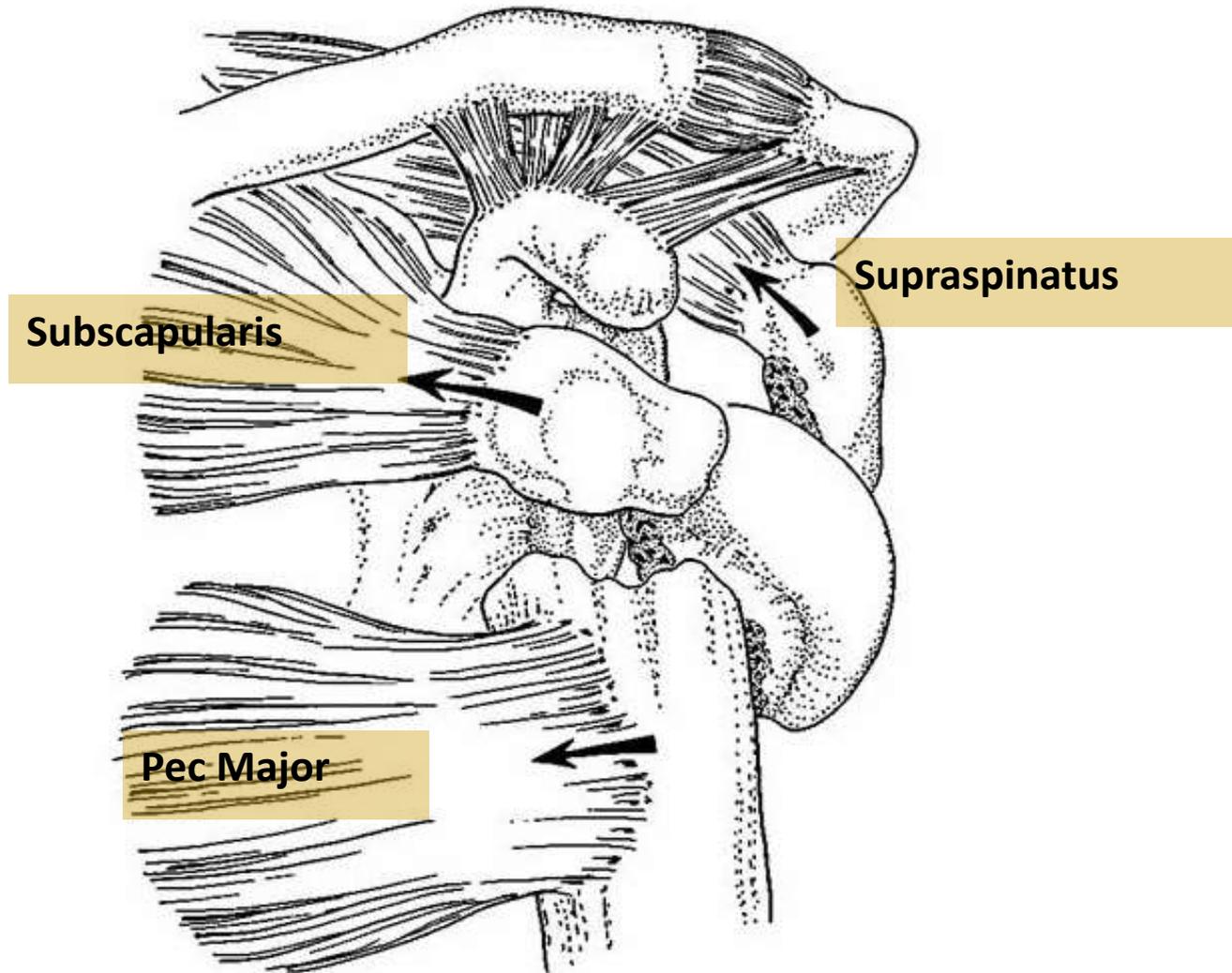


Proximal humerus fractures, ORIF or Arthroplasty

M.N. Naderi, MD

Deforming forces in proximal humeral fractures

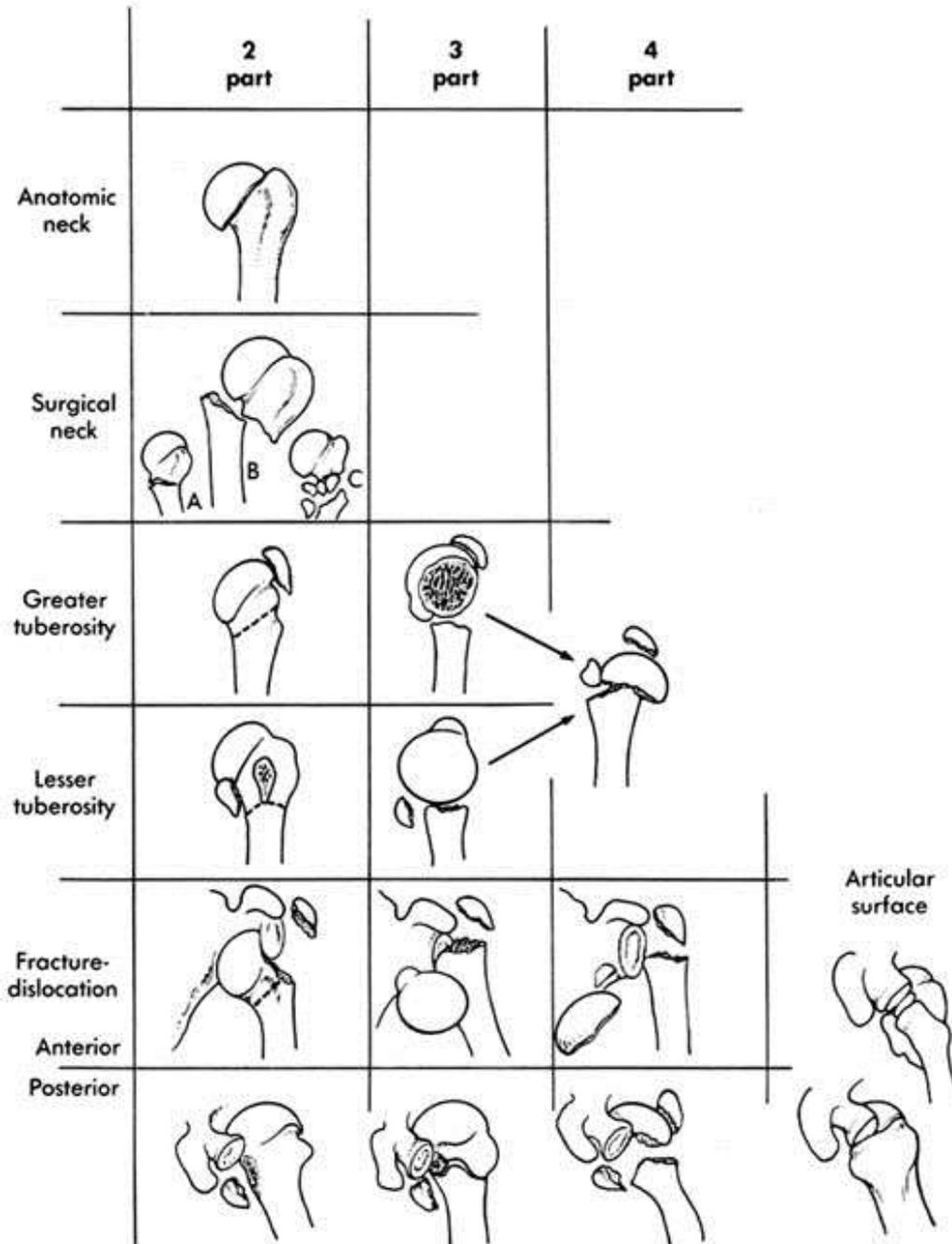


From Copeland: Operative Shoulder Surgery

Neer classification

(based on displacement of fragment)

Criteria: displacement >1 cm
or angulation >45°

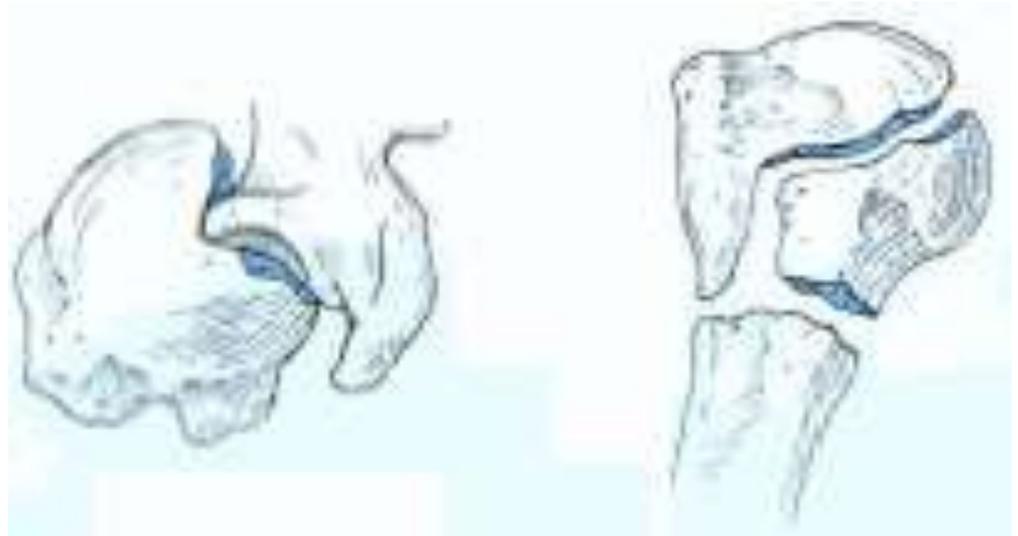


Neer CS II. Displaced Proximal Humerus Fractures. Part I: Classification and Evaluation. JBJs 1970;52-A:1077.

The greater the number of displaced fragments, the higher the risk of AVN



valgus-impacted four-part fracture



Impression fracture

Head splitting

(Hertel et al)

The length of dorsomedial metaphyseal extension & integrity of medial soft tissue are more important than number of "parts" and degree of displacement in development of osteonecrosis

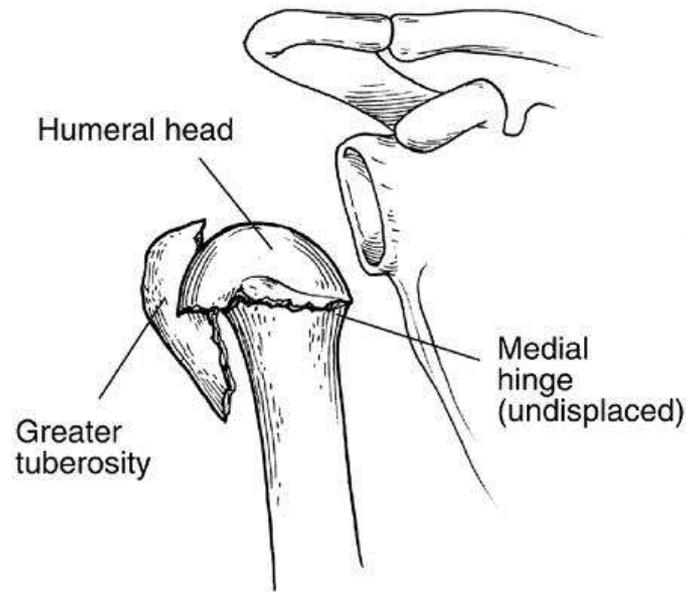


Fig. 8-C

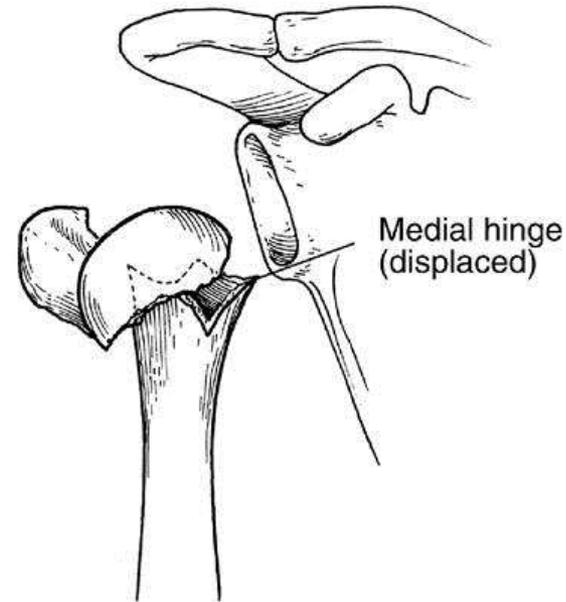


Fig. 8-D

Hertel R, Hempfing A, Stiehler M, Leunig M. Predictors of humeral head ischemia after intracapsular fracture of the proximal humerus. *J Shoulder Elbow Surg.* 2004;13:427–33.

Indications for operative therapy :

- angulation of the humeral head $>45^\circ$,
- displacement of the greater tuberosity >0.5 cm
- displacement of the shaft >1 cm

Neer CS II. Displaced proximal humerus fractures, I: Classification and evaluation. *J Bone Joint Surg Am.* 1970; 52(6):1077-1089.

Treatment options in displaced fx

- **Nonoperative**
- **Fixation**
 - **ORIF**
 - **CRIF**
- **Arthroplasty**



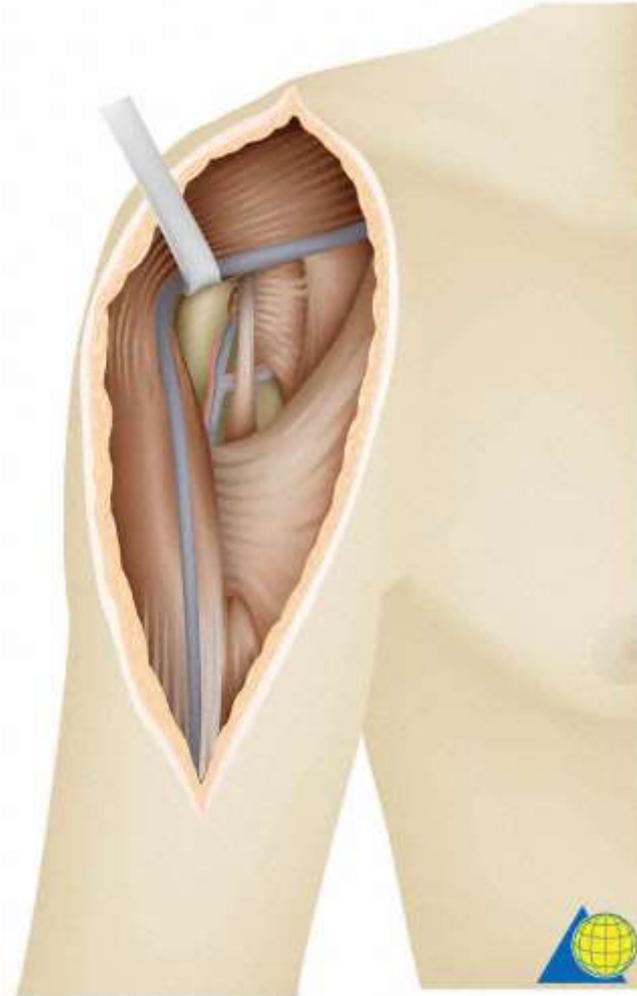
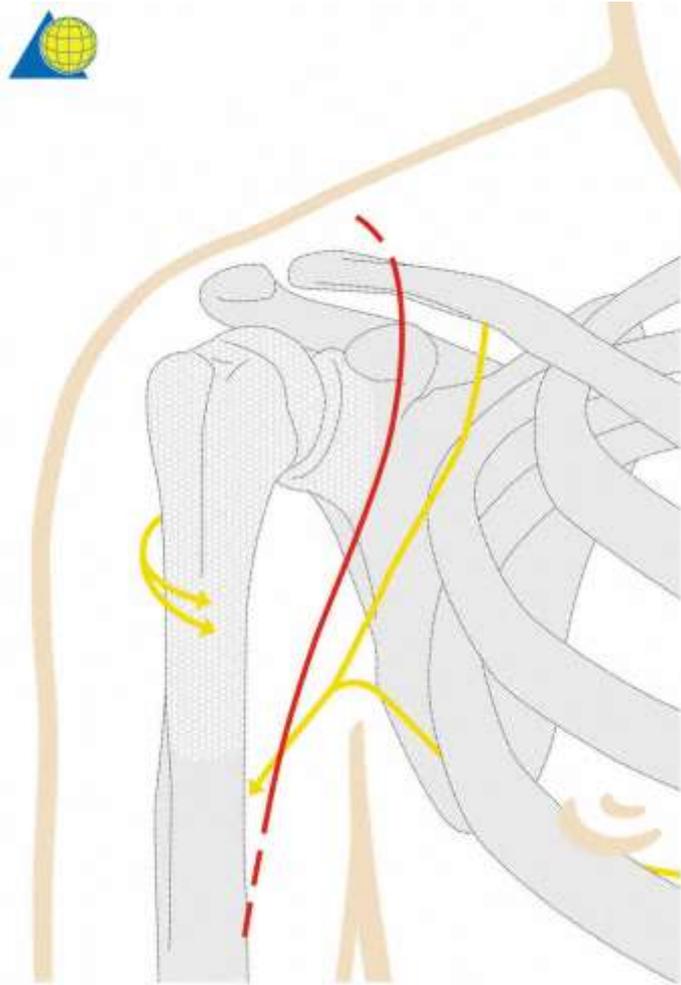
- **Suture**
- **Tension band**
- **Pins**
- **Plate**
- **Nail**
- **EF**

- **The goal of fixation proximal humerus fx is :**
 - **anatomic reduction**
 - **mechanical stability**
 - **early ROM**
 - **preserving the humeral head's blood supply**



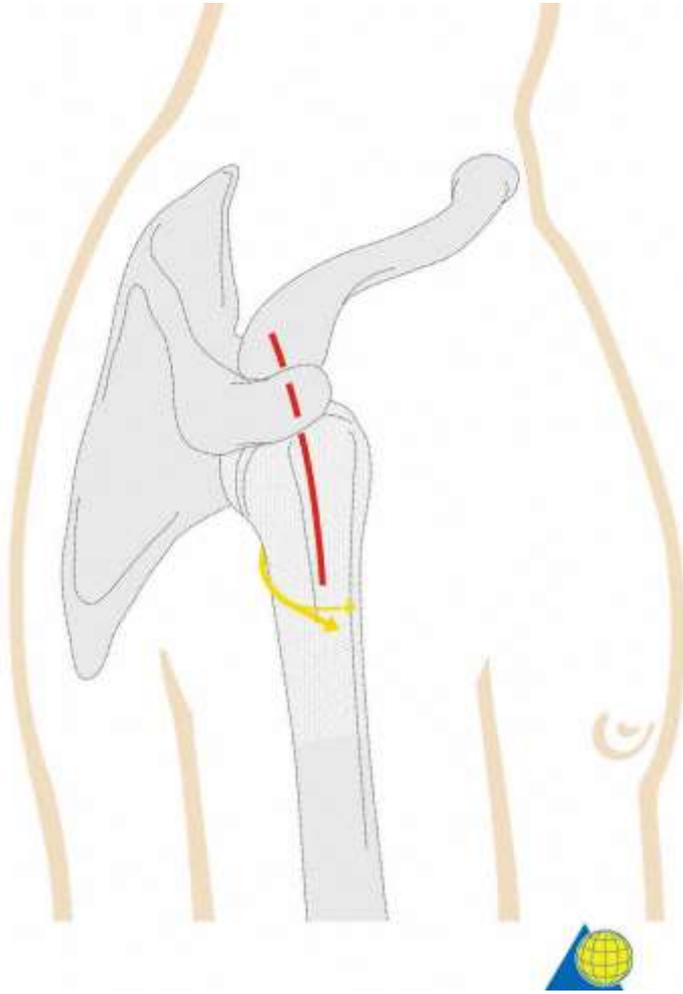
Approach

Delto-Pectoral Access

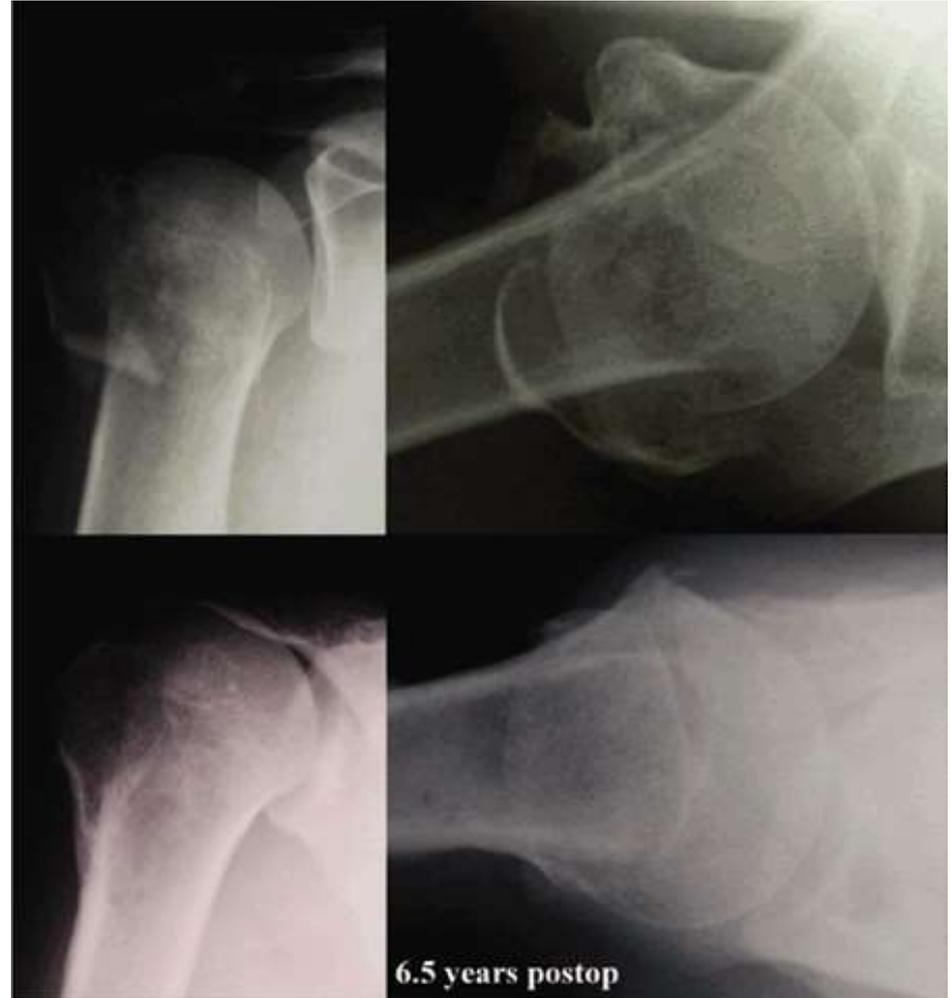
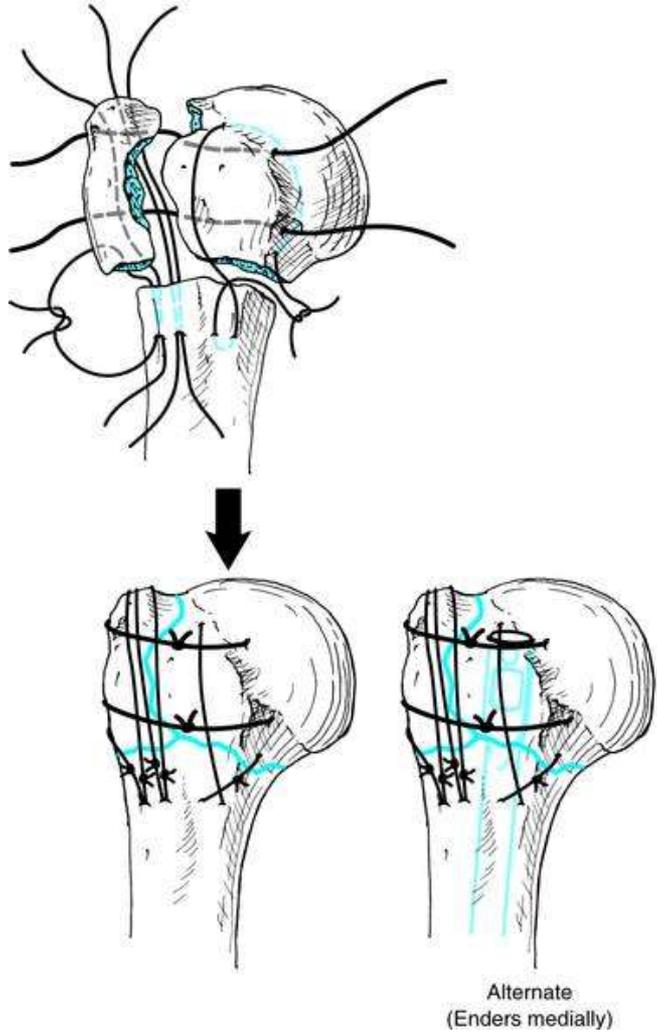


Approach

Deltoid Split



Fixations methods - Transosseous Suture



Fixations methods - pins

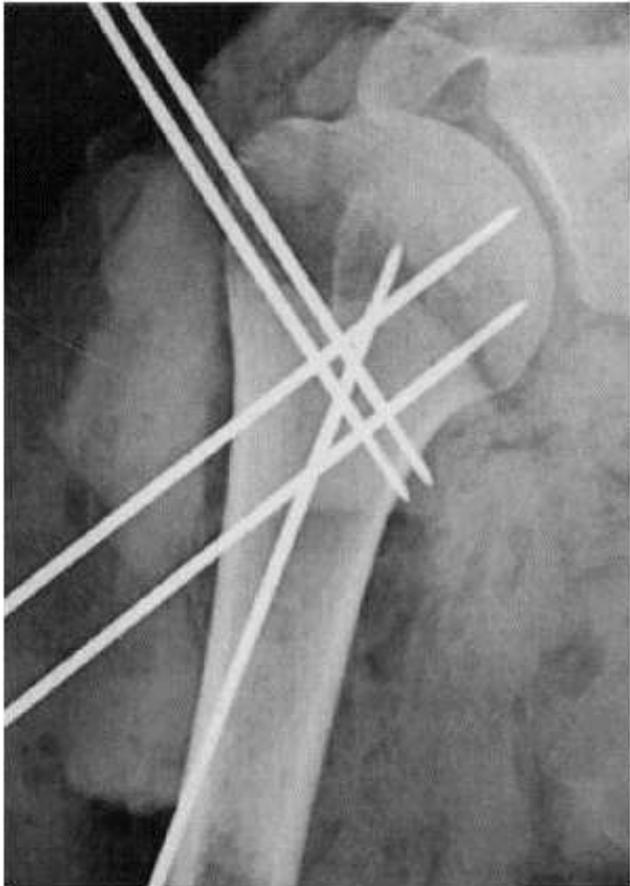


Fig. 2-A

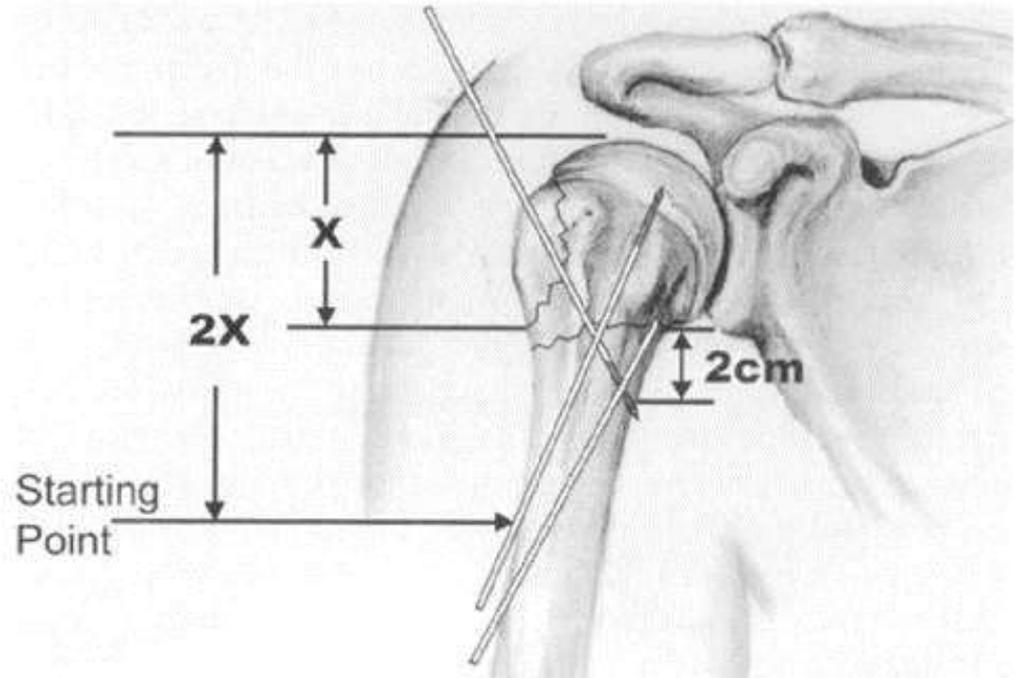
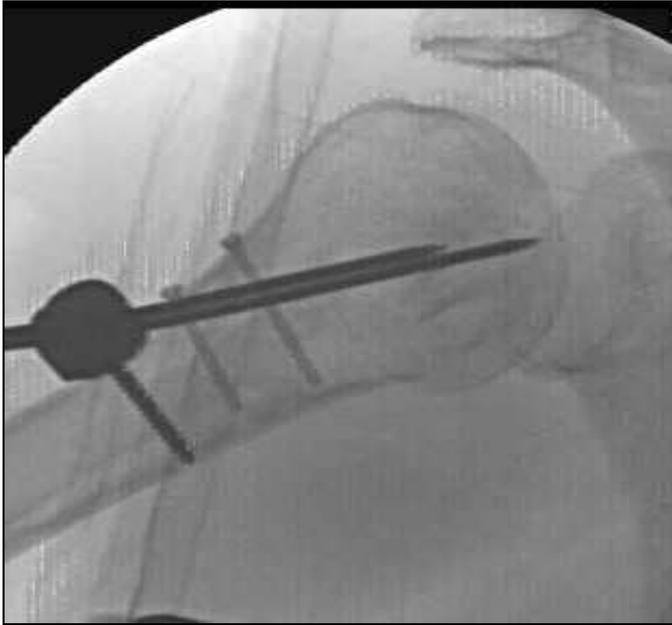


Fig. 2-B

Fixations methods - pins, humeral block



percutaneous methods, although theoretically advantageous because of preservation of the blood supply, are inferior in stability compared with intramedullary devices and conventional plating

Bathis H, et al. Surgical treatment of proximal humeral fractures. Is the T-plate still adequate osteosynthesis procedure? *Zentralbl Chir.* 2001;126(3):211-216.

Fixations methods - Tension band



Fixations methods - Nail

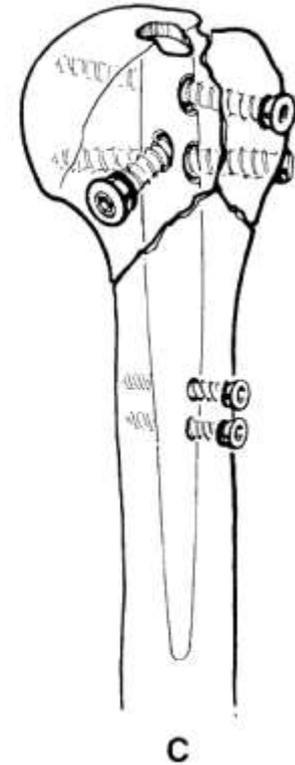
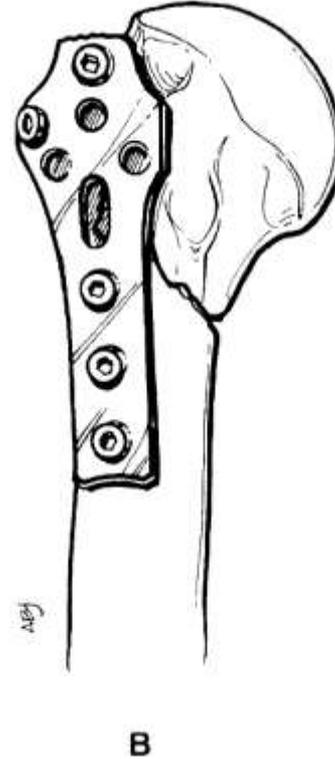
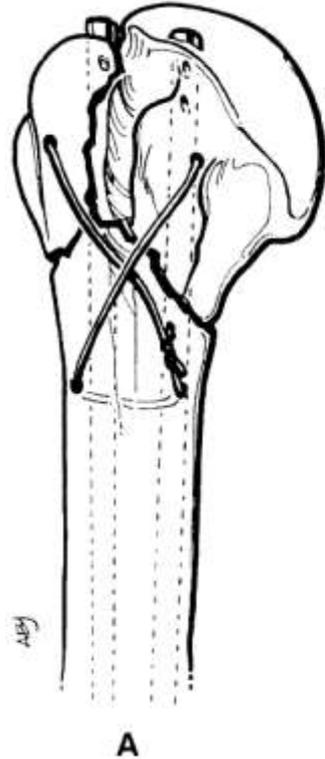
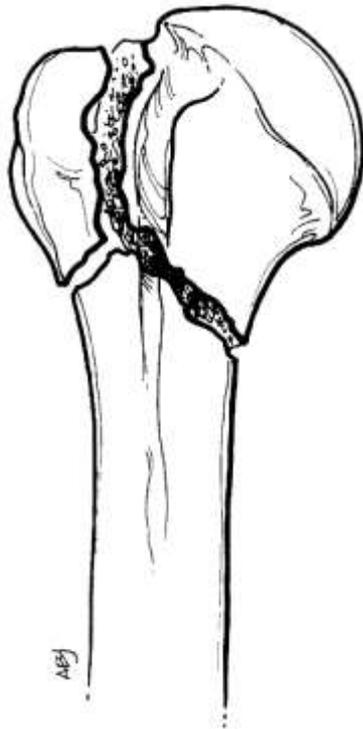


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Fixations methods - plate

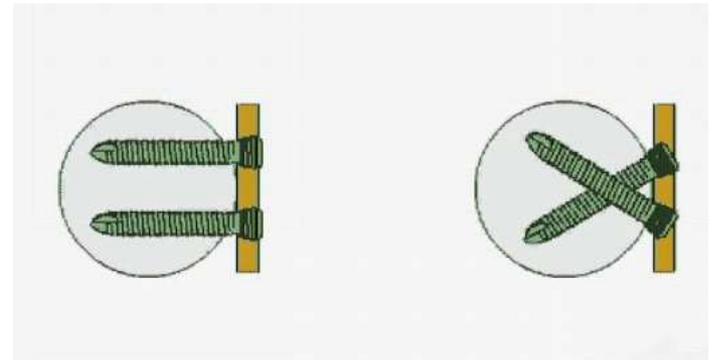
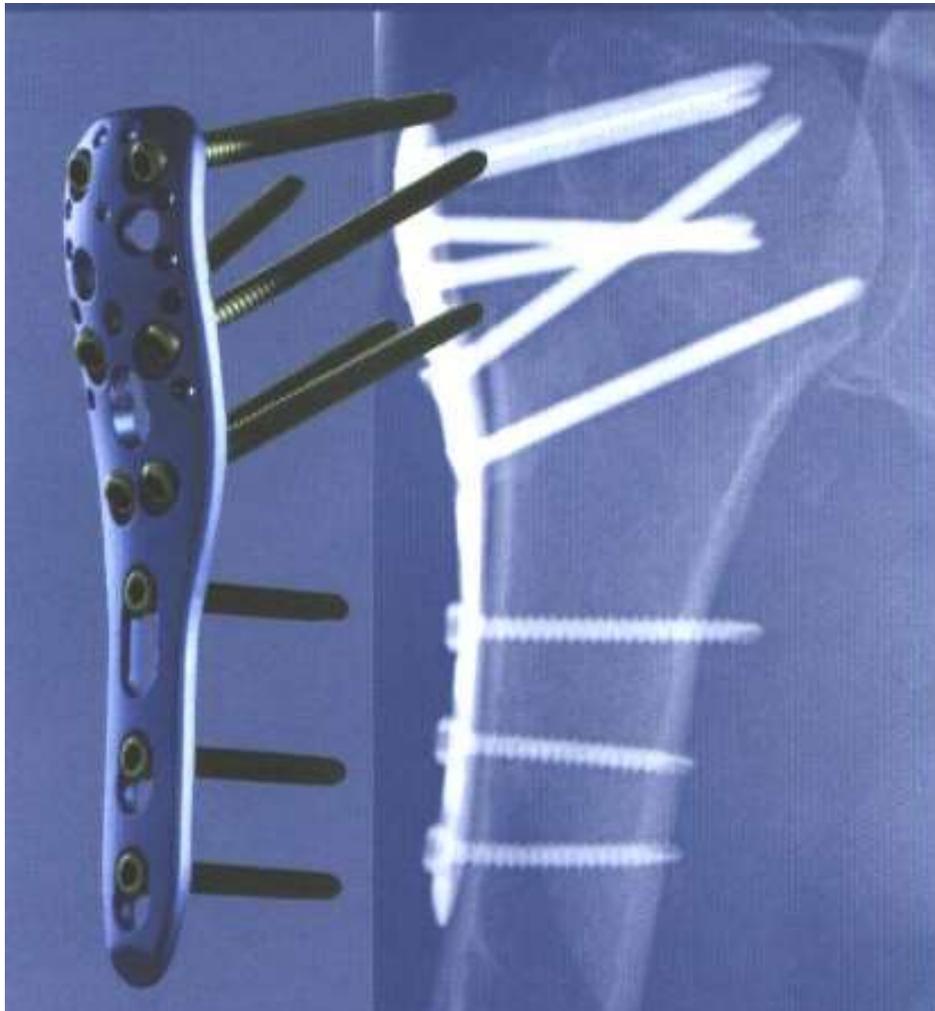


Ruch DS.et al. Fixation of three-part proximal humeral fractures: a biomechanical evaluation. Journal of Orthopaedic Trauma. 14(1):36-40, 2000 Jan



In cantilever bending and torsional stiffness testing, the plate/screws construct and the IM nail construct were superior to the TBW/Enders nail construct

Proximal humerus locking plate



Lill H, et al . Proximal humeral fractures: how stiff should an implant be?
A comparative mechanical study with new implants in human specimens.
Arch Orthop Trauma Surg. 2003; 123(2-3):74

- **In vitro analysis of implant anchoring in osteoporotic bone demonstrated significant lower loosening of angular plates at the bone-implant interface compared to the humerus T-plate and proximal humerus nail**

Fixations methods - Locking plate

- Rigid Fixation
- Early Mobilisation



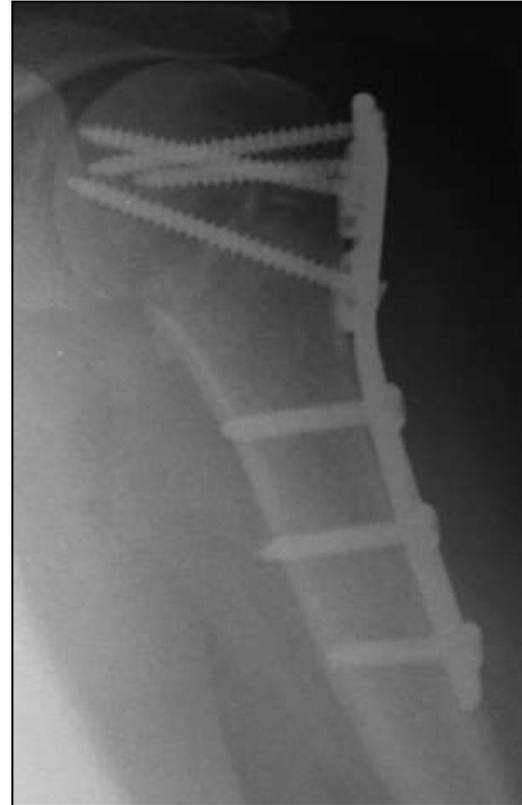
Secondary loss of reduction into varus-malalignment is seen especially in fractures with medial comminution



Gardner MJ, et al. The Importance of medial support in locked plating of proximal humerus fractures. *J Orthop Trauma*. 2007; 21(3):185-191.

❑ **Micro-CT study of humeral head :**

- **marked porosity in greater tuberosity region**
- **densest bone just underneath humeral head**



(Meyer DC, Fucentese SF, Koller B, et al: Association of osteopenia of the humeral head with full-thickness rotator cuff tears, J Shoulder Elbow Surg 13:333, 2004.)

**To overcome loss of reduction in medial comminution:
Anatomical reduction & careful placement of buttressing
inferomedial screws or impaction of the shaft into humeral head**



Plecko M, Kraus A. Internal fixation of proximal humerus fractures using the locking proximal humerus plate. *Operat Orthop Traumatol.* 2005; 17(1):25-50.

Osterhoff G. et al. The calcar screw in angular stable plate fixation of proximal humeral fractures--a case study. *J Orthop Surg Res.* 2011 Sep 24;6:50.

BARBARA (F)

LEXERHAG
L



L

KGG



L

STUD, GM



L

KRM



BARA (F)

L

STUD/ E

How manage displaced 3 & 4 part fx?



Treatment of 3 & 4 part fx

blood supply head	yes	yes	no	no
Anatomical stability by osteosynthesis	yes	no	yes	no
	osteos.	prosth	osteos.	prosth

Hertel R, et al. Predictors of humeral head ischemia after intracapsular fracture of the proximal humerus. J Shoulder Elbow Surg. 2004;13:427–33.)



In 4-part fx and some 3-part fx and fx-dx in old patients :
ORIF usually leads to a **poor outcome** as a result of osteonecrosis,
failure of fixation, posttraumatic arthritis, and stiffness



Cai M, Tao K, Yang C, Li S. Internal fixation versus shoulder hemiarthroplasty for displaced 4-part proximal humeral fractures in elderly patients. *Orthopedics*. 2012 Sep;35(9):

- **advantage in functional outcomes favoring shoulder hemiarthroplasty compared with ORIF with a locking plate**

Three- or four-part proximal humerus fracture identified preoperatively or intraoperatively

Patient medically unfit for surgery

Nonoperative treatment

Patient medically cleared for surgery

Valgus-impacted four-part fracture

Open reduction and internal fixation

Physiologically young patient with good bone stock

Physiologically old patient with poor bone stock

Hemiarthroplasty

Indications for primary hemiarthroplasty

- displaced four-part fractures in old patients
- Fx/dx with impaired vascular supply of the head fragment
- head-splitting fx involving $>40\%$ of the articular surface



hemiarthroplasty offers high subjective patient satisfaction despite moderate function

Three part fx-dx



Shoulder 4 part fx-dx

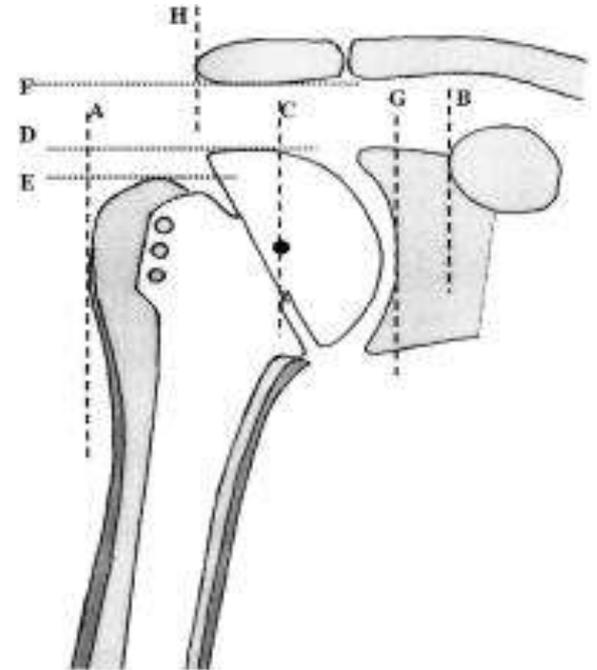


4 part fx-dx, prosthesis



Demirhan, Mehmet. et al. Prognostic Factors in Prosthetic Replacement for Acute Proximal Humerus Fractures. JOT ,Volume 17(3), March 2003, pp 181-188

- **Parameters influencing the clinical outcome:**
 - Preoperative delay
 - problems of tuberosity fixation
 - position of the tuberosities
 - humeral offset and head height





Failed previous fixation of proximal humerus fx



Conclusion

- Difficult Fractures
- Require skilled decisions
- Tuberosities position
- ORIF ?!
- Consider primary prosthesis?

