

KATOWICE, 04 grudnia 2015



POLISH SHOULDER CLUB MEETING

15 LAT KATEDRY I KLINIKI

ORTOPEDII I TRAUMATOLOGII NARZĄDU RUCHU SUM
oraz POLSKO-FRANCUSKIE SYMPOZJUM

CHIRURGIA BARKU



Shoulder Hemiarthroplasty for treating proximal humeral fractures

Aloplastyka połowicza w leczeniu złamań bliższego końca kości ramiennej

Michał Łaszczyca, Damian Kusz

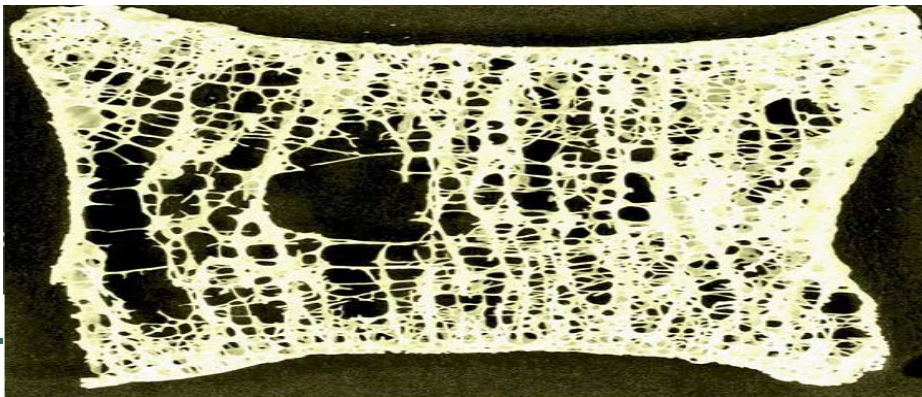
Katedra i Klinika Ortopedii i Traumatologii Narządu Ruchu
Śląskiego Uniwersytetu Medycznego w Katowicach
Kierownik: prof. dr hab. med. Damian Kusz

Proximal humeral fractures

Epidemiology

Incidence

- 5% of all fractures (third most common)
- 80% of all humeral fractures
- over 85% patients had low bone density
- 80% of cases affects women
- increases with age
- 8% lifetime risk of fractures for women > 60yrs

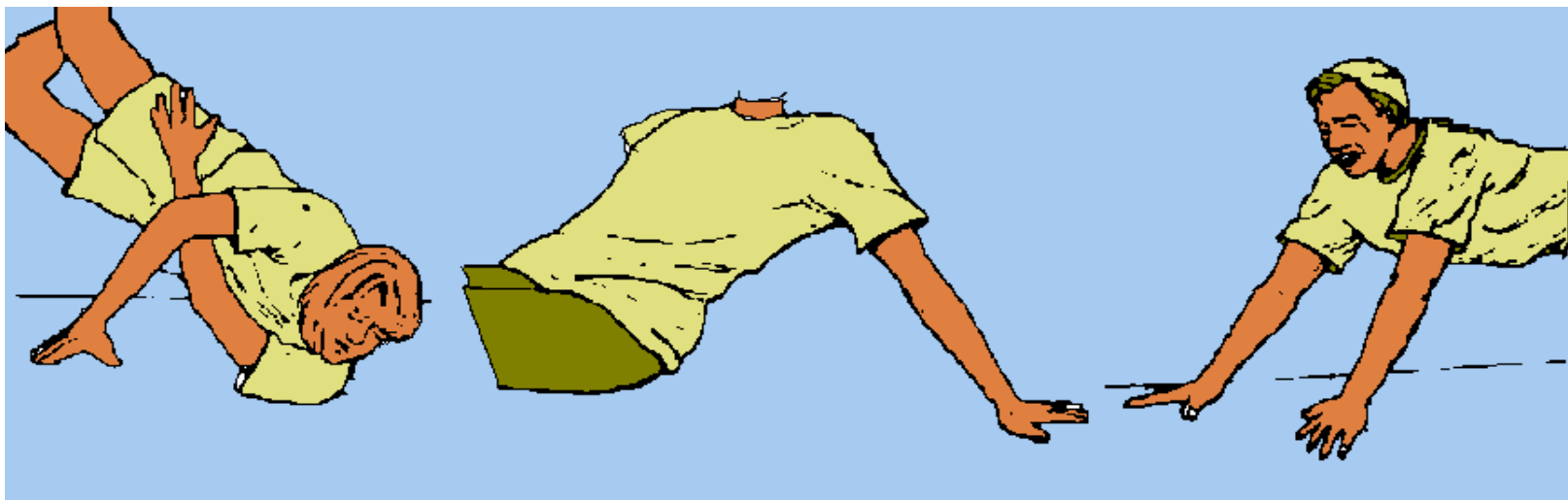


Proximal humeral fractures

Etiology

More frequently

- low energy injury (fall from a standing height, on the outstretched hand)
- elderly patients, usually females > 60 yrs



Less frequently

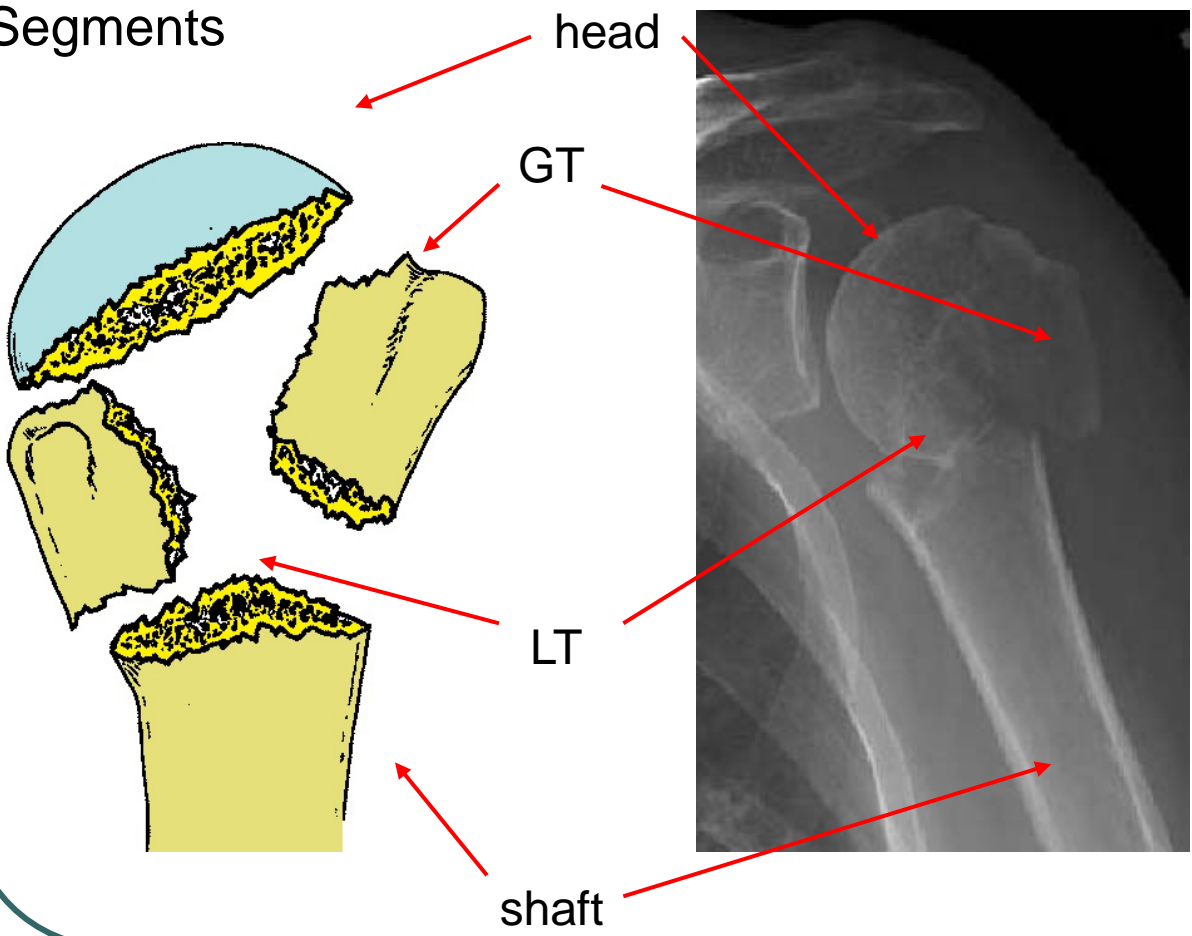
- high energy trauma (sports injury / car accident)
- younger patients, complex fracture patterns

Proximal humeral fractures

Anatomy

Fracture type

Segments



anatomical neck AN

surgical neck SN

greater tuberosity GT

lesser tuberosity LT

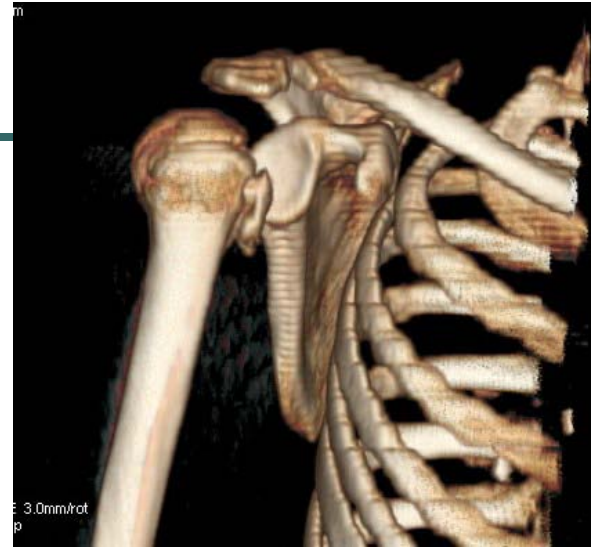
fracture dislocation

head split

Proximal humeral fractures

CT scans

3-D reconstructions



Proximal humeral fractures

Classification: Neer with modifications

- the most popular
- number of fracture parts: head / greater tuberosity / lesser tuberosity / shaft
- displacement = more than 10mm (GT >5mm) or 45° angulation, fracture-dislocation

1-part fracture (nondisplaced) 70-80%

2 -part fracture ~20%

3 -part fracture ~5%

4 -part fracture <5%

Articular surface

Head splitting

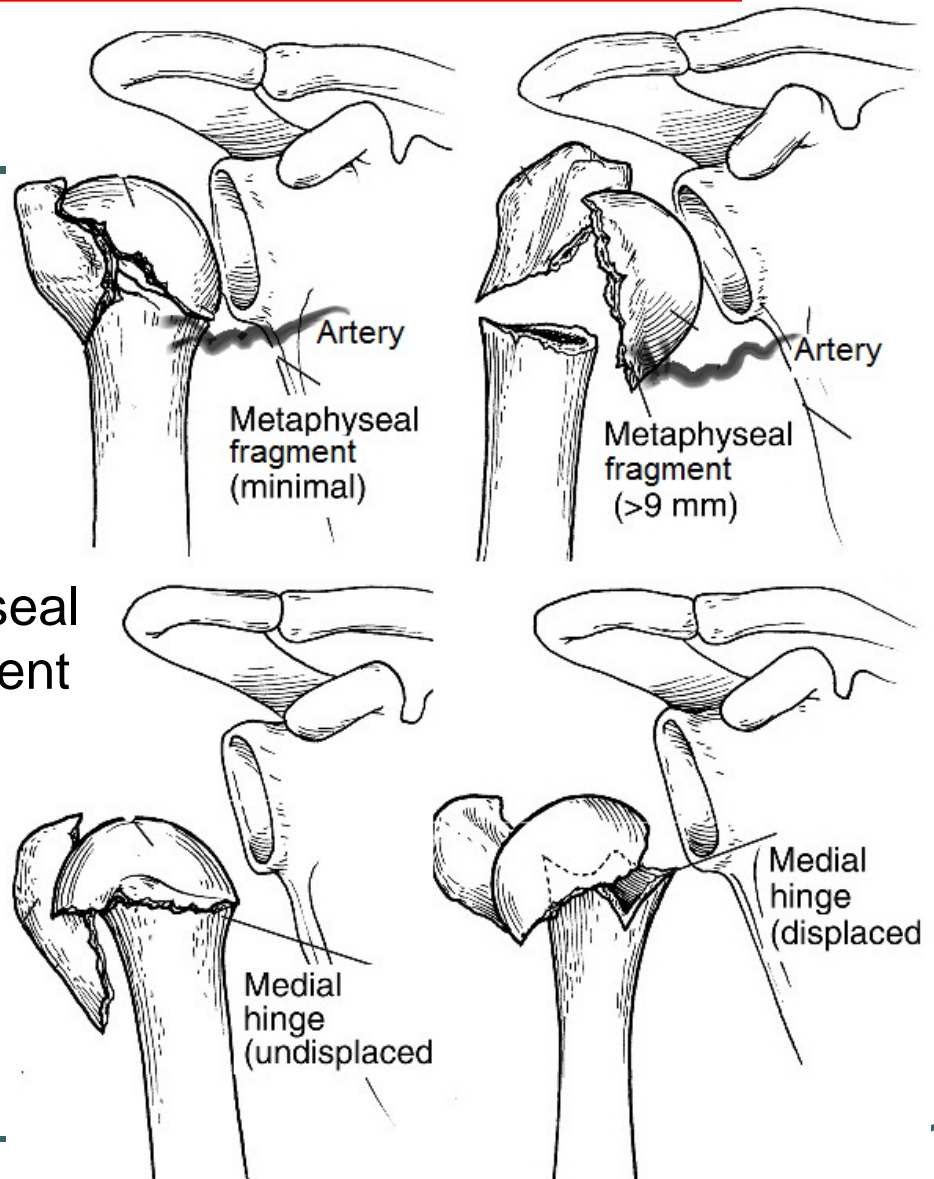
| Anatomical neck | Surgical neck | Greater tuberosity | Lesser tuberosity | dislocation | |
|-----------------|---------------|--------------------|-------------------|-------------|--|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Proximal humeral fractures

Classification: Hertel

Predictors of humeral head ischemia

- disruption of medial hinge
- length of dorsomedial metaphyseal spike attached to the head fragment



Proximal humerus blood supply

Vessels

anterior humeral circumflex

posterior humeral circumflex

arcuate

rotator cuff tendon vessels

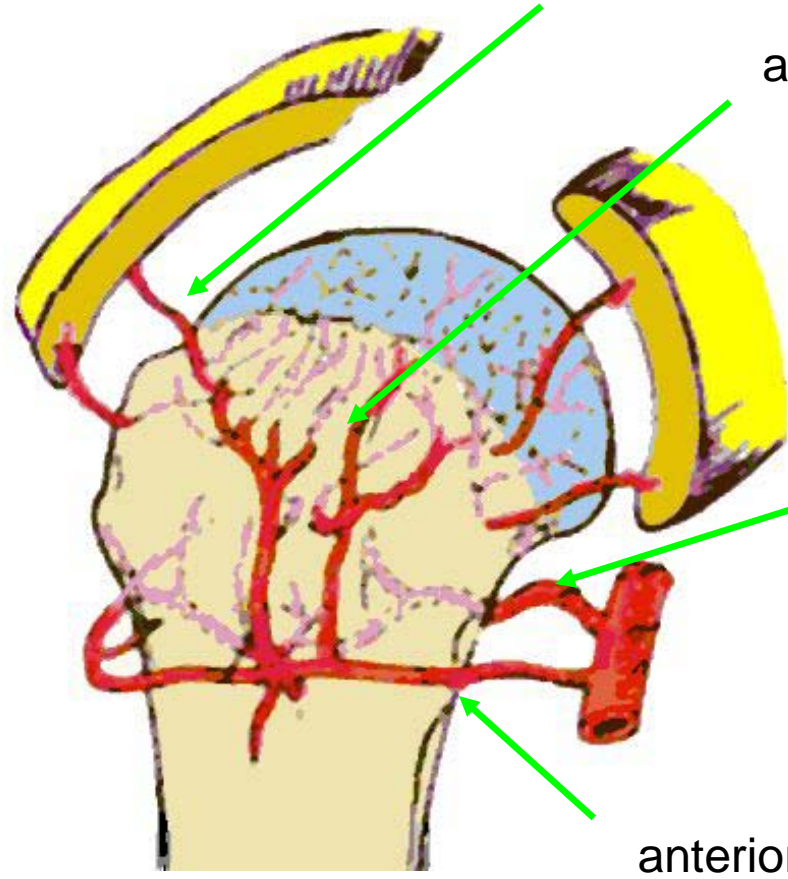
periosteal

rotator cuff tendon vessels

arcuate

posterior humeral circumflex

anterior humeral circumflex



Proximal humerus - Avascular necrosis

Avascular necrosis of the humeral head - AVN

Vascular disruption more likely with

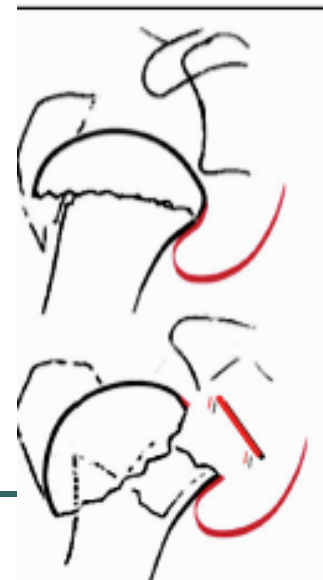
- soft tissue displacement and
- higher energy fractures

Factors related to humeral head ischemia

- + metaphyseal head fragment extension < 8 mm,
- + medial head disruption > 2 mm
- + fracture with dislocation
- + head-split components
- = all - 97 % predictive for head ischemia

Fracture nonunion and tuberosity reabsorption

- injury of the arcuate + extraosseous collateral circulation
- anterior + posterior humeral circumflex vessels disruption





Proximal humeral frx - Treatment

Treatment algorithm

Decision :
 + patient factor
 + injury factor

| Young (<50 yrs) | Middle age (50–70 yrs) | Elderly (>70 yrs) |
|-------------------------|------------------------------|--|
| <u>Nonoperative</u> | <u>Nonoperative</u> | <u>Nonoperative</u> |
| 1-part | 1-part | 1-part 2-part (some) 3-part (some) |
| <u>Operative (ORIF)</u> | <u>Osteosynthesis (ORIF)</u> | <u>Osteosynthesis (ORIF)</u> |
| 2-part | 2-part | 2-part |
| 3-part | 3-part | 3-part |
| 4-part | 4-part | |
| Head split | - | <u>Arthroplasty</u> |
| Fracture-dislocation | <u>Arthroplasty</u> | 3-part (some) |
| | Head split | 4-part |
| | Fracture-dislocation | Head split |
| | | Fracture-dislocation |

Proximal humeral - Treatment

Proximal humeral fractures - Treatment

Non-operative treatment

75–85% are minimally displaced
- successfully treated without surgery

15-20% are comminuted or displaced
- require surgical intervention



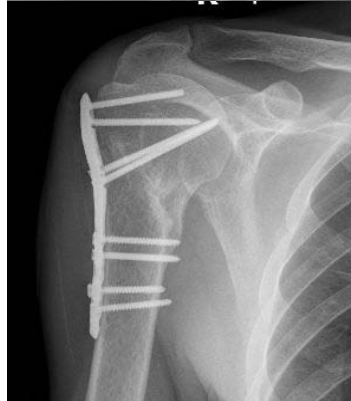
Proximal humeral - Treatment

Treatment

Closed reduction and percutaneous fixation



Open reduction and interlocking plates



Proximal humeral nailing



Complications

- nonunion
- displacement
- osteonecrosis (20-50%)
- screw cut-out



Proximal humeral - hemiarthroplasty

Shoulder hemiarthroplasty 40% of operated fractures

Indications:

patient

- better than fixation in >70 y.o.
- better than reverse arthroplasty in young

facture

- 4 part fractures
- 3 part with poor bone quality or risk of AVN
- head split, destruction of articular surface
- failed previous surgery
- avascular head necrosis

Contraindication

- coracoacromial ligament deficiency
- glenoid arthrosis
- rotator cuff deficiency



Proximal humeral - hemiarthroplasty

Shoulder hemiarthroplasty – timing

The time from injury to surgery

--**acute <4 weeks** – much better outcomes

--**late/chronic >4 weeks** - risk of capsular stiffness, rotator cuff insufficiency and AVN



Proximal humeral - hemiarthroplasty

Shoulder hemiarthroplasty – anatomy

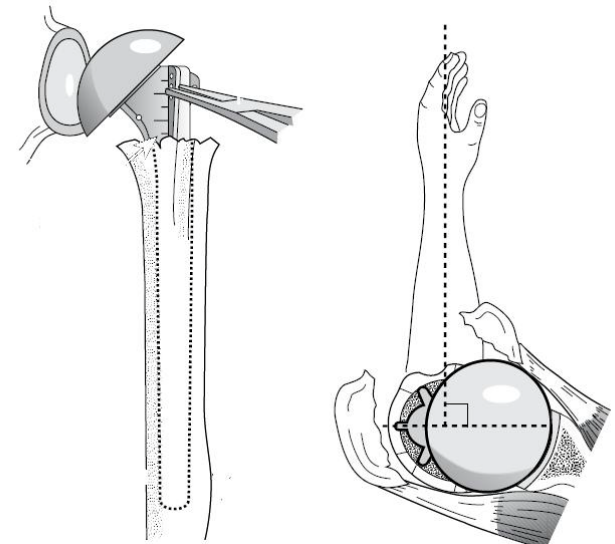
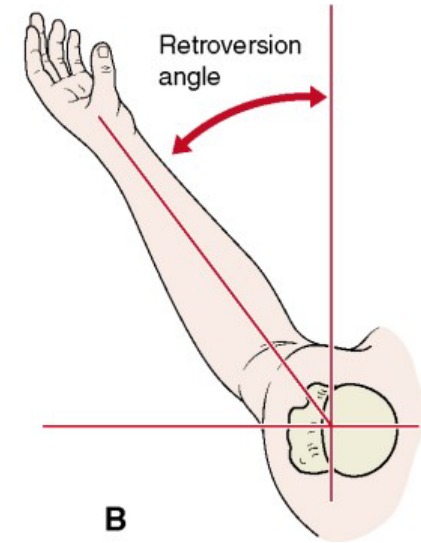
Restore function and imitate natural anatomy

Natural head

- diameter ~ **46 mm** (37mm - 55mm)
- height ~ **8 mm** superior to the greater tuberosity
- **30°** of retroversion (6.7° anteversion – 47.5 ° retro),
- inclination 130° to the shaft

Prosthetic head size and positioning

- diameter **40-48 mm**, similar to the removed head
- top - **55mm** over margin of pectoralis major tendon
- **20° -30°** of retroversion



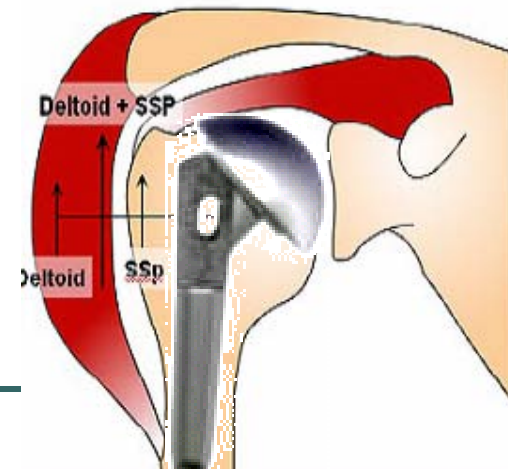
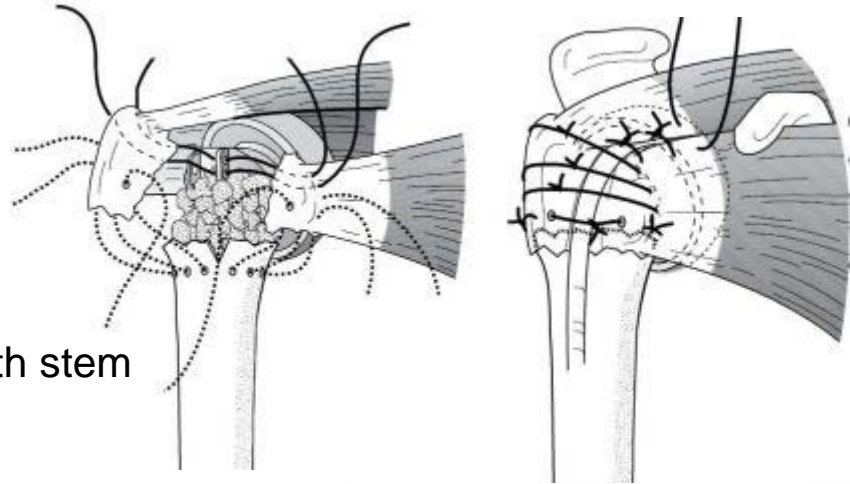
Proximal humeral - hemiarthroplasty

Shoulder hemiarthroplasty – anatomy

Tuberosity healing is the main condition for success

Positioning

- anatomic reduction
- fixation with each other, with shaft and with stem
- bone grafting
- greater tuberosity – 10mm below articular surface of head
- GT malposition and malunion
postero-superior displacement ↑ deltoid force 29 %



Proximal humeral - hemiarthroplasty

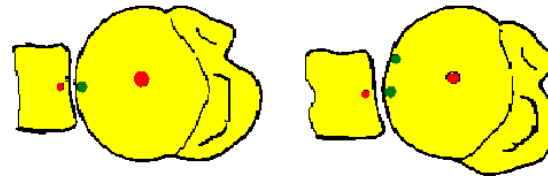
Shoulder hemiarthroplasty – biomechanics

Imitate natural biomechanics

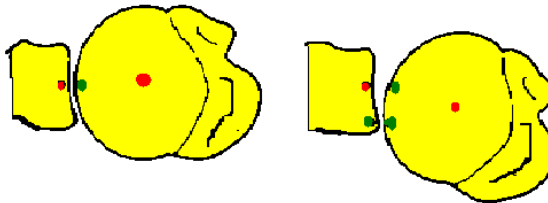
Kinematics

1. Flexion/Extension
2. Abduction/Adduction
3. Medial/Lateral Rotation

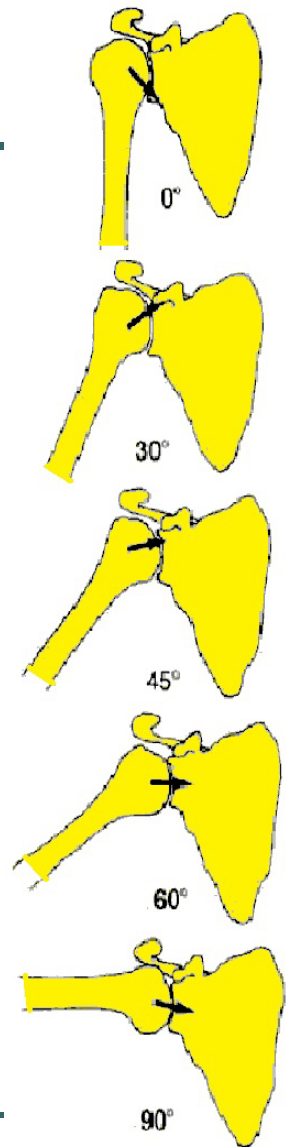
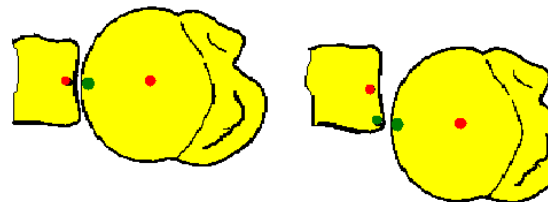
1. Rotation - spin
(pure flexion/ext)



2. Rolling
(Abduction/Adduction)



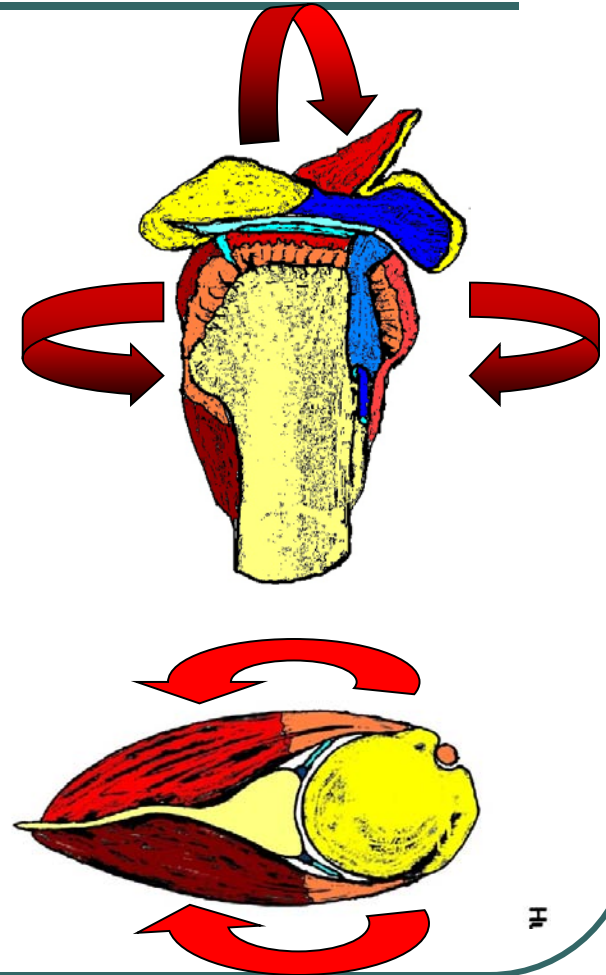
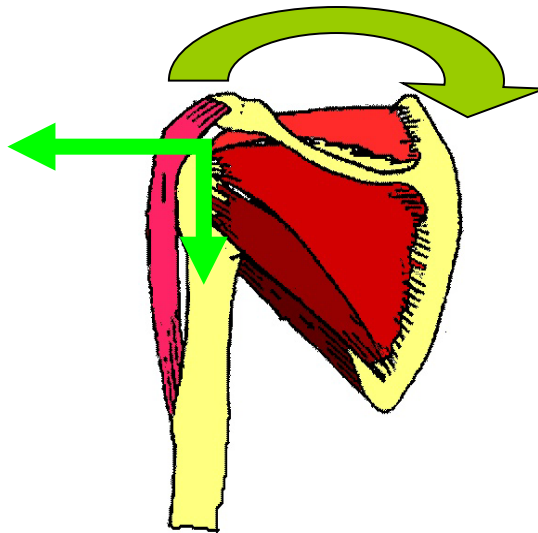
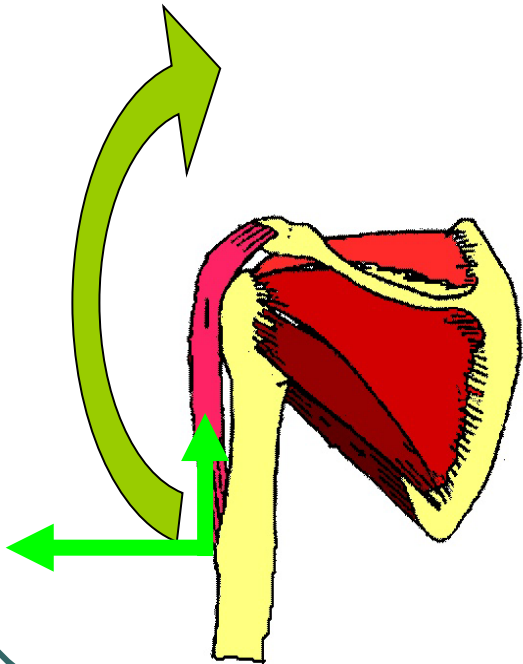
3. Sliding
(MedRot/LatRot)



Proximal humeral - hemiarthroplasty

Shoulder hemiarthroplasty – muscle function

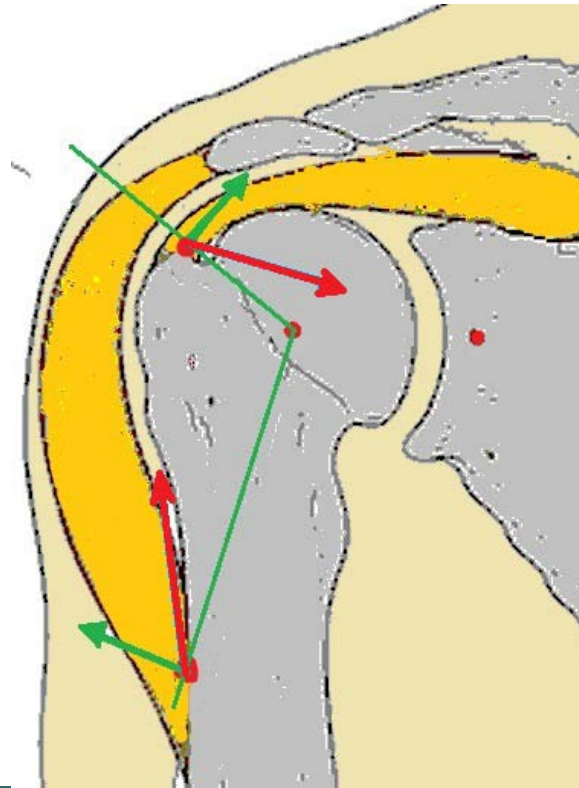
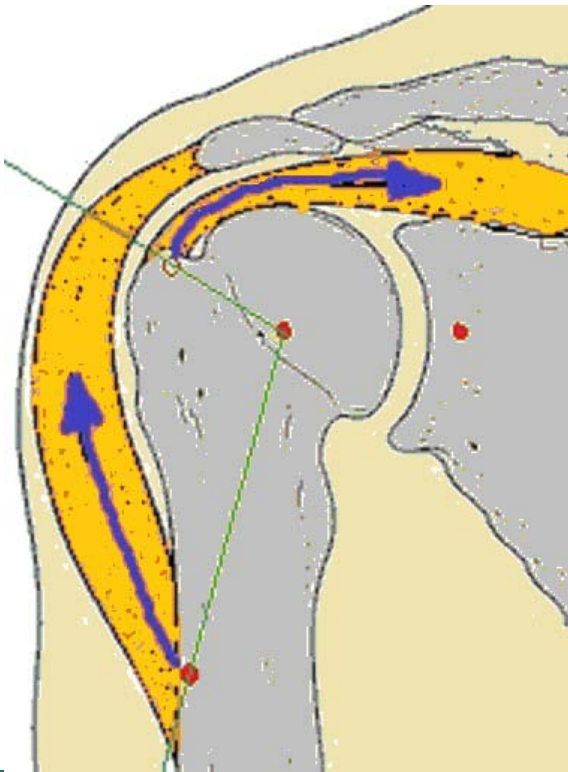
Appropriate tuberosities and cuff reconstruction provides stability and mobility of the prosthesis



Proximal humeral - hemiarthroplasty

Shoulder hemiarthroplasty – muscle function

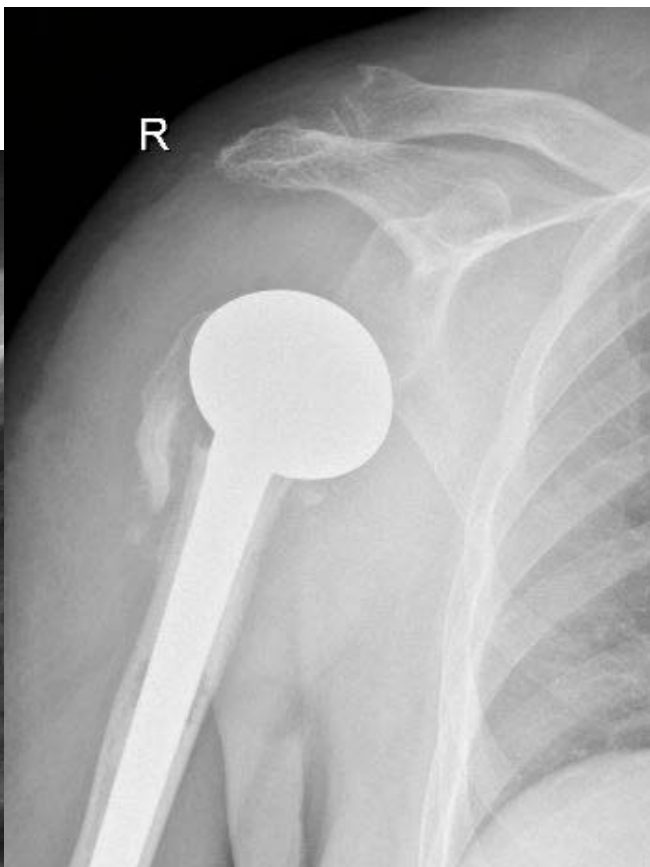
Superficial and deep muscles of the shoulder - balanced forces
- axis, rotation center



Hemiarthroplasty

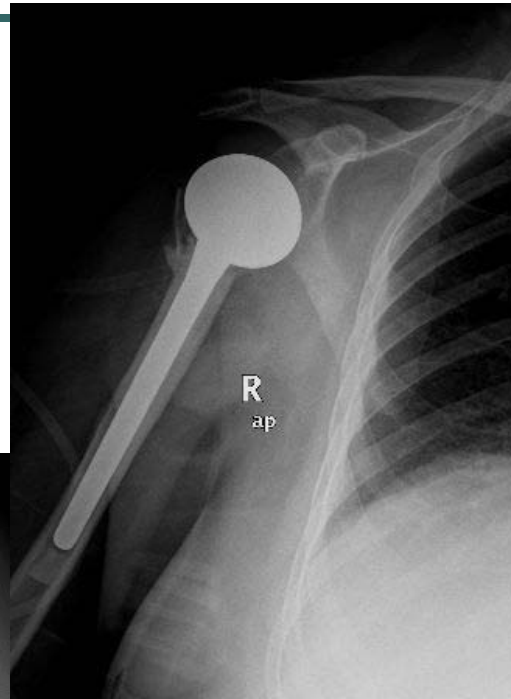
Clinical decisions

case #1
B.K. male 71
3part/nonunion



Hemiarthroplasty

Clinical decisions

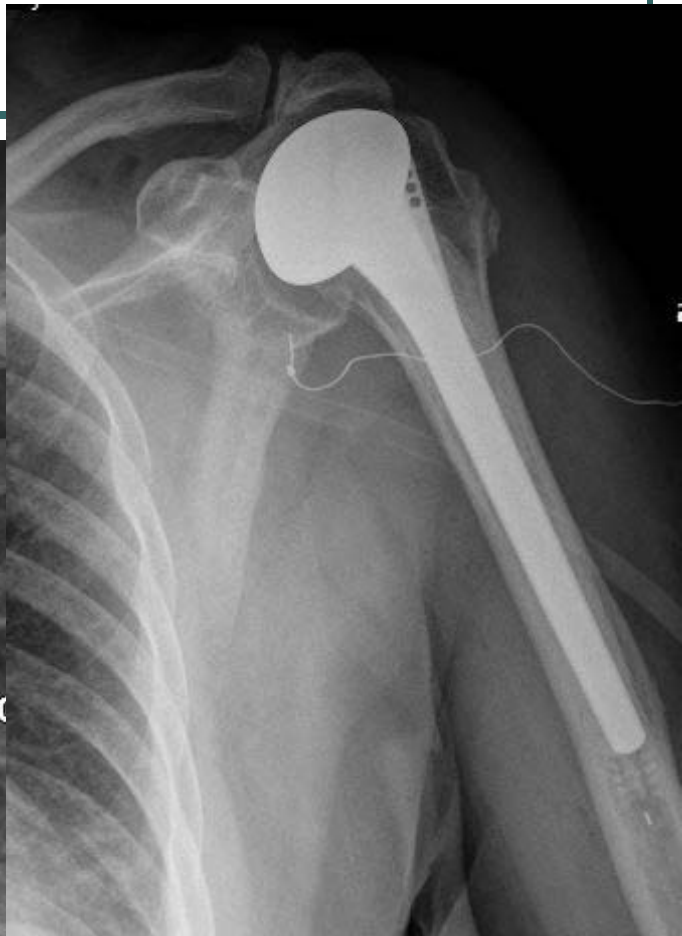


case #2
K.I. female 74
4part/med. hinge

Hemiarthroplasty

Clinical decisions

case #3
P.K. female 70
AN+GT



Hemiarthroplasty

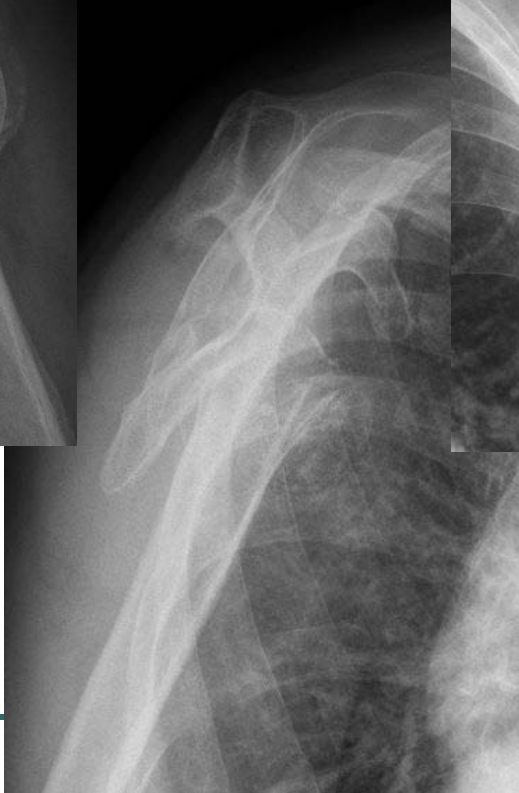
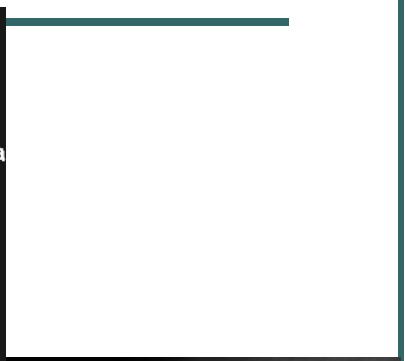
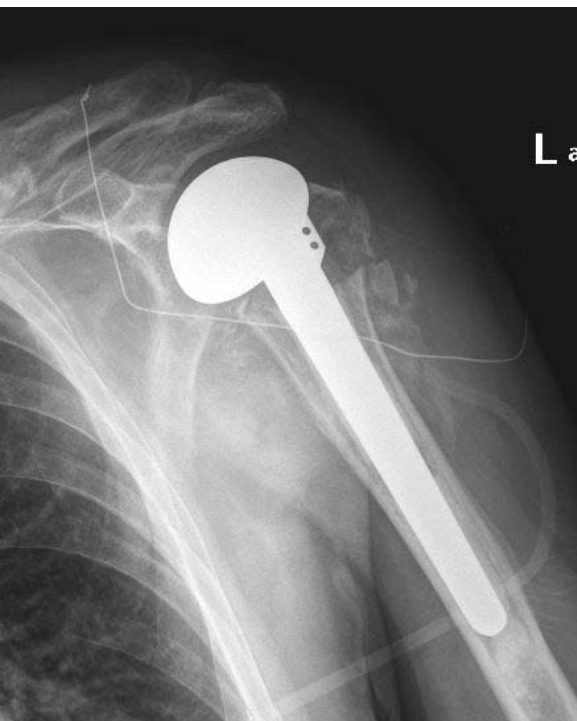
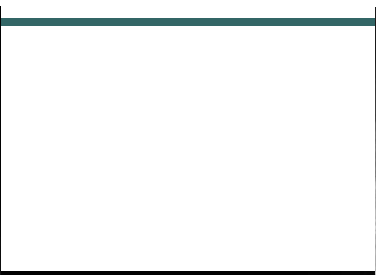
Clinical decisions

case #4
J.K. female 68
4part



Hemiarthroplasty

Clinical decisions



case #5
S.F. female 62
head split/disl.

Hemiarthroplasty – problems

Inappropriate implantation

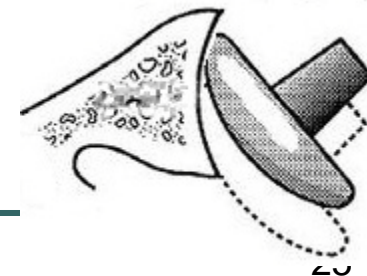
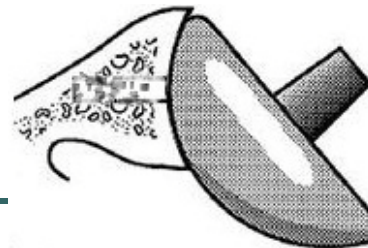
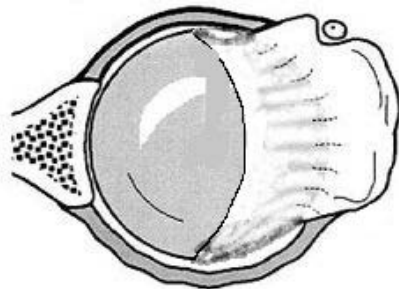
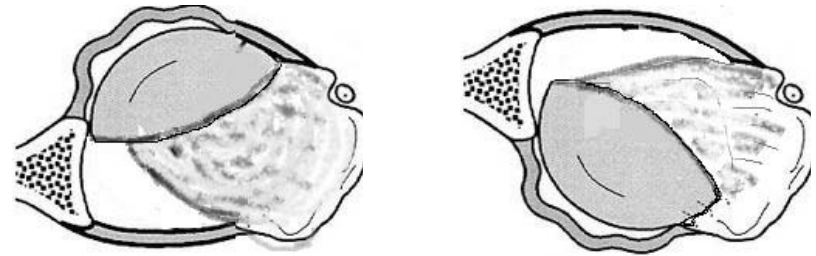
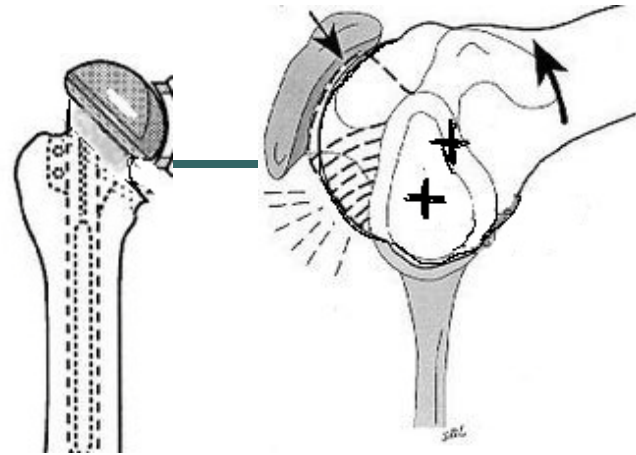
stem

- too short → inferior subluxation and instability
- too high → subacromial impingement and decreased ROM

- excessive anteversion → anterior instability
- retroversion → posterior instability

head diameter

- too large → stiff joint
- too small → glenoid damage and instability



Hemiarthroplasty – Outcomes

Good result

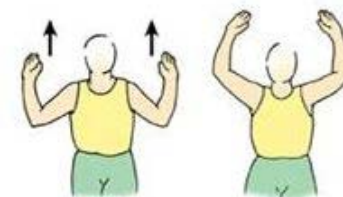
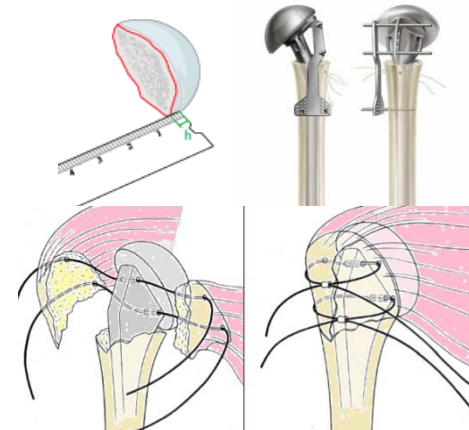
-treatment selection (fracture, age, time from injury)

-prosthesis selection (status of the rotator cuff),

-optimal implant positioning

-optimal management of tuberosity fixation,

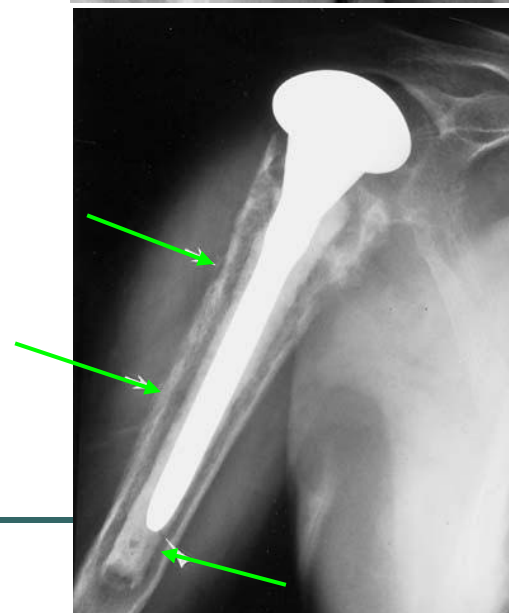
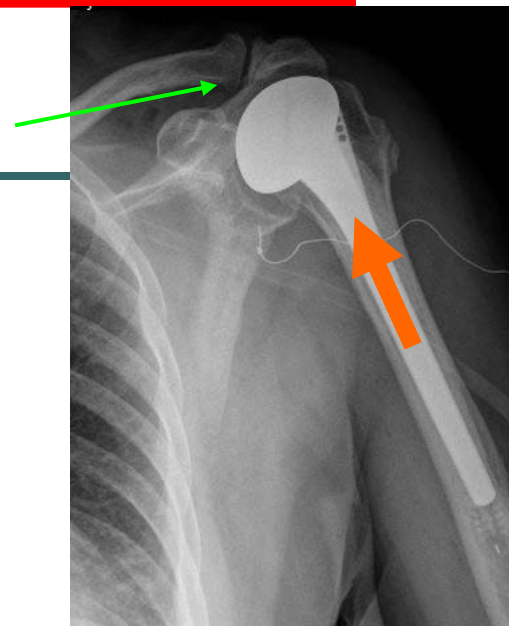
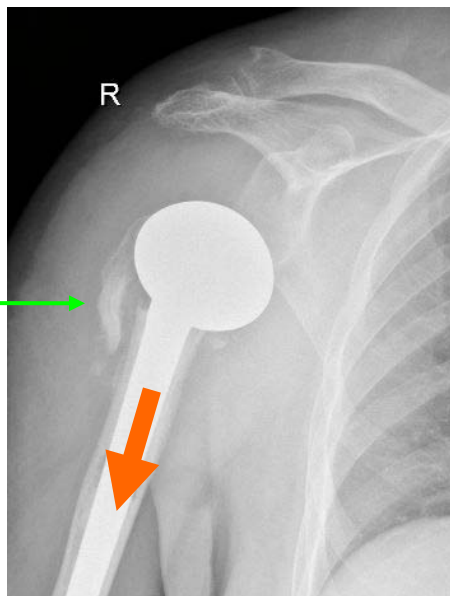
-appropriate rehabilitation protocol



Hemiarthroplasty – Complications

Hemiarthroplasty complications

- joint stiffness
- rotator cuff dysfunction
- superior migration of the prosthesis
- instability
- tuberosities nonunion,
- glenoid arthrosis,
- stem loosening
- humeral periprosthetic fracture
- infections



Hemiarthroplasty – Complications

Reverse Total Arthroplasty

Fortunately, we have one more solution ...



Hemiarthroplasty



Thank You for Your Attention