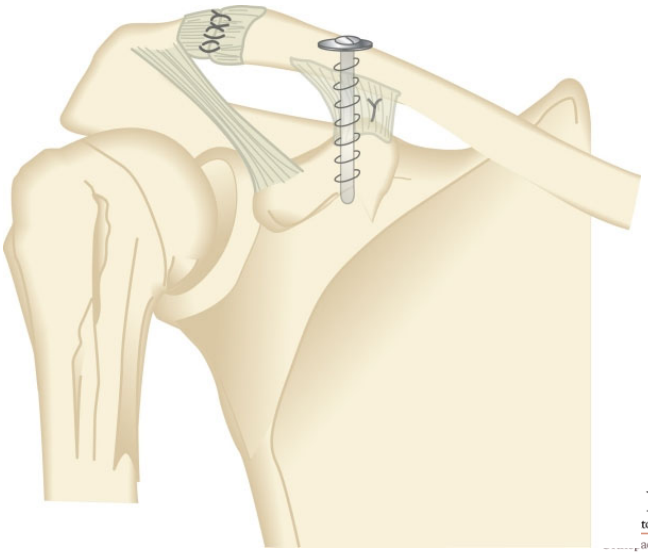
Screw Fixation to Coarcoid



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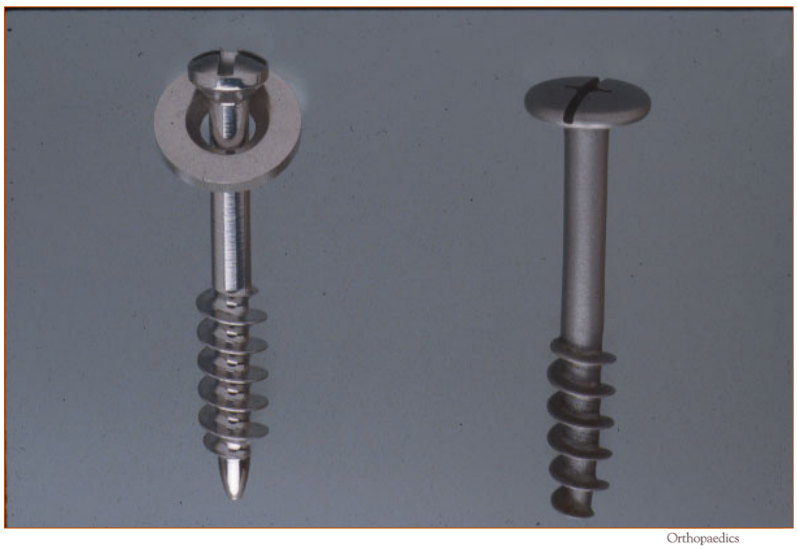
Bosworth or Rockwood Screw



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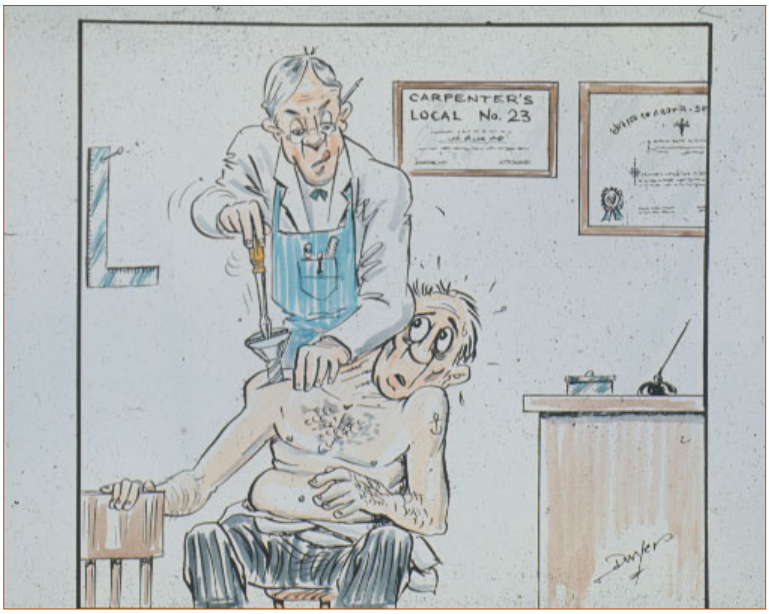

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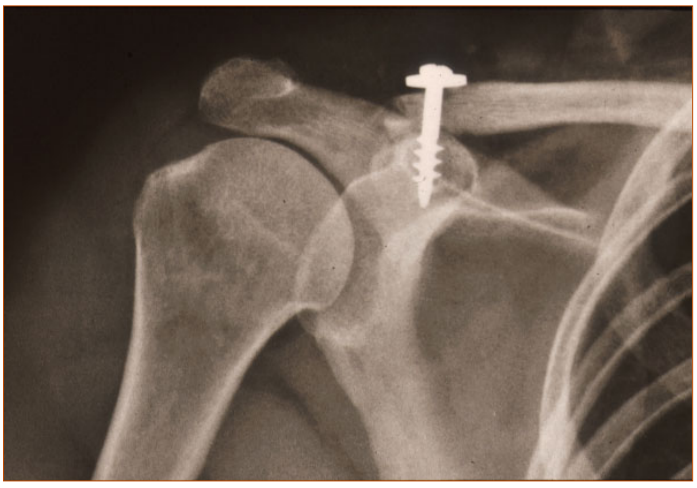

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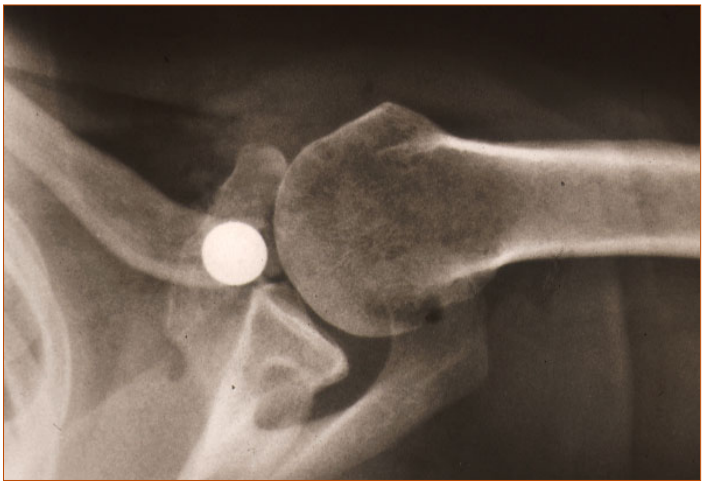

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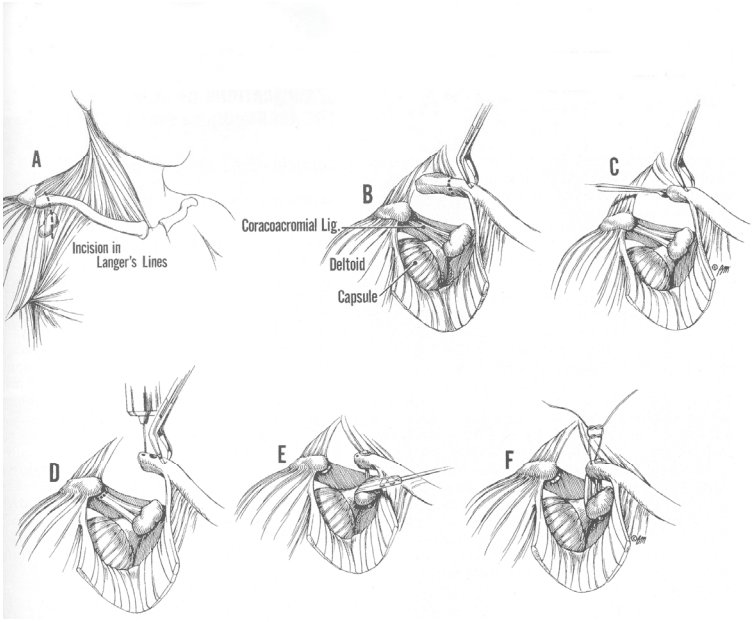
Modified Weaver-Dunn



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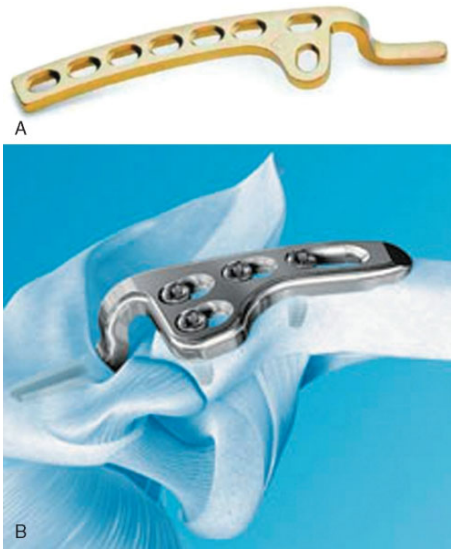
Hook Plates



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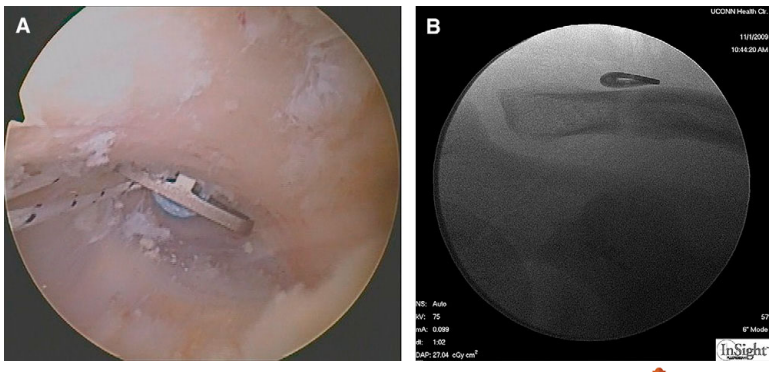
AC reconstruction with Fixed Suture Button



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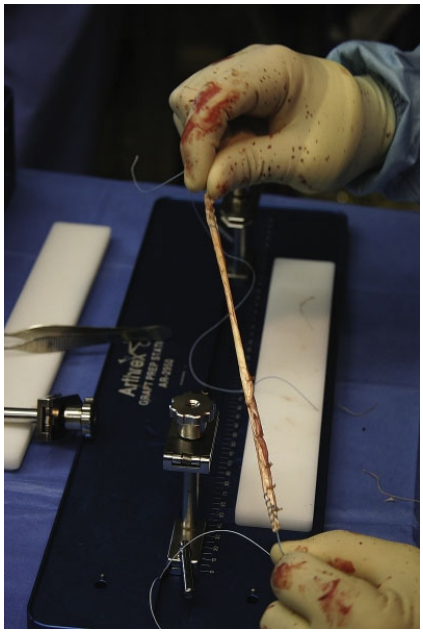

GRAFT AUGMENTATION

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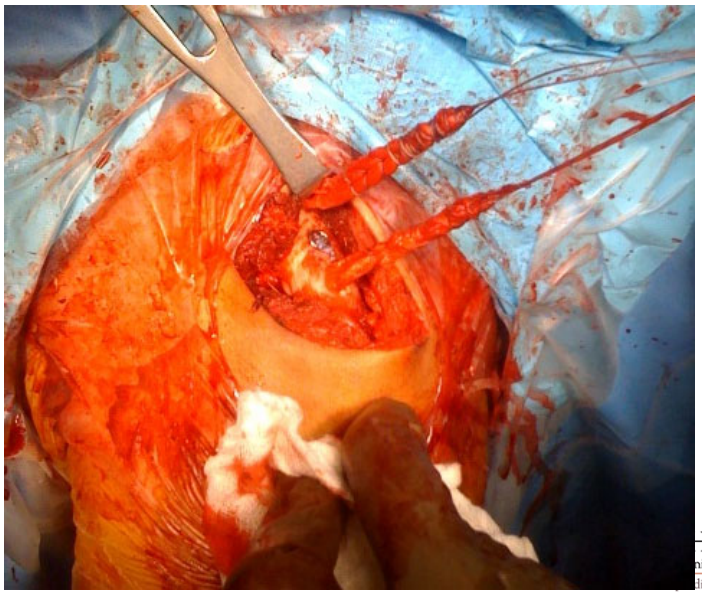

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POST-OP CARE

1. Sling 6 weeks
2. Active use of arm in adduction
3. Gentle rehabilitation range of motion
4. No weights for 6 weeks
5. Return to Competition
    1. Full ROM
    2. Full strength

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CLAVICLE FRACTURES

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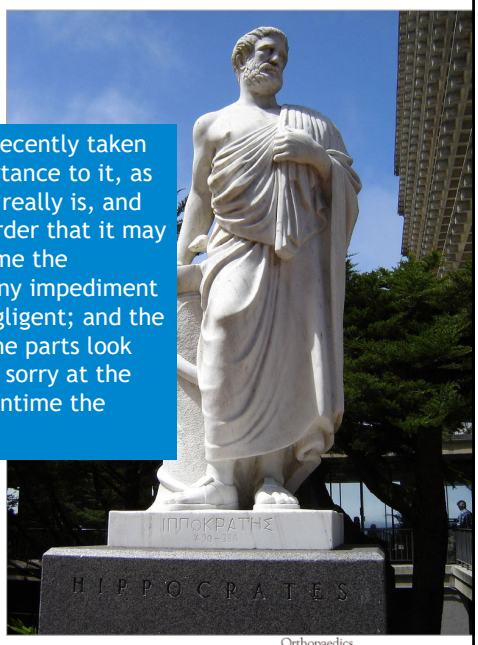
Clavicle Fractures – Indications Nonoperative/Operative

When, then, a [clavicle] fracture has recently taken place, the patients attach much importance to it, as supposing the mischief greater than it really is, and the physicians bestow great pains in order that it may be properly bandaged; but in a little time the patients, having no pain, nor finding any impediment to their walking or eating, become negligent; and the physicians finding they cannot make the parts look well, take themselves off, and are not sorry at the neglect of the patient, and in the meantime the callus is quickly formed.

Hippocrates, 4th Century BC



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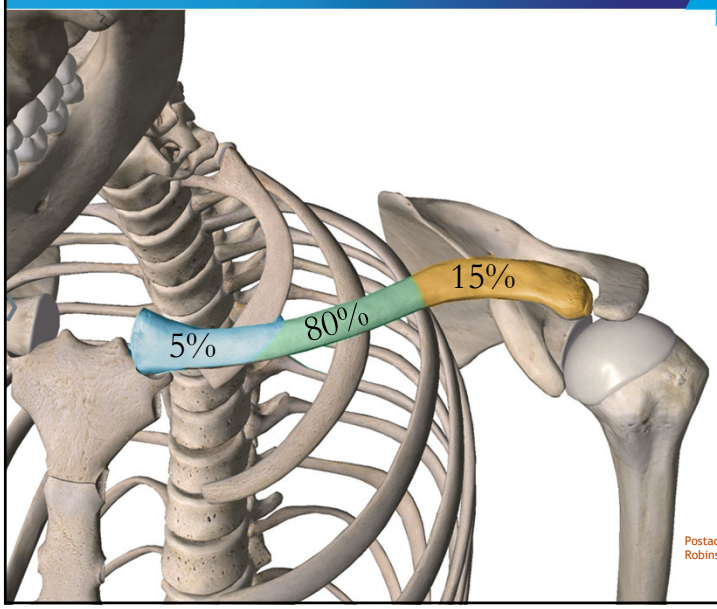
Location of Clavicle Fractures



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Postacchini R, et al. *J Shoulder Elbow Surg*, 2002
Robinson, CM *Bone Joint Surg Br*, 1998

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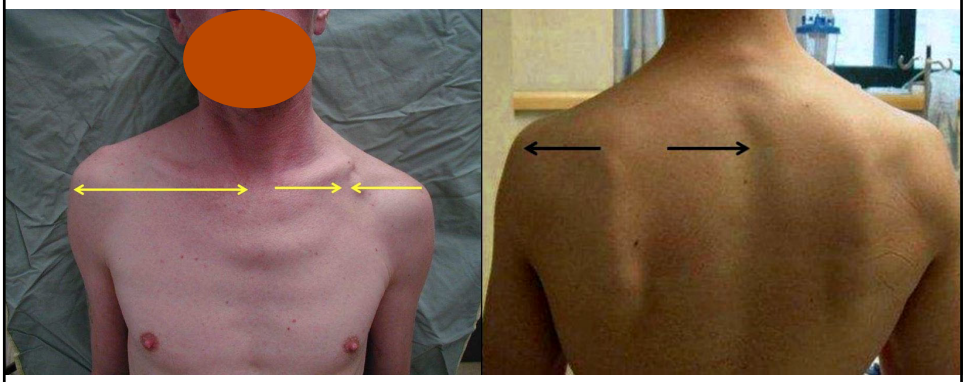

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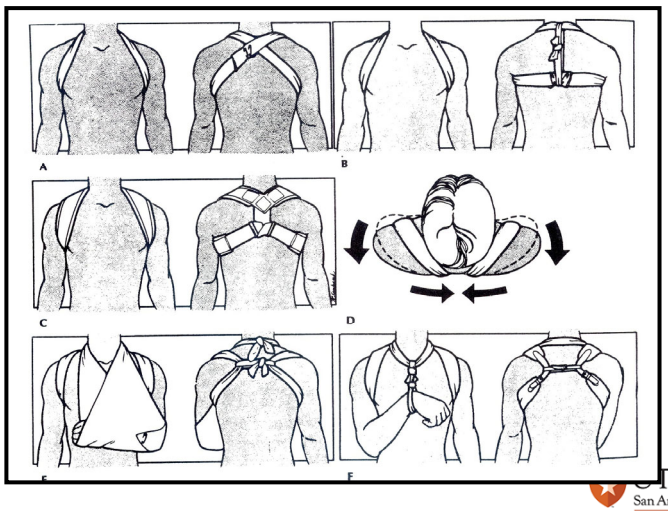
Figure of 8



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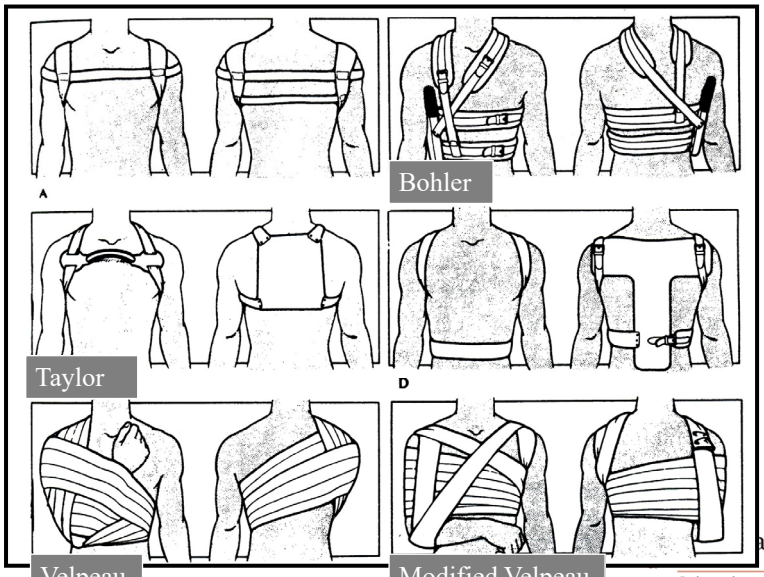
Braces



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MIDSHAFT
Classical Operative Indications

- **INDICATIONS:**

Open Fracture
Scapulothoracic Dissociation / Floating Shoulder
Major Vascular Injury
Segmental Fractures
Multiple Trauma
Severe displacement/ tenting of skin (non-responsive to reduction)

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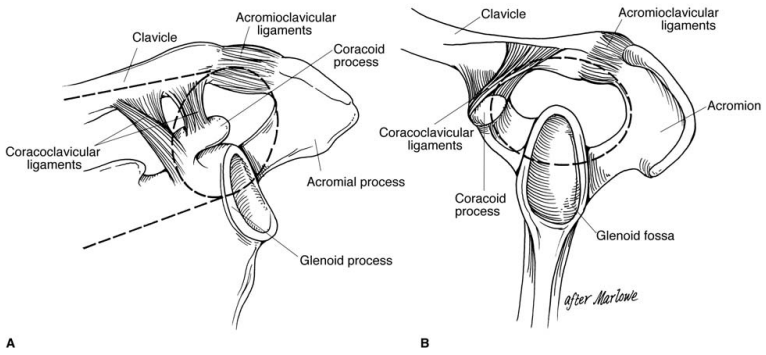
Double Disruptions SSSC



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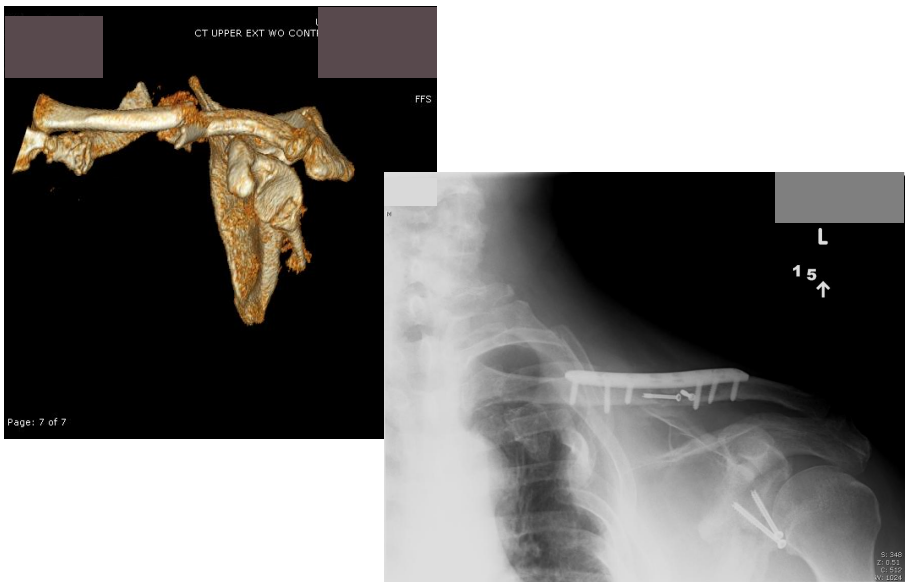
Floating Shoulder



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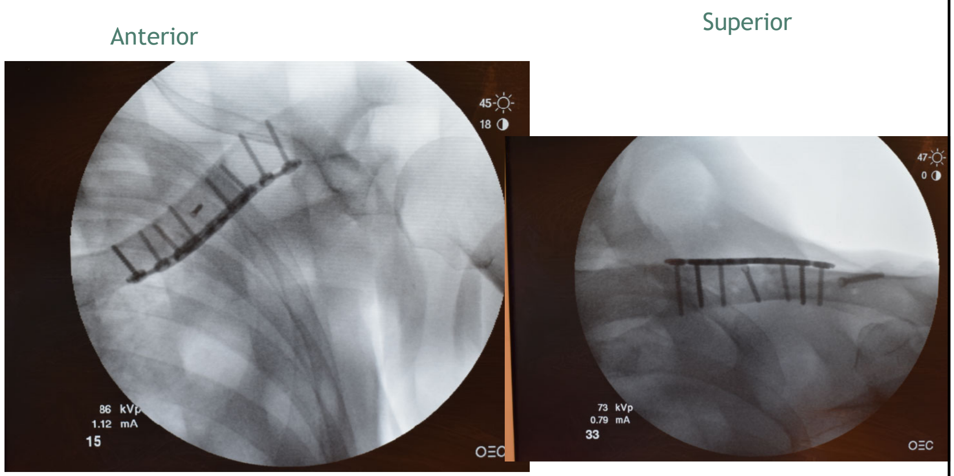
Clavicle Plating



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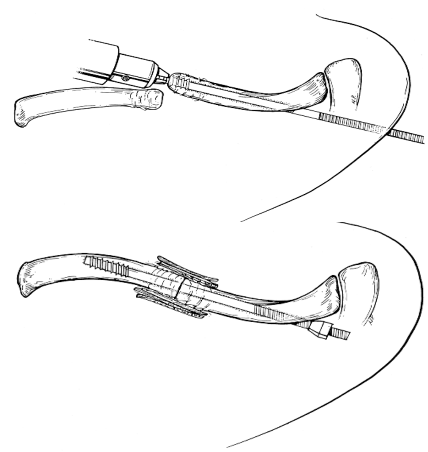
* Images from the cadaveric validation lab on 2/25/2018.

Intramedullary Fixation

- Potentially high complication rates
- Studies are equivocal
- Biomechanically less stable than plating
- High incidence of pin irritation
- Pin removal
- Patient selection is key – Avoid comminuted fractures!!
    - Need axial stability



Christopher D. Mudd MD, et al, *Clin Orthop Relat Res* (2011) 469:3364-3370
S Raymond Golish, Jason A Oliviero, Eric I Francke and Mark D Miller, *JOSR* 2008, 3:28

Note: A.L.P.S. Clavicle plating system was not used in these studies

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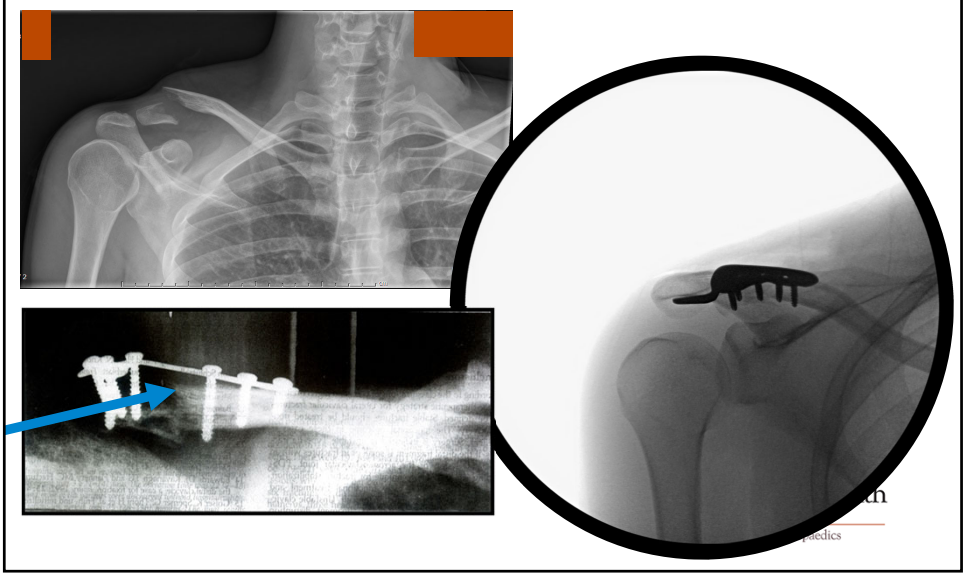
Hook Plate



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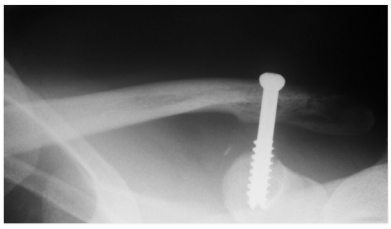
Distal Clavicle

CC SCREW

Suture endobutton construct



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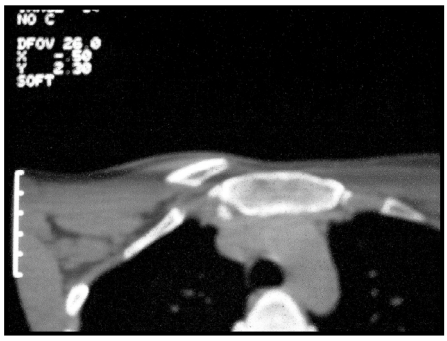
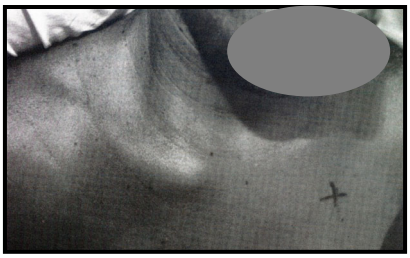
Medial Clavicle Fractures

- Nonoperative
- Displaced fractures require C.T. to assess mediastinum





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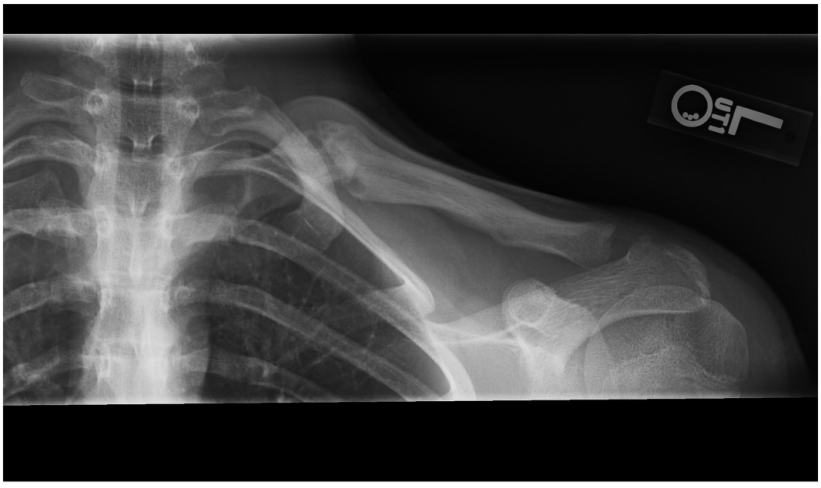

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Late arthritis treated with resection of medial clavicle

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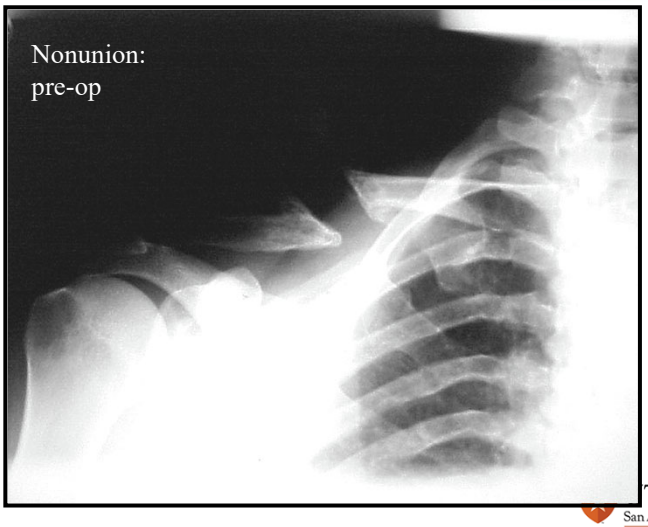
Nonunion



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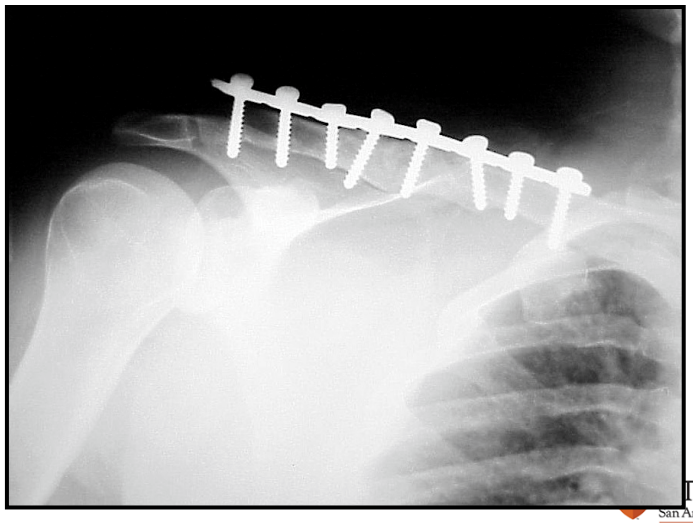

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Neer CS, "Nonunion of the clavicle" *JAMA* 1960, reported 3 nonunions in 2235 fractures treated closed
Rowe CR, "Am atlas of anatomy and treatment of midclavicular fractures" *CORR* 1968, reported 4 nonunions in 566 fractures treated closed

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Consequences of Shortening in non-op fractures

> Arch Orthop Trauma Surg. 1986;105(6):337-8. doi: 10.1007/BF00449938.

Outcome of clavicular fracture in 89 patients

A Eskola, S Vainionpää, P Myllynen, H Pätiälä, P Rokkanen

- Threshold : 15 mm shortening caused pain and weakness

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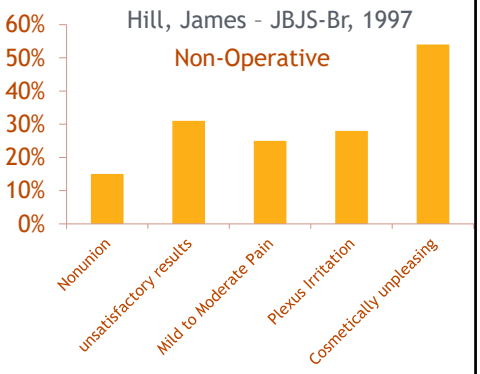
Clavicle Fractures - Modern Thoughts: To Fix or Not

242 Fx's | 66 mid 1/3 | 52 reviewed

All fractures treated non-operatively

- 15% nonunion
- 31% unsatisfactory results
- 13 (25%) mild to mod. pain
- 15 (28%) plexus irritation
- 54% found end result cosmetically unpleasing



Conclusion

- ✓ >20mm initial disp assoc. with nonunion
- ✓ Rec'd ORIF of severely displaced middle 1/3 fractures in adults

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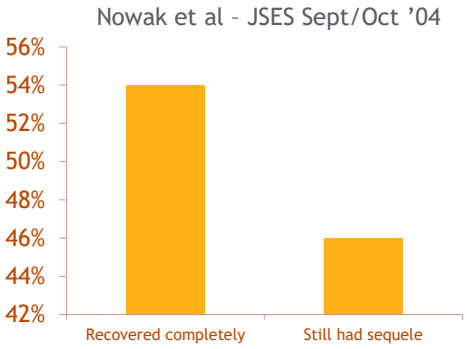
Clavicle Fractures - Modern Thoughts: To Fix or Not

245 pts. treated non-op and eval'd prospectively with 208 seen at 9-10 year F/U

- 54% recovered completely
- 46% still had sequelae (Pain at rest, pain with activity and cosmetic deformity)
  - 9% pain at rest
  - 29% pain with activity
  - 27% cosmetic defects



Conclusion

- ✓ Displaced w/o bony contact esp. with transverse fx's was the strongest predictor of sequelae
- ✓ Rec'd more aggressive treatment in pts with displaced, comminuted fx's with no bony contact esp. in the elderly
- ✓ Nonunion should not be the single benchmark for success in the Rx of clavicle fx's

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"Treatment of Acute Mid-shaft Clavicle Fractures: Systematic Review of 2144 Fractures"

Nonunion Rates:

- Displaced fracture treated with plating – 2.2%
- Displaced fracture treated non-operatively – 15.1%

Conclusion: Early operative Fixation of completely displaced mid-shaft clavicle fractures has reportedly achieved:

- ✓ Improved patient oriented outcome
- ✓ Improved surgeon oriented outcome
- ✓ Earlier return to function
- ✓ Decreased nonunion rate (10/460 vs 24/159), an 86% reduction in relative risk

Zlowodzki, M et al. *J Orthop Trauma*, 2005

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"Nonoperative Treatment Compared with Plate Fixation of Displaced Mid-shaft Clavicular Fractures. A Multicenter, Randomized Clinical Trial"

- Multicenter, prospective randomized trial
- **Completely displaced** mid-shaft clavicle fracture
- 132 patients (age 16-60) randomized
  - ORIF (plate fixation) 62 patients
  - Non-operative treatment 49 patients
  - 111 patients followed for 1 year

Canadian Orthopaedic Trauma Society (2007) Nonoperative treatment compared with plate fixation of displaced midshaft clavicular fractures. A multicenter, randomized clinical trial. *J Bone Joint Surg Am* 89:1-10

Plate fixation was achieved with either contact dynamic compression plates, 3.5-mm reconstruction plates, pre-contoured plates, or other plates (systems and manufacturers not specified). The Zimmer Biomet A.L.P.S. Clavicle Plating System was not used in this study.

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Operative vs Nonoperative

What Is the Best Evidence for Management of Displaced Midshaft Clavicle Fractures? A Systematic Review and Network Meta-analysis of 22 Randomized Controlled Trials

Daniel E Axelrod [1], Seper Ekhtiari, Anthony Bozzo, Mohit Bhandari, Herman Johal

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Plate vs Nail

Plate fixation or intramedullary fixation for midshaft clavicle fractures: a systematic review and meta-analysis of randomized controlled trials and observational studies

Roderick M. Houwert, MD, PhD[a,b,*], Diederik P.J. Smeeing, MD[a,c], Usama Ahmed Ali, MD, MSc[c], Falco Hietbrink, MD, PhD[c], Moyo C. Kruyt, MD, PhD[d], Olivier A. van der Meijden, MD, PhD[e]

- 20 studies
- No difference in union rates or re-operation rates
- Hardware removal Rate : plate 38% , Nail: 73%
- Refracture after removal and infection rates higher in Plate
- Comminuted fractures frequently excluded in nail studies

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ANTERIOR VS SUPERIOR PLATING

Anterior-Inferior Plating Results in Fewer Secondary Interventions Compared to Superior Plating for Acute Displaced Midshaft Clavicle Fractures

Rafael Serrano, MD, Amrut Borade, MD,† Hassan Mir, MD, MBA, FACS,‡ Anjan Shah, MD,‡ David Watson, MD,‡ Anthony Infante, DO,‡ Mark A. Frankle, MD,§ Mark A. Mighell, MD,§ H. Claude Sagi, MD,‖ Daniel S. Horwitz, MD,† and Roy W. Sanders, MD*‡*

Midshaft Fractures of the Clavicle: A Meta-analysis Comparing Surgical Fixation Using Anteroinferior Plating Versus Superior Plating

Alex Nourian, BS, Satvinder Dhaliwal, MPH,† Sitaram Vangala, MS,† and Peter S. Vezeridis, MD‡*

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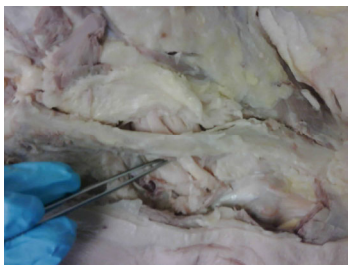
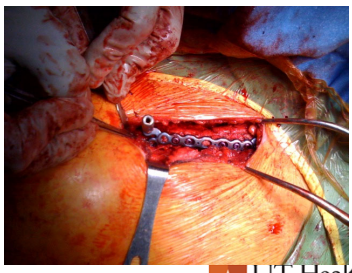
Anterior vs Superior Safety

Analysis of Neurovascular Safety Between Superior and Anterior Plating Techniques of Clavicle Fractures

Michael M. Hussey, MD, Yumin Chen, MS,† Roberto A. Fajardo, PhD,* and Anil K. Dutta, MD**





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Dual Smaller Plates?

Low-Profile Dual Small Plate Fixation Is Biomechanically Similar to Larger Superior or Anteroinferior Single Plate Fixation of Midshaft Clavicle Fractures

Connor G. Ziegler,*† MD, Zachary S. Aman,‡ BA, Hunter W. Storaci,‡ MS, Hannah Finch,‡ BS, Grant J. Dornan,‡ MSc, Mitchell I. Kennedy,‡ BS, Matthew T. Provencher,§ MD, and Thomas R. Hackett,§ MD
Investigation performed at The Steadman Clinic, Vail, Colorado, USA, and the Steadman Philippon Research Institute, Vail, Colorado, USA

Dual mini-fragment plating for midshaft clavicle fractures: a clinical and biomechanical investigation

Mark L. Prasarn[1] · Kathleen N. Meyers[2] · Geoffrey Wilkin[1] · David S. Wellman[1] · Daniel B. Chan[1] · Jaimo Ahn[1] · Dean G. Lorich[1] · David L. Helfet[1]

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Late Operative Treatment

Does delay matter? The restoration of objectively measured shoulder strength and patient-oriented outcome after immediate fixation versus delayed reconstruction of displaced midshaft fractures of the clavicle

Jeffrey M. Potter, BSc (Kin),[a] Caroline Jones, BSc, PT,[a] Lisa M. Wild, RN, MN, ACNP,[a] Emil H. Schemitsch, MD, FRCS(C),[a] and Michael D. McKee, MD, FRCS(C),[b] *Toronto, Ontario, Canada*

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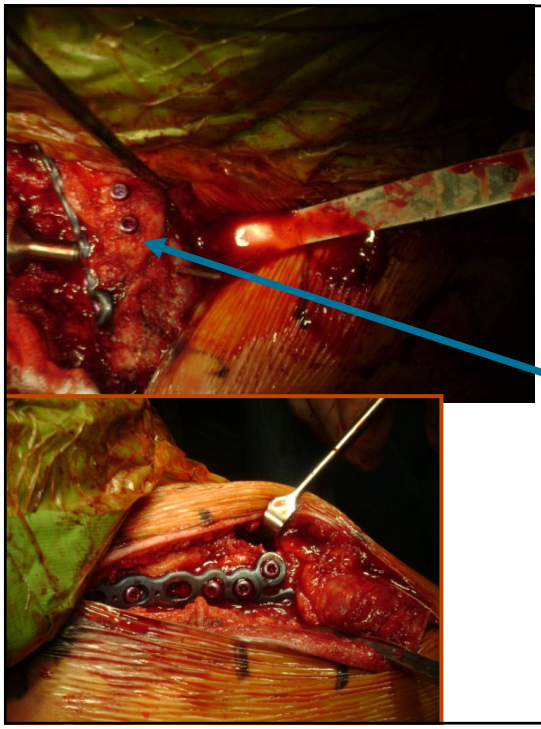

DUTTA PREFERENCE

- PERSONAL PREFERENCE ANTERIOR PLATE
- LONGER SCREWS IN THE WEIGHT BEARING SEGMENT (LATERAL)
- SUPERIOR SCREWS PULLOUT, ANTERIOR SCREWS HAVE TO CUT OUT
- REPRODUCES THE ANTERIOR COLUMN

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INJURIES TO STERNOCLAVICULAR JOINT

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TREATMENT
IS
CLOSED
IN MOST CASES

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INJURIES OF S/C JOINT

1. Dislocation & Subluxations
2. Fracture & Dislocation
3. Epiphyseal Injuries
4. Subluxation ie voluntary and spontaneous

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TYPES OF STERNOCLAVICULAR DISLOCATIONS

1. Anterior
2. Posterior

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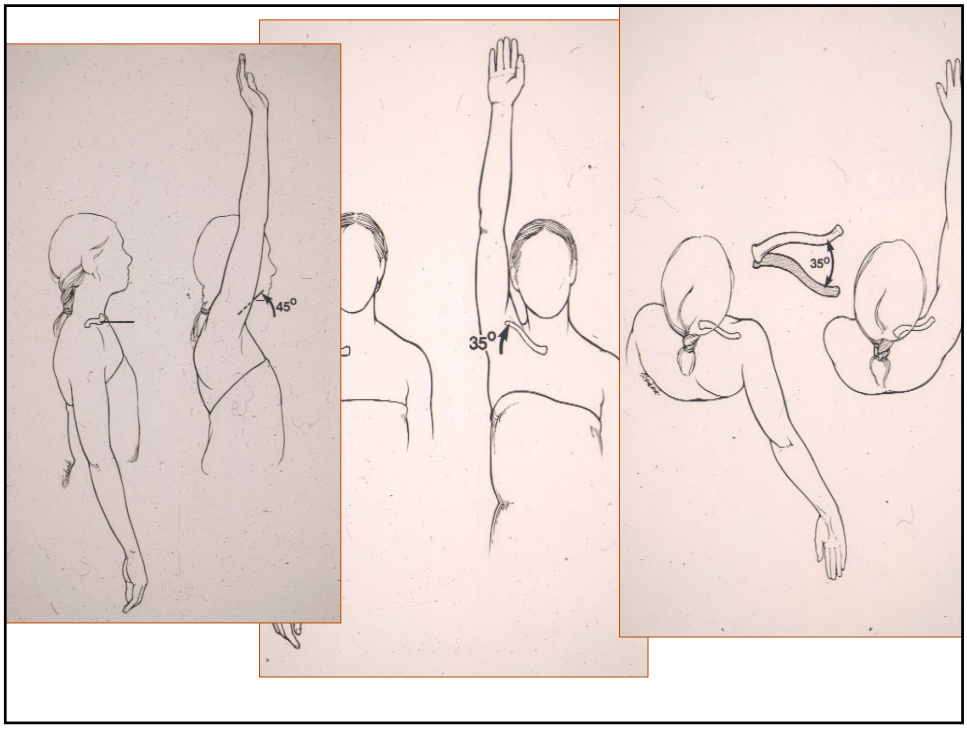

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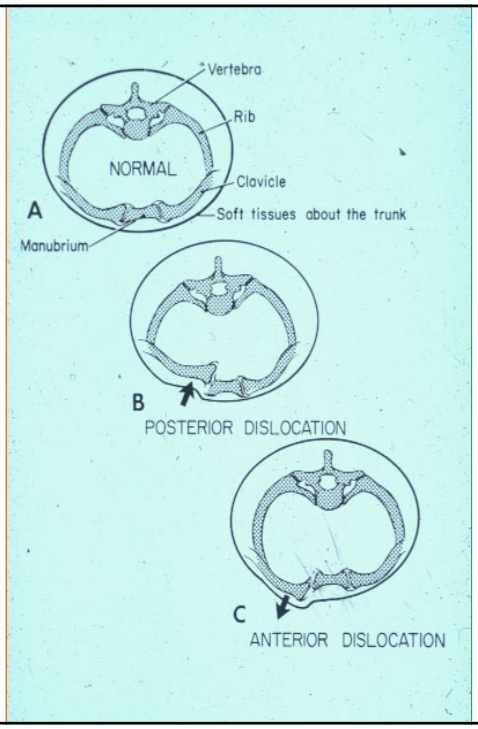

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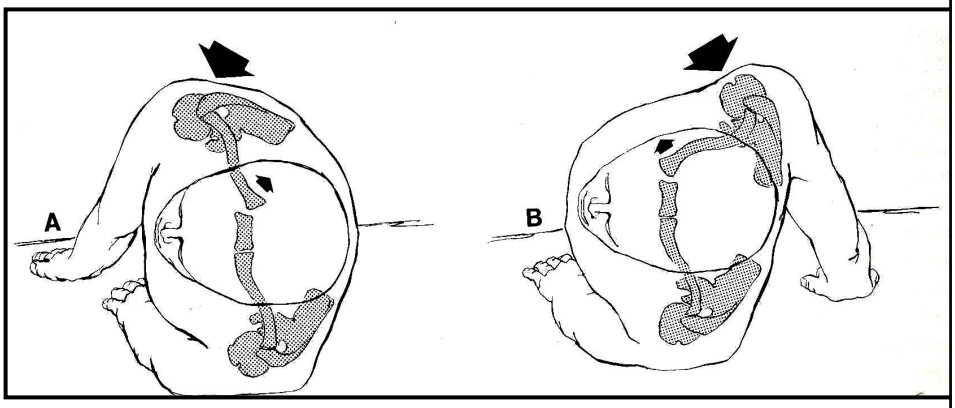
Mechanism of Injury



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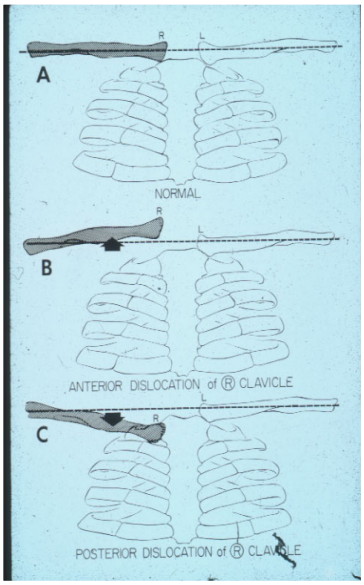

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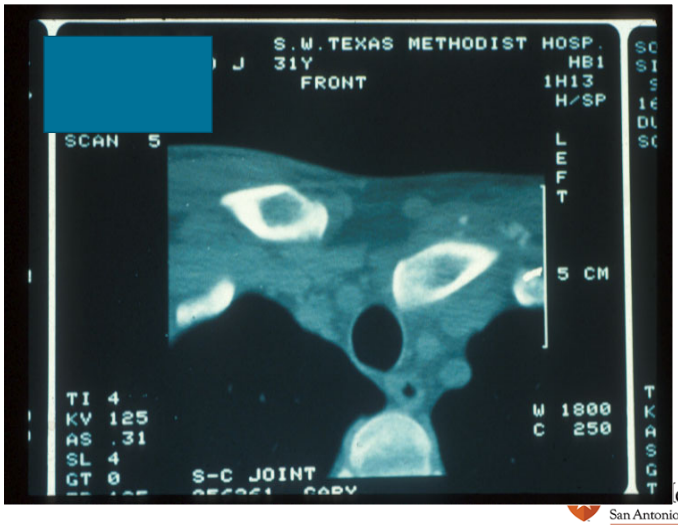
CT SCAN



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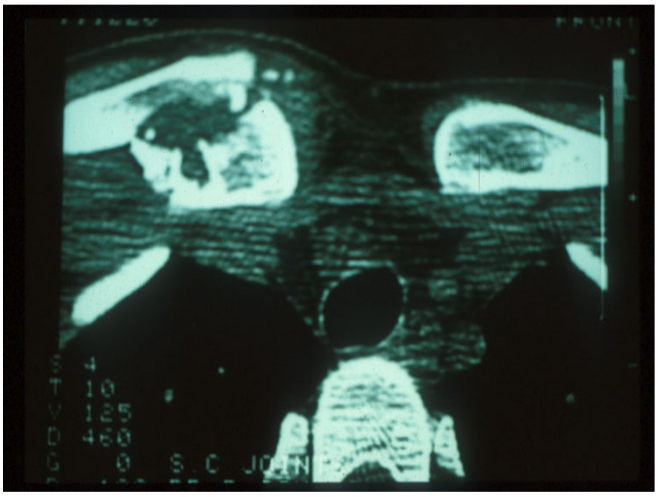

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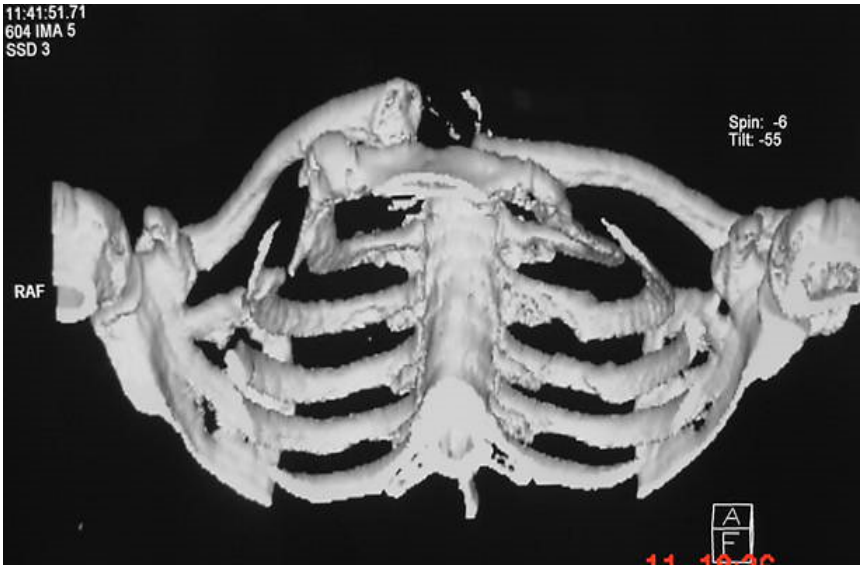

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TREATMENT OF ANTERIOR PROBLEMS

1. Open reduction ??
2. Closed reduction??
3. Skilled neglect??

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Is surgery indicated in treating spontaneous dislocation or atraumatic dislocation of the Sternoclavicular joint?

RARELY !!

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Open reductions and internal fixation may create more problems ! !

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SURGERY FOR RECONSTRUCTION

: A:intramedullary ligament transfer

B: costoclavicular ligament reconstruction

C: Sternoclavicular ligament Reconstruction

Anchor Points

a. stabilize to first rib

b. stabilize to manubrium

c. stabilize to the first rib and the manubrium.

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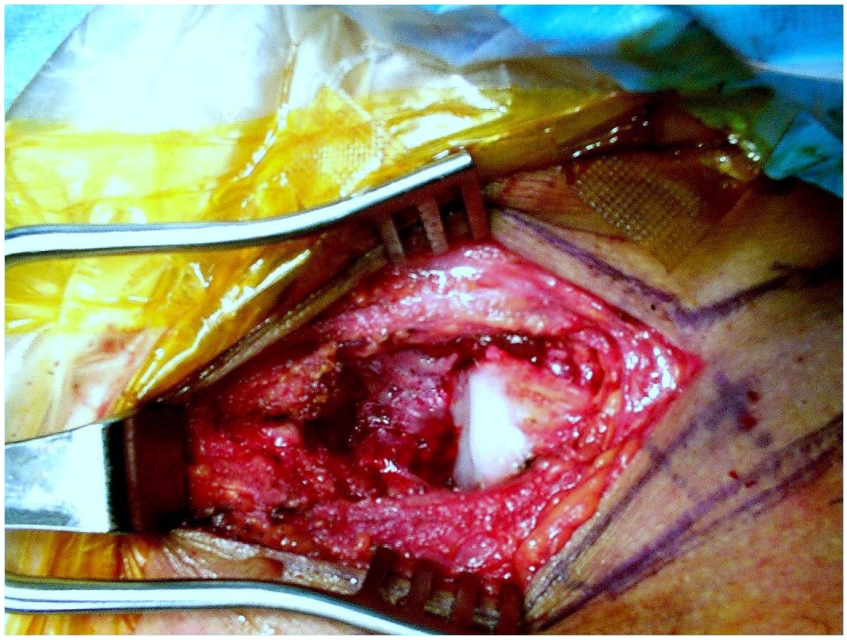

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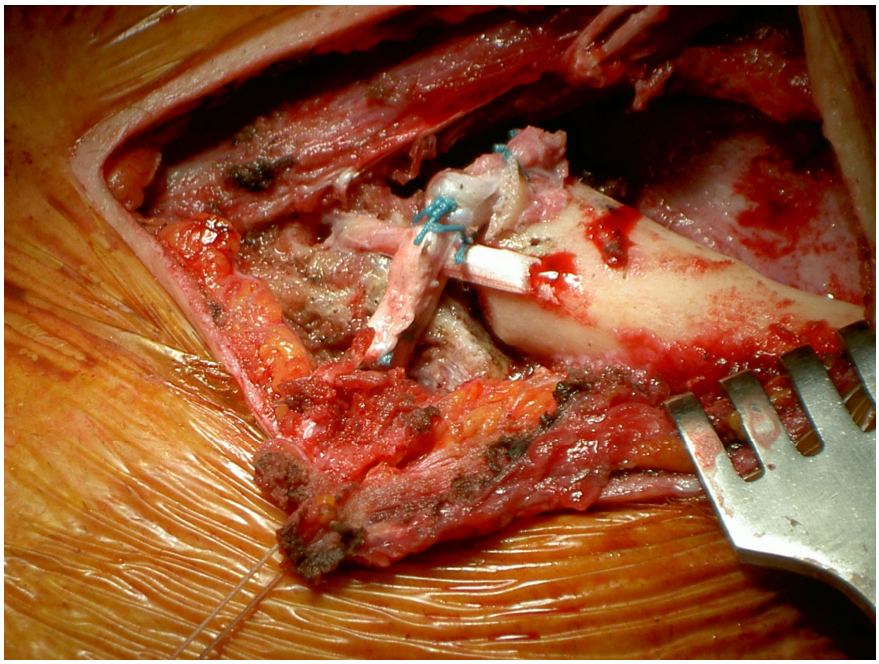

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TREATMENT OF POSTERIOR PROBLEMS

1. Closed reduction??
2. Skilled Open reduction??
3. Neglect??

DEPENDS ON THE AGE OF THE PATIENT !!

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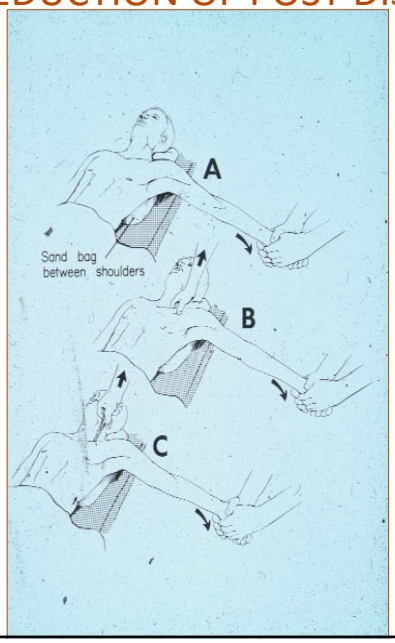
CLOSED REDUCTION OF POST DISLOCATION



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OPEN REDUCTION OF POST DISLOCATION

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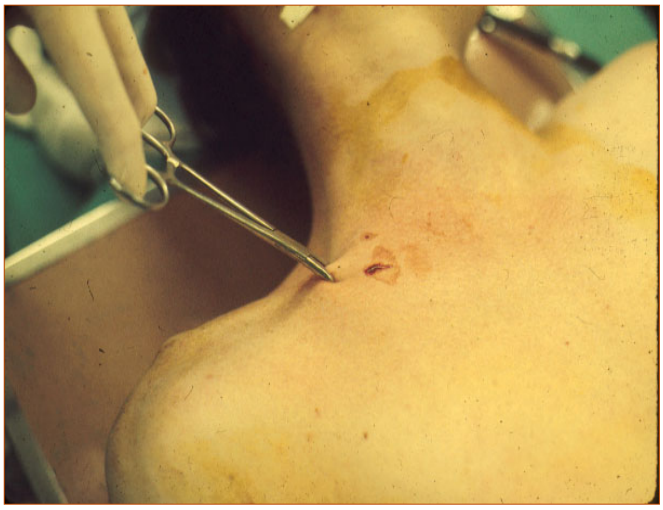

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OPEN REDUCTION OF POSTERIOR DISLOCATION

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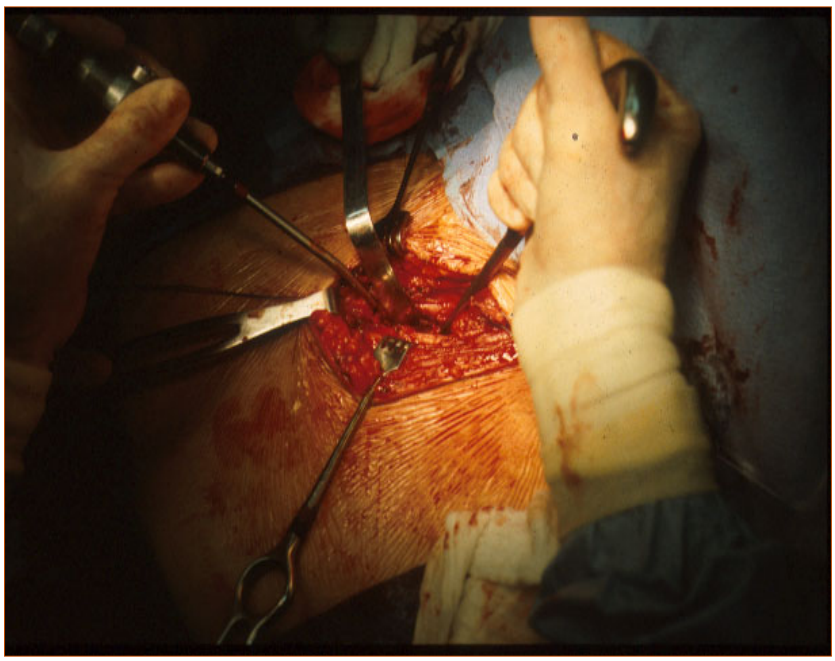

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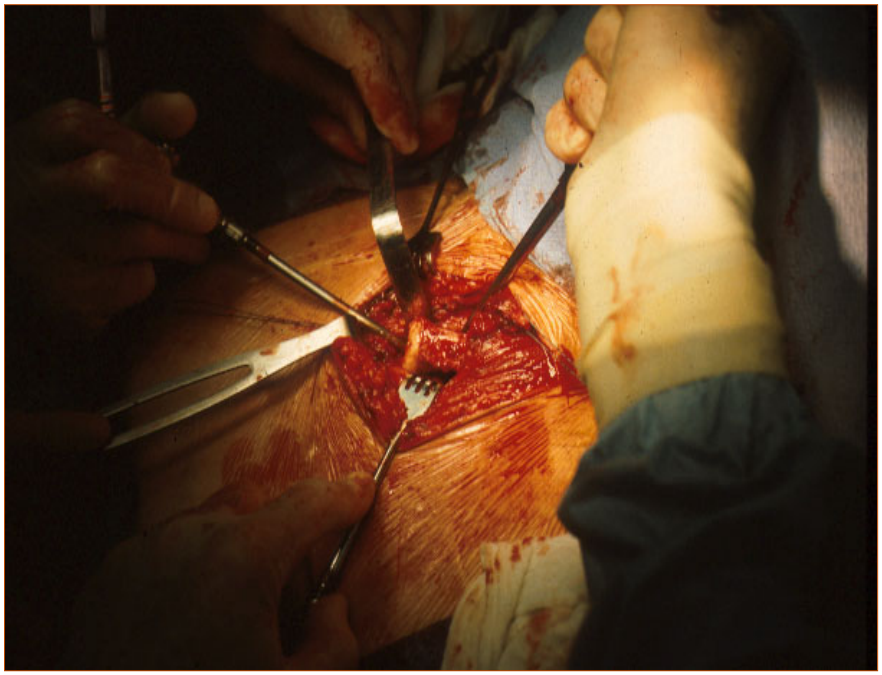

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EPIPHYSIS MEDIAL CLAVICLE

Appears age 18

Closes age 22 - 25

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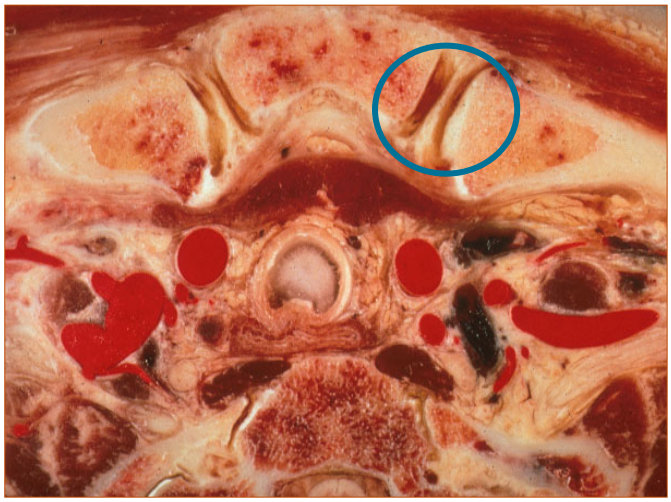
Medial clavicle epiphysis is a tiny thin disc



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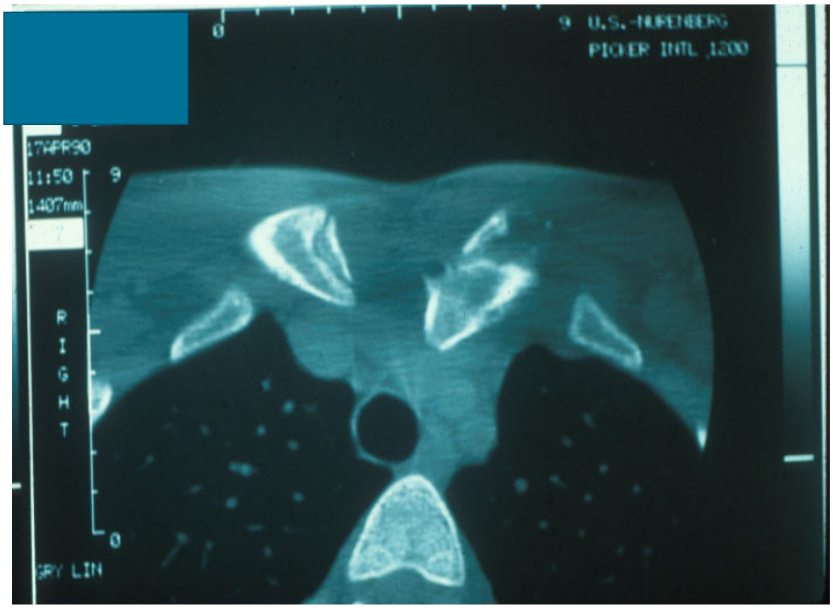

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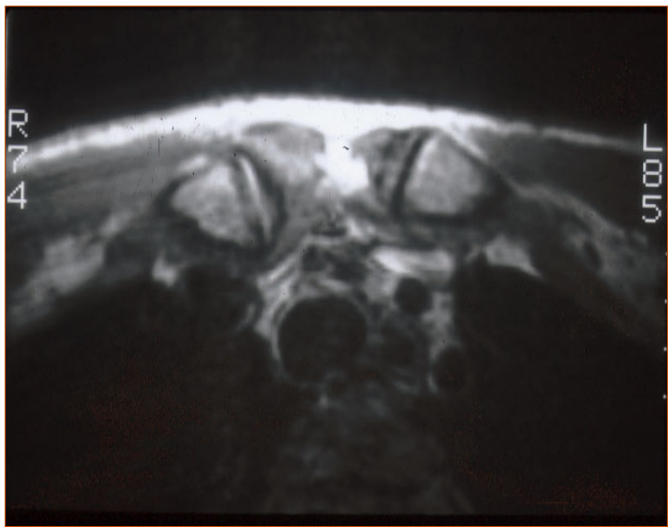

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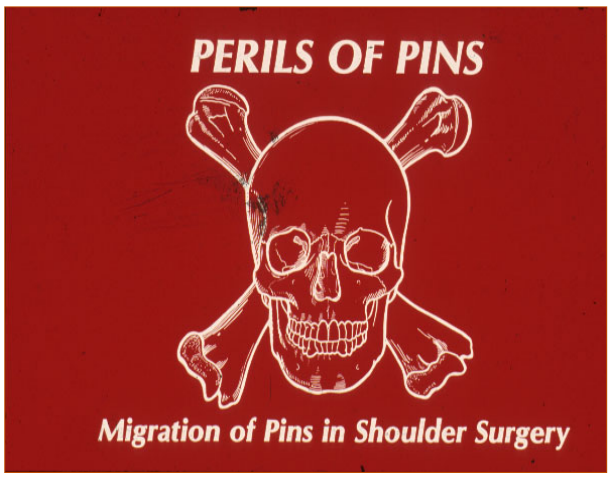

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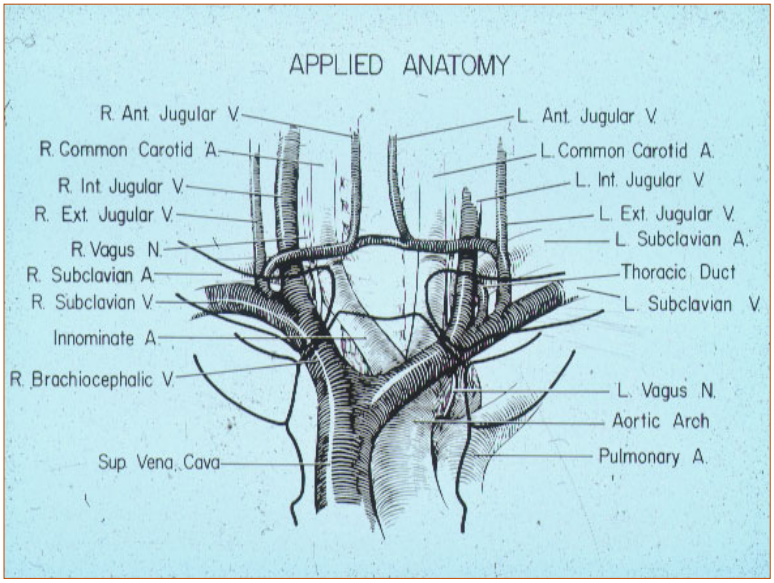

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MIGRATION OF PINS IN SHOULDER SURGERY

CASE REPORTS	47
PIN MIGRATIONS	49

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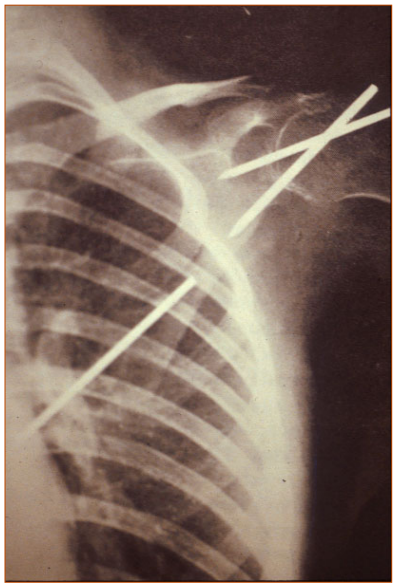

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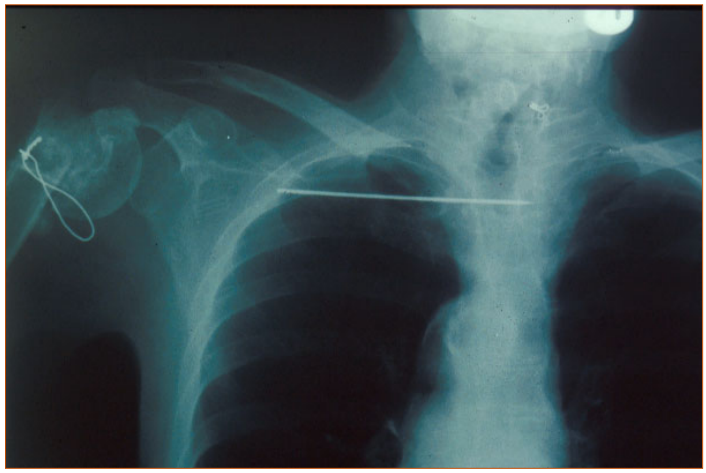

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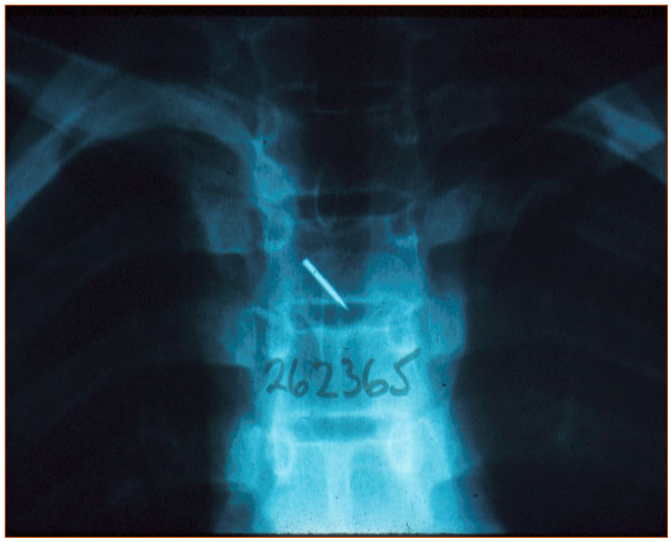

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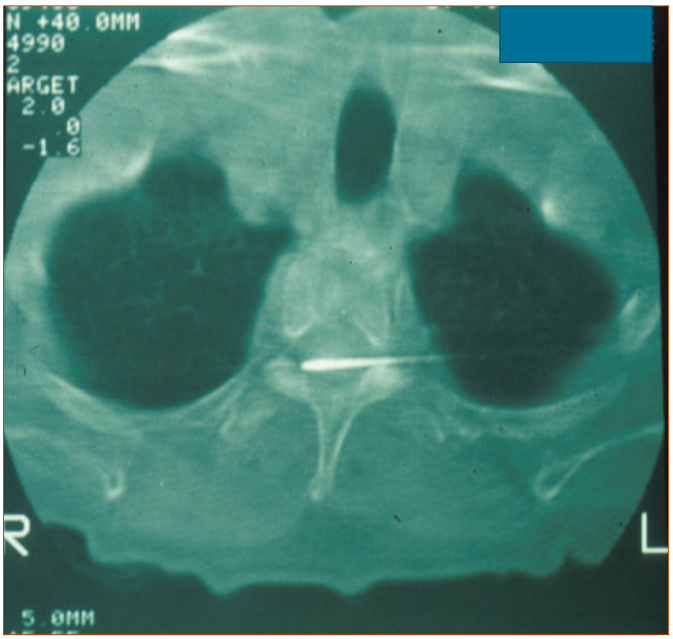

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THANK YOU

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