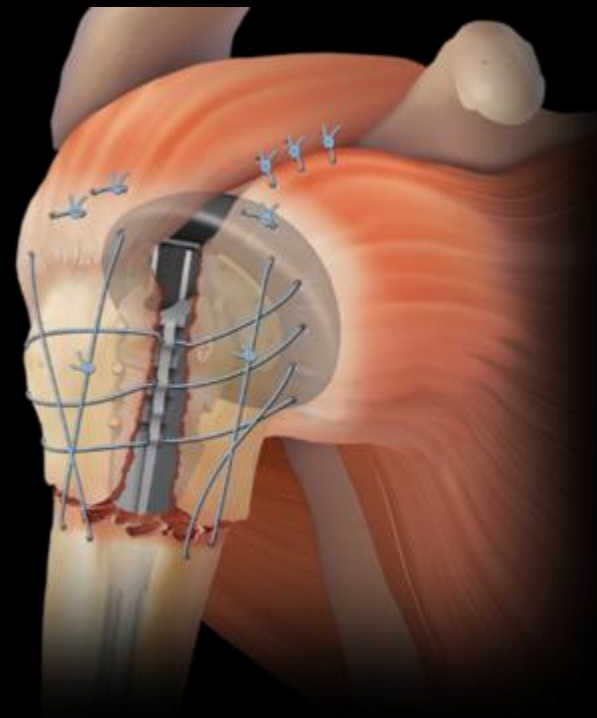
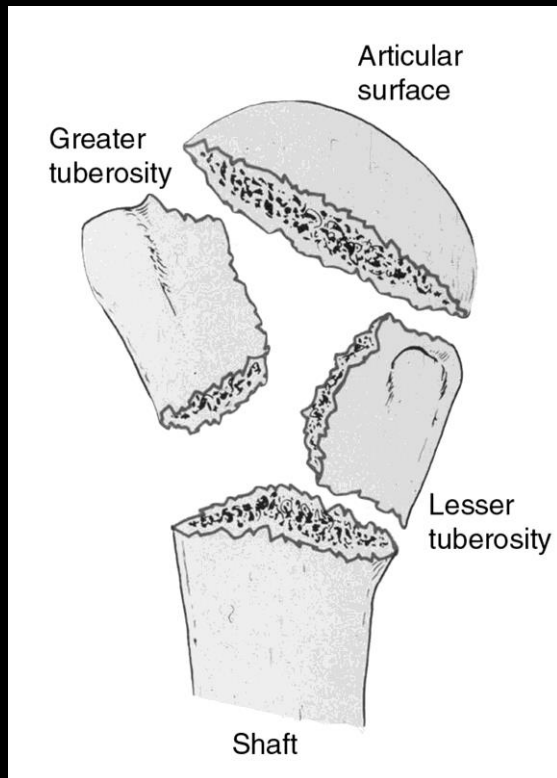
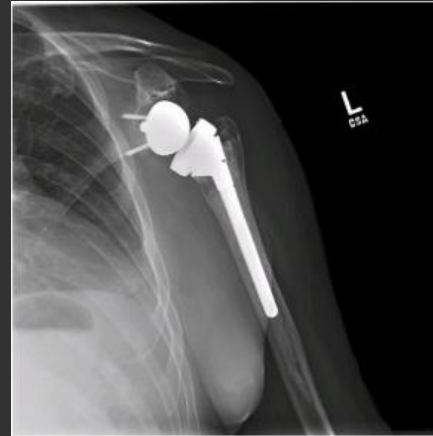


# Shoulder Hemi-Arthroplasty for fracture of the proximal humerus



# Therapeutic considerations



# Predictors of humeral head ischemia

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- Posteromedial metaphyseal extension > 8mm
- Disruption of medial hinge > 2mm
- Acute ischemia may not predict AVN

Hertel JSES 2004

Hertel JSES 2008



# indications

---



4-part fracture



Fracture with shoulder dislocation

4 - part fx in older Individuals

# indications

---



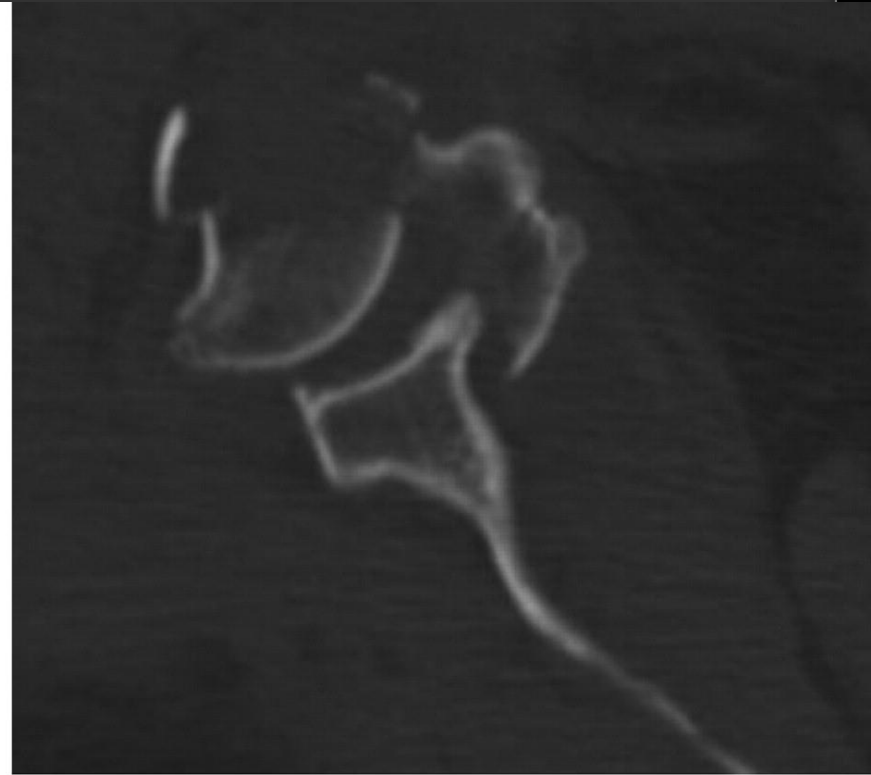
3 part fx associated with osteopenia

# indications

---



**A**

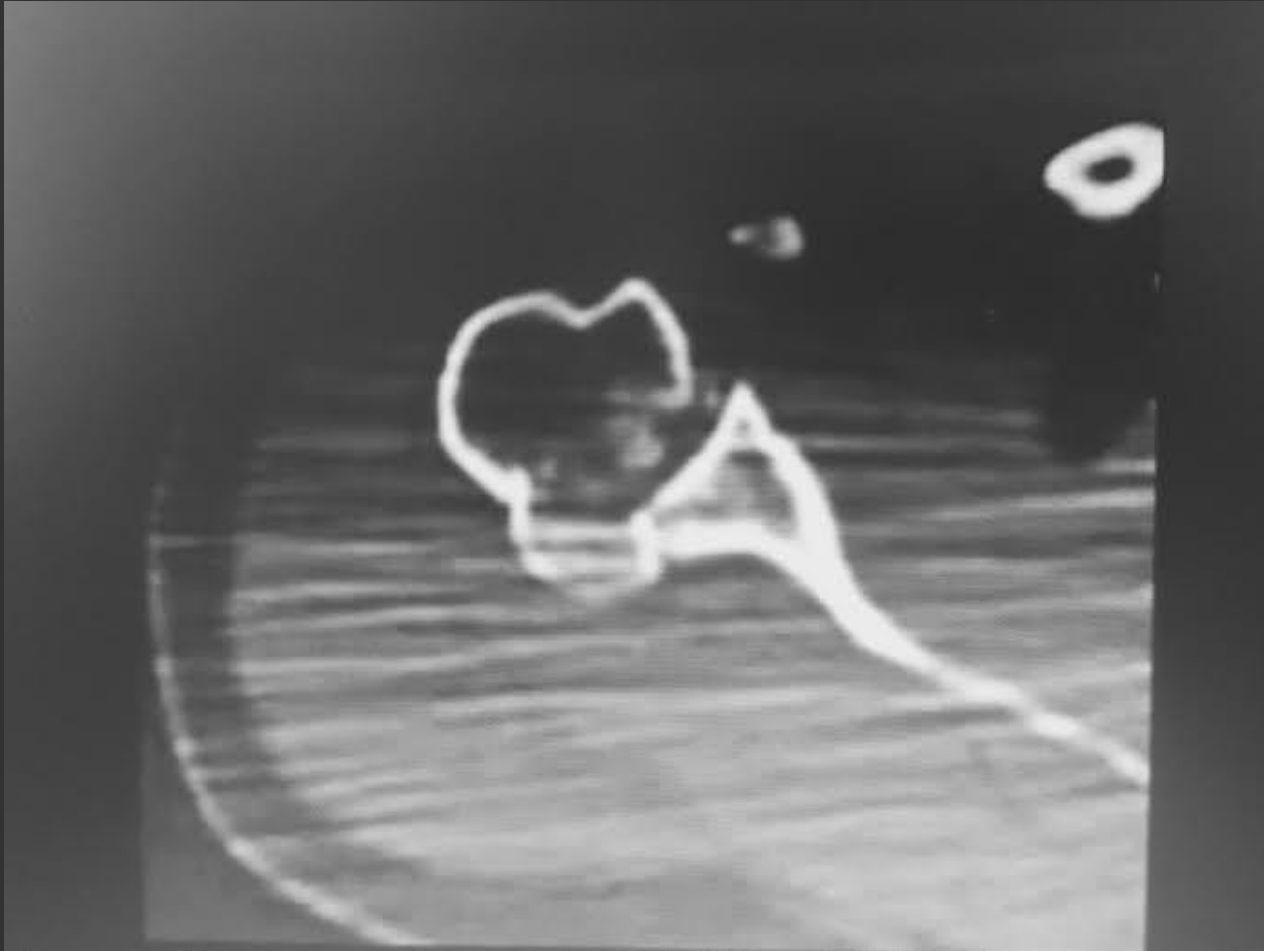


**B**

Head split fx

# indications

---



Impaction fx > 40% of articular surface

# indications

---



Anatomic neck fx



# Timing of surgery

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- Ultimate functional outcome-Dependent
- Best time: 6-14 days
- Untreated fracture > 4wks is considered chronic sequelae and no longer considered acute

Dines JSES 1993

Boileau CORR 2006

Smith JSES 2007

# Technique sensitive procedure

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- Flattow et al
- 23000/year shoulder arthroplasties
- ~45% for fractures
- 78% done by surgeon doing 1 or 2 /year
  - Limited experience
  - Difficult reconstructions HA and now reverse TSA

# Successful Conventional Arthroplasty for fractures

---

- Depends upon:
  - Patient selection and evaluation of the fracture configuration
  - Dedicated fracture implants
  - Appropriate surgical technique
  - Proper Rehab

# Evaluation of fracture pattern

---

- Displacement, **comminution** and **bone quality**
- Configuration (Neer) “lesser tuberosity”
  - Proper x-rays= Trauma series axillary view
  - CT scan
  - Scanogram

# Successful Conventional Arthroplasty for fractures

---

- Depends upon:
  - Patient selection and evaluation of the fracture configuration
  - **Dedicated fracture implants**
  - Appropriate surgical technique
  - Proper Rehab

# Fracture specific Implant considerations

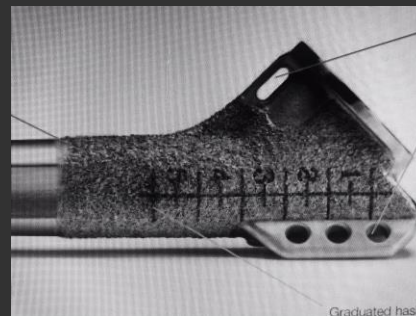
## Current concepts

- **Stem design:**

- Low profile
- Anterolateral fins to fix the tub properly
- Medial and lateral fixation holes
- Graduation markings

Facilitates tuberosity positioning,  
fixation and healing

Improves component positioning



# Successful Conventional Arthroplasty for fractures

---

- Depends upon:
  - Patient selection and evaluation of the fracture configuration
  - Dedicated fracture implants
  - **Appropriate surgical technique**
  - Proper Rehab

## Successful technique in arthroplasty for fracture

---

- **Keys to success**
  - Preservation of deltoid origin/function
  - Proper component placement and fixation
  - Tuberosity reconstruction and healing



## Proper Humeral Length

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- ✓ Pre-Op evaluation
- ✓ Intra-Op assessment
- ✓ Fracture positioning jigs
- ✓ Length matters for ROM, stability and proper tuberosity repair

*Boileau, Walch JSES 2002*

# Proper Humeral length Pre-Op measurement

## Template

Mark the medial calcar

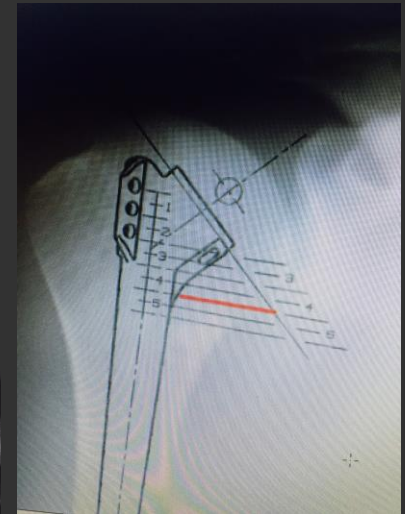
Superimpose the pathologic x-Ray on normal side x-ray in same rotation

Mark normal side

Template normal side

- Read off height
- Utilize that height number during insertion of implant as it corresponds to gradation markings on implant or fx jig

Template head size as well



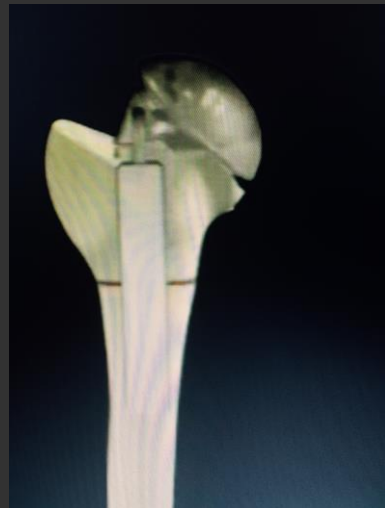
# Proper Humeral length Intra-Op measurement techniques

**Access intra-articular calcar loss**

**Positioning sleeve/ Fracture jig many available**

**Pectoralis major tendon reference;insertion to top of head intra-op**

**check 5-6cm**



**JP Warner 2006**

- **Implant Height**

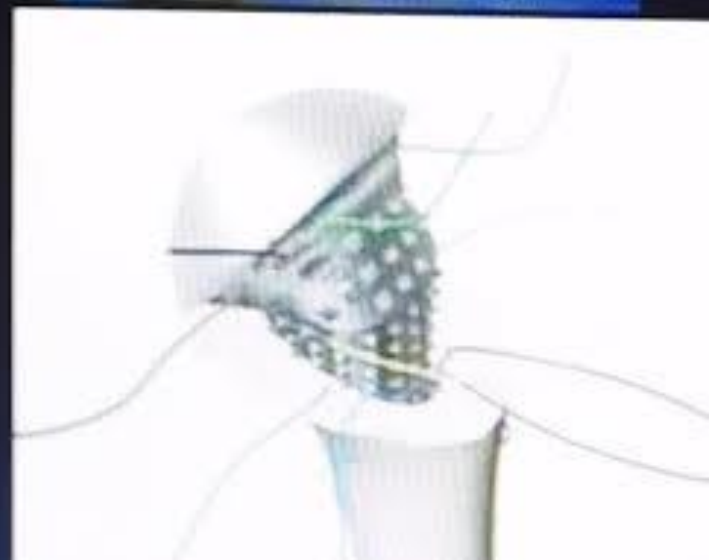
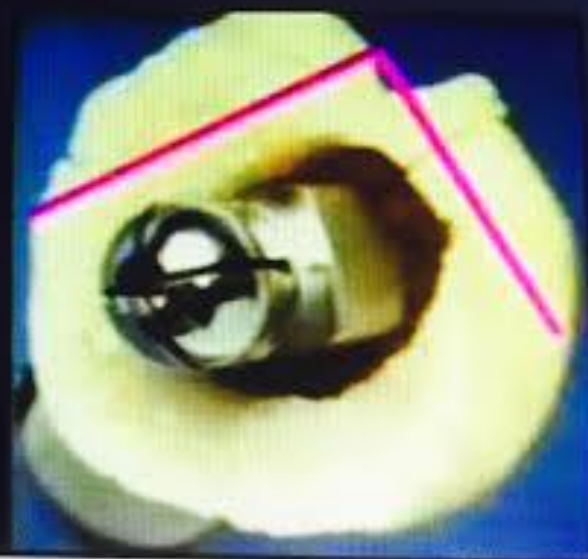
- PHH: Pectoralis-Humeral Head Height<sup>1</sup>



# Principles of Tuberosity Fixation

## Proper Tuberosity Positioning

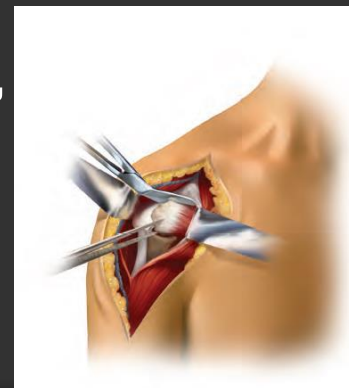
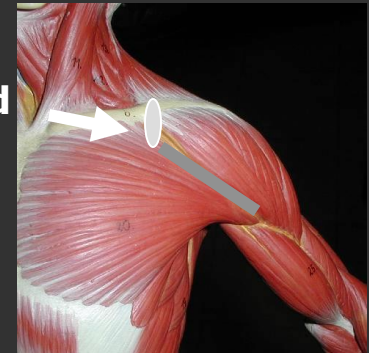
- 90° Orientation of Tuberosities to one another
- Suture Lattice Reconstruction<sup>5</sup>



# Surgical Technique

- Regional and general anesthesia
- Semi-Beach chair positioning
- Lateralized to allow Add/Ext of humerus
- Deltopectorel approach
- LHB Landmark- Fx slightly posterior
- Open groove and interval
- Deconstruct Fracture
  - Elevator in fracture site to dislodge fragments
  - Open interval
  - Separate and isolate tuberosities, head fragment and shaft
  - Remove head fragment

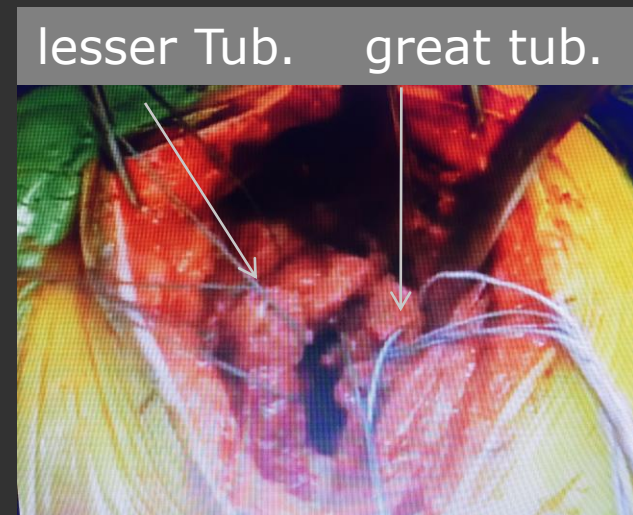
Coracoid



# Surgical Technique

- Isolate GT and LT with #5 non-absorbable sutures or fiberwire bone tendon insertion
  - Later used in tuberosity reconstruction
  - 3 or 4 in Greater tuberosity
  - 2 in lesser tuberosity

Assess Glenoid





# Isolate and prepare the humeral shaft

- Isolate
- Ream to “chatter”
- Fracture positioning device
- Shaft sutures



# Fracture placement sleeve

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- Ream canal to size
- Ream jig guide to height number
- Place fracture jig to number
- Cement sized stem (after suture placement)

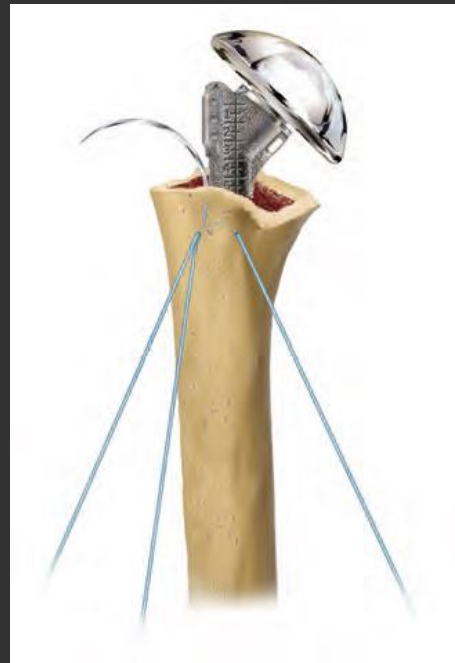




# Humeral Preparation

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- **Prior to cementing place humeral shaft sutures for later tuberosity reconstruction**
  - Longitudinal
  - Figure of 8



# Humeral Preparation Proper Retroversion

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- “Proper Retroversion does matter”  
Boilleau
- Proper version- 20→40 deg (I prefer 30 deg)
- Instrumentation
  - External Rotate the lower arm to desired degrees +10 deg carrying angle for elbow) for retroversion required
  - Using inserter as ER guide

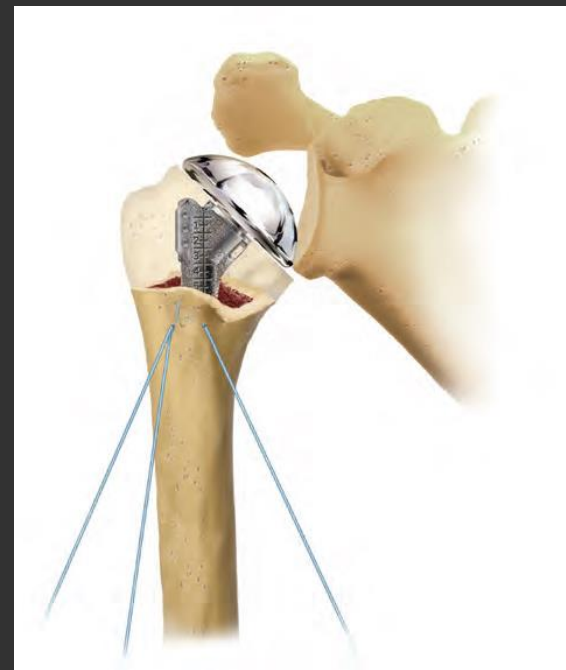
# Humeral Preparation Proper Retroversion



# Humeral fracture stem placement

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- Cement component at proper humeral height (length) and version
- Cement gun low pressure
- Clean cement off exposed prosthesis



# Humeral Head Replacement

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- Size resected head fragment
- Dummy prosthesis trial reduction
- 50% ant,post, inferior override and clear acromion at 90 deg
- Place real HH component

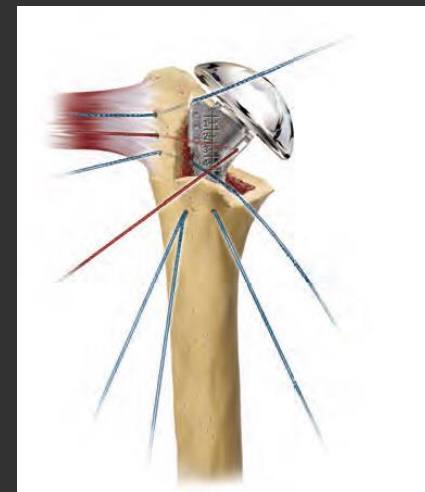


# Tuberosity Reconstruction

---

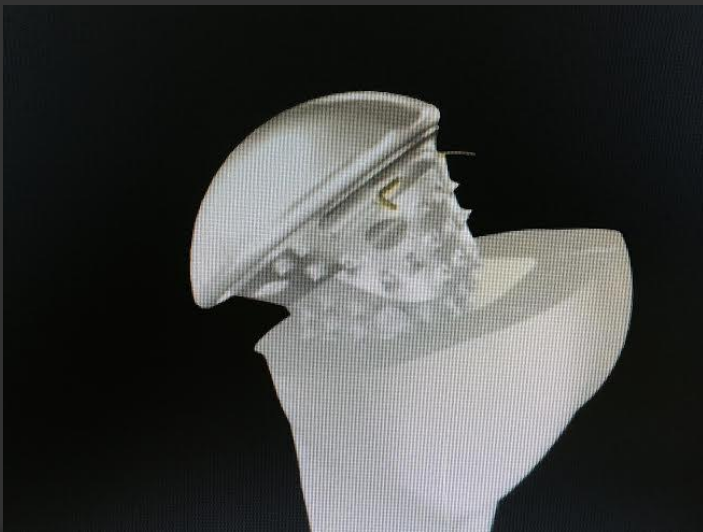
## Principles

- Tuberosity reconstruction critical
- Tuberosities must heal to humeral shaft and themselves for proper cuff function
  - 5-9mm below superior aspect of prosthetic head
  - All sutures are placed before repair takes place
  - Bone graft from head fragment



# Tuberosity Reconstruction

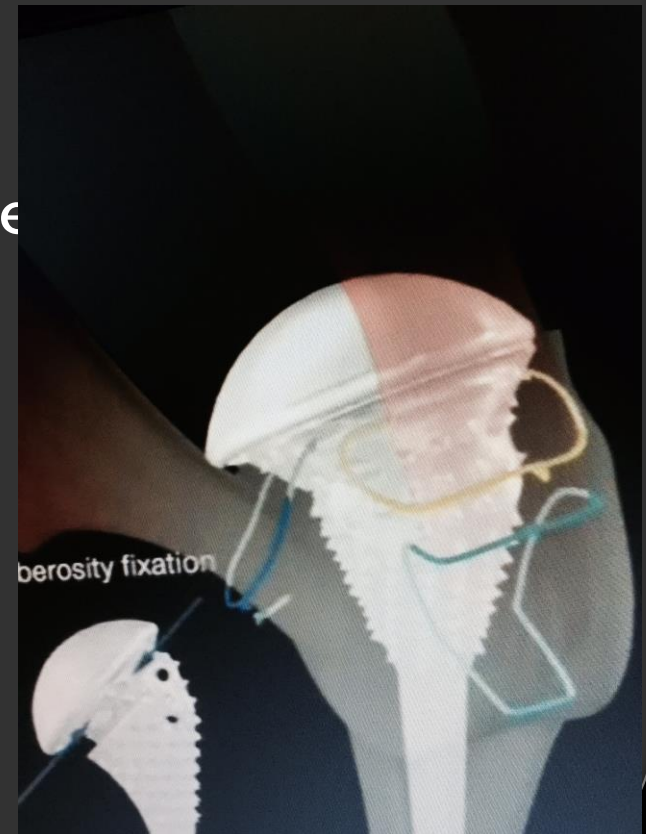
- Fix greater tuberosity to humeral shaft and around the prosthesis
  - Transverse
  - Posterior longitudinal suture
- ◉ Place tuberosity below the top of the humeral head (5-9mm) best result
- Sutures placed around prosthesis through slot
- Greater tuberosity place and fixed



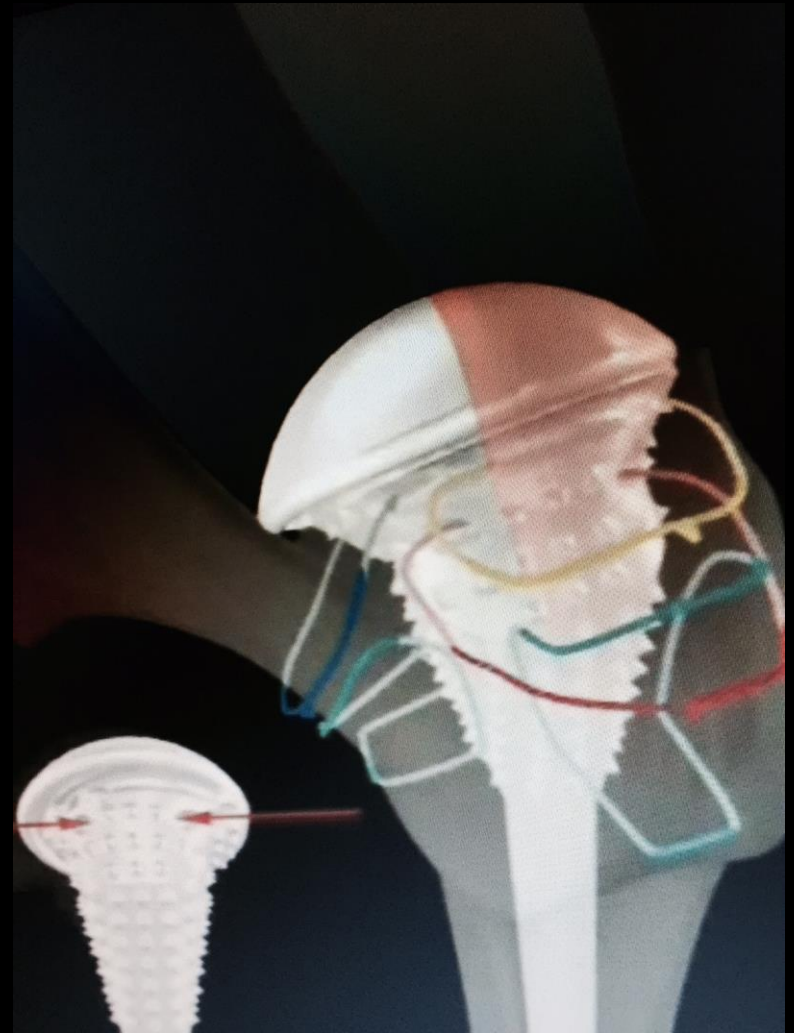
# Tuberosity Reconstruction

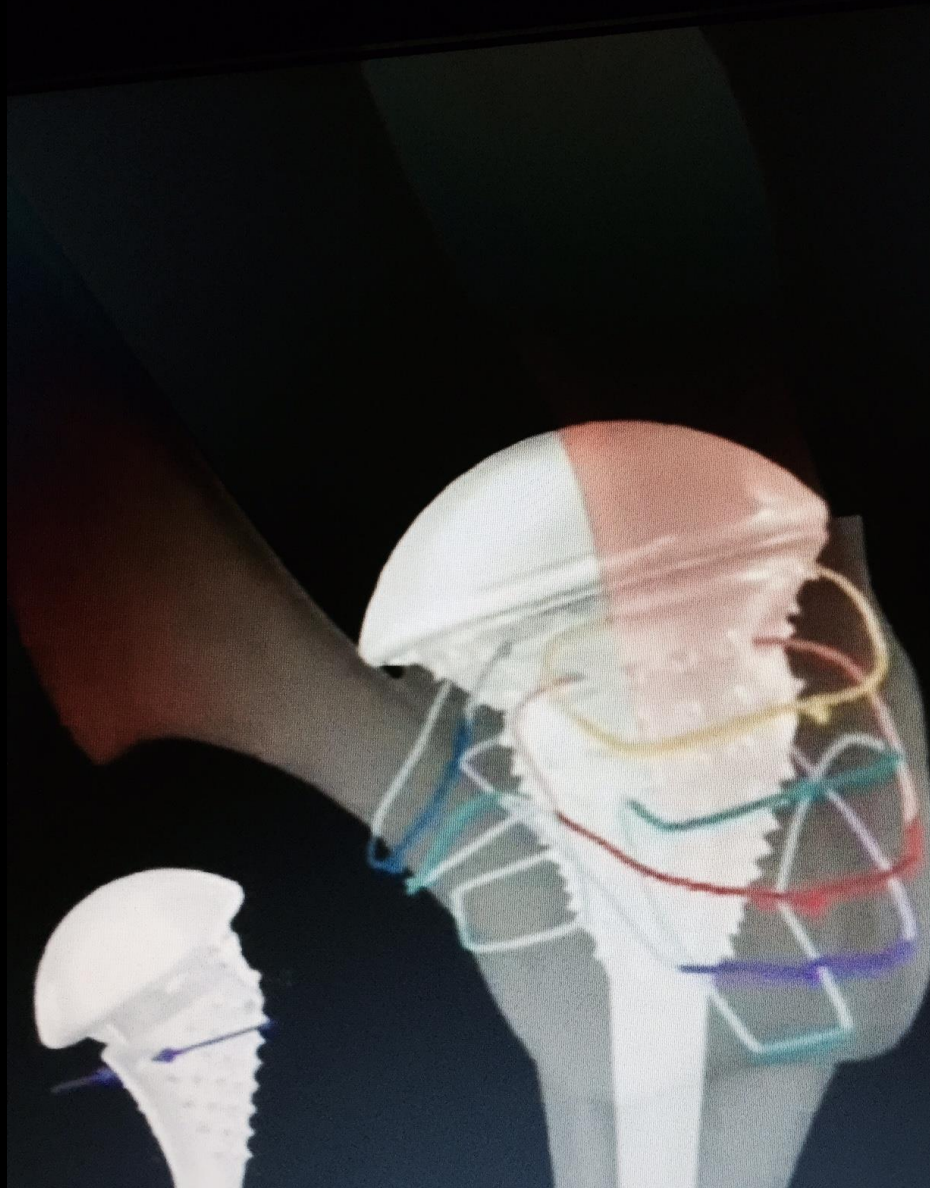
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- Lesser tuberosity reattached
  - 2 transverse sutures #5
  - Bone graft
  - Figure of 8 tension band
- Tuberosity reconstruction complete with figure of 8 tension band



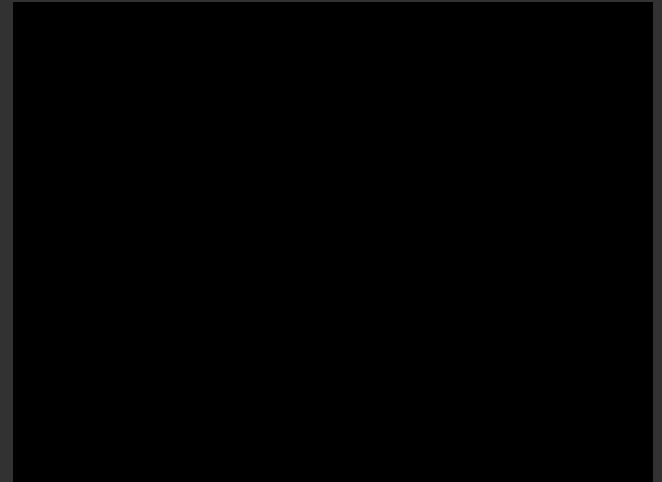






# Tuberosity Reconstruction

- **Assess stability and fixation of the reconstruction**
  - Moves as solid unit
  - Clears acromion at 90 deg ABD
- **Safe PROM for rehab**



# Hemiarthroplasty results

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- **Depend upon tuberosity placement and healing**
  - **Frankle-Head to tuberosity distance of**
    - 6-9mm Best ASES
    - >13mm Worst ASES
  - **Cuomo, Zuckerman**
    - 10mm best outcome
  - **Mighell et al, Dines , Elmes et al**
    - Transverse and longitudinal fixation constructs better results
- **Inferior positioning of tuberosities (>20mm) compromises function of Rotator Cuff**
  - **Huffmann et al, JSES 2008 (Neer Award)**

# Rehabilitation

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- PROM defined by “safe” stable ROM in OR started immediately
- In severe osteoporotic bone maintain in a sling for 3-4 wks
- Shrugs, elbow, wrist and hand ROM early
- AAROM 4-6 wks with tuberosity healing on x-ray
- Strengthening 8-12 wks

# Hemiarthroplasty Results

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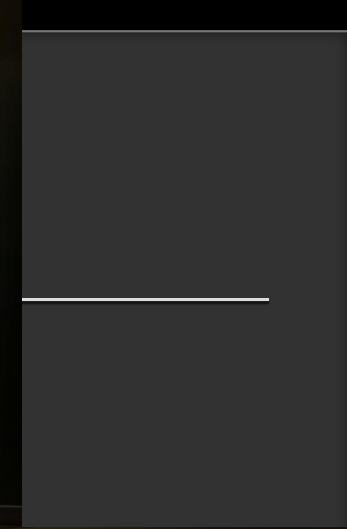
- **Depend upon:**
  - **Age**
    - Less than 70 better than over 70
  - **Timing of surgery**
    - Acute (<4wks) Better
  - **Tuberosity placement and healing**
- **Success...**
  - Restore proper height
  - Replicate version
  - Secure tuberosity fixation
  - Early rehab
  - Young age

# Conclusion

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- HA can give outstanding results in properly selected patients
- Tuberosity Reconstruction most critical factor in success
- Patients with compromised healing, severe osteoporosis and/or tuberosity comminution should consider reverse TSA

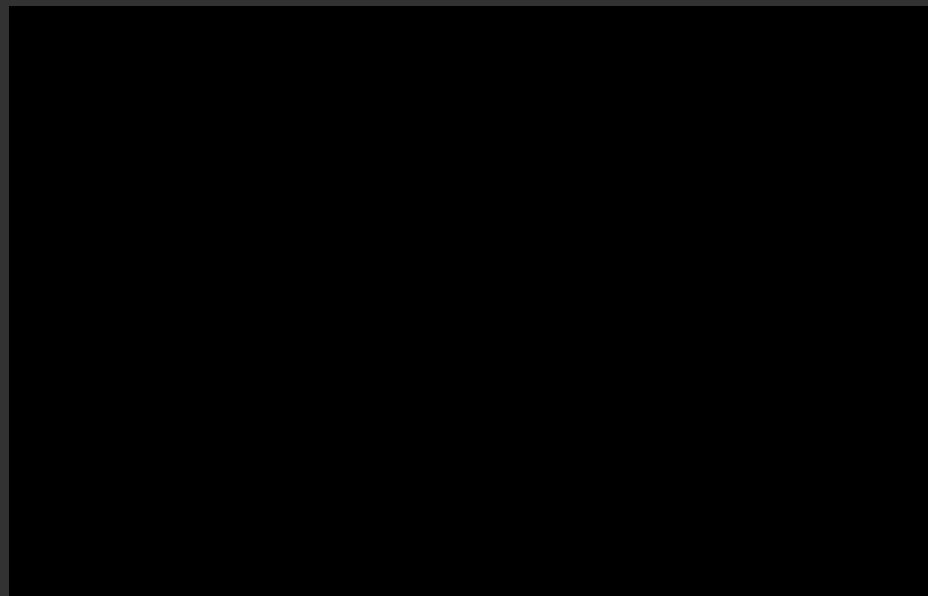




Low Disk Space  
You are running very low  
disk space on this drive.  
To free space on this drive,  
uninstall any unnecessary files.



# # - dislocation 4 part



3 m po



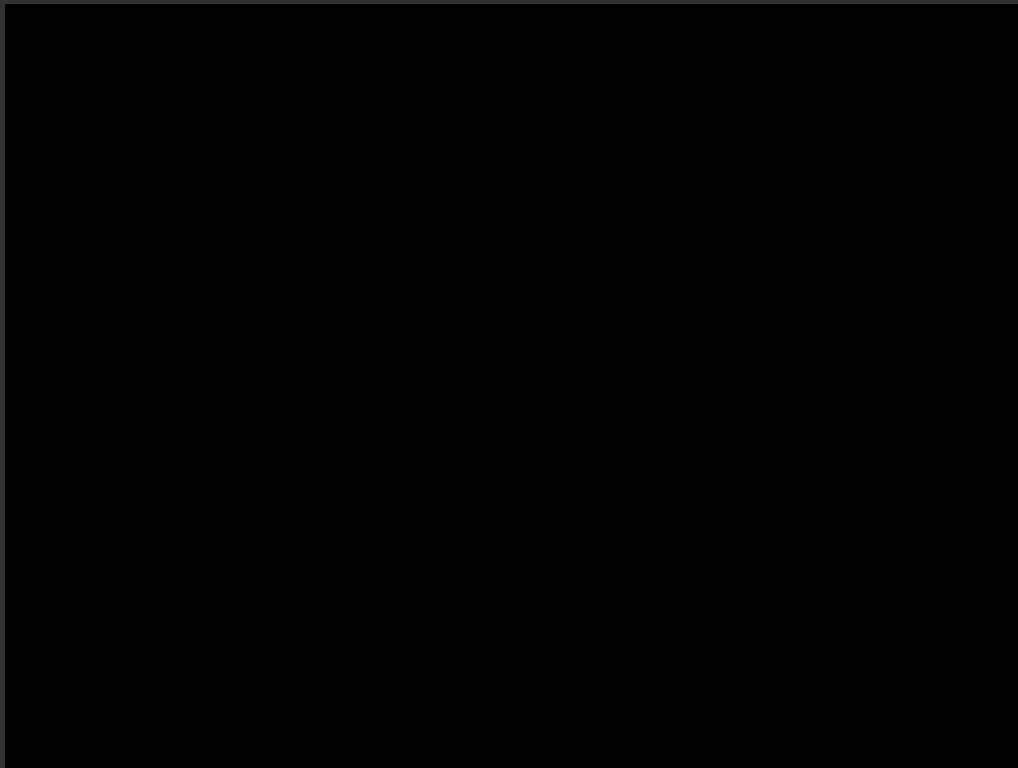
# 4 part

---

10 y po



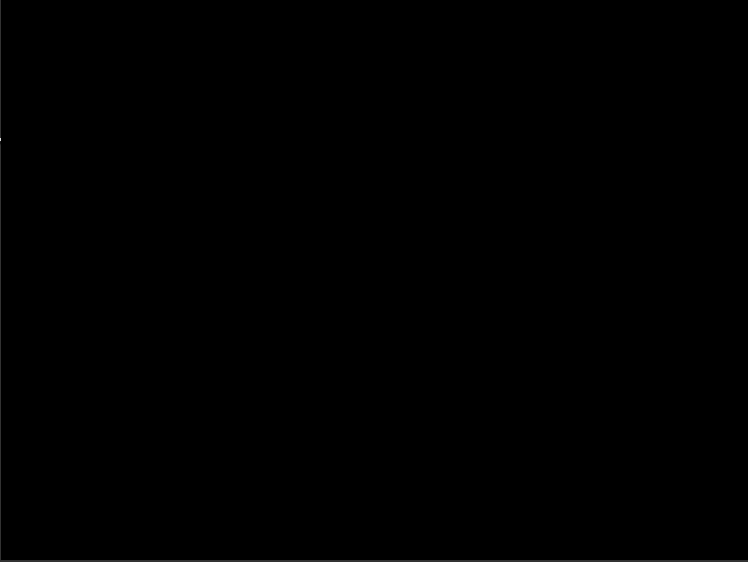
Non union 3 part fx 1 y pt



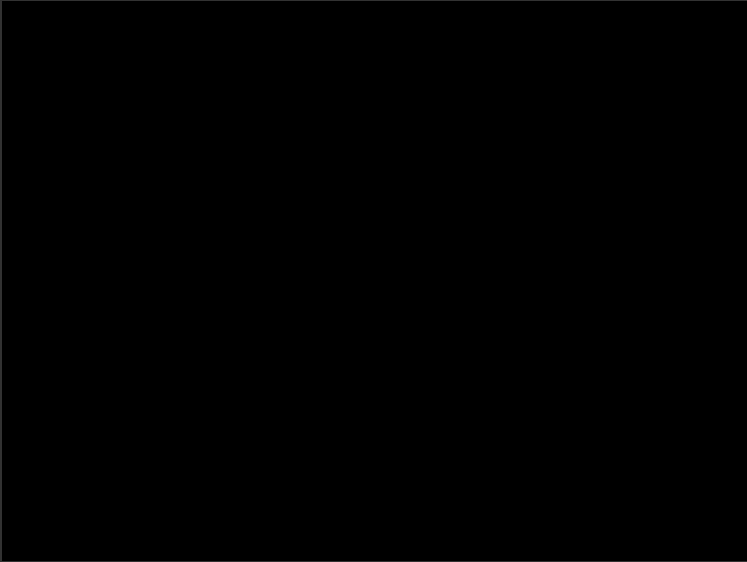
8 y po

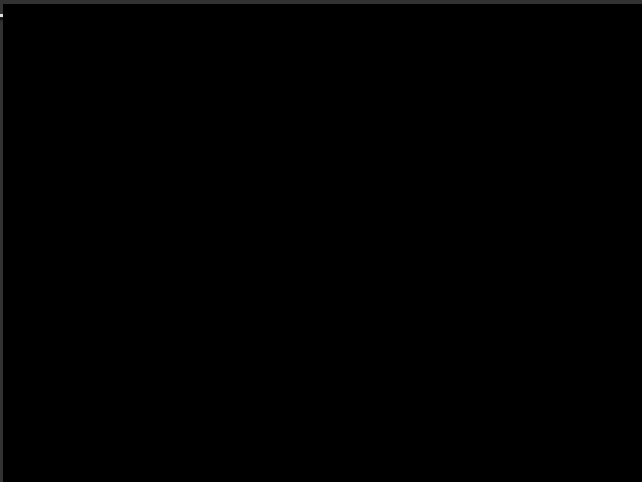


5 m po

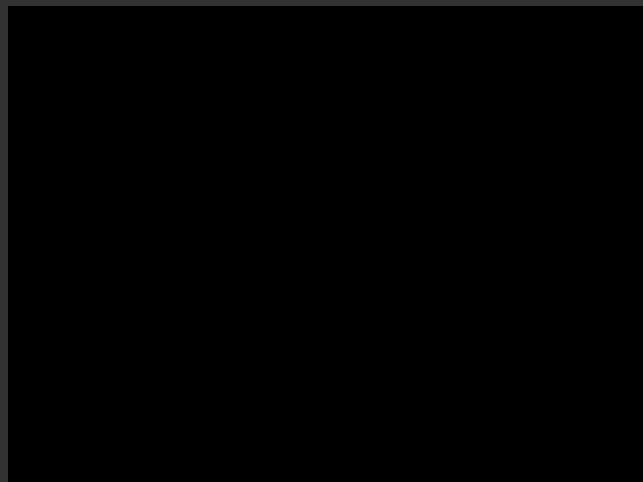


2 m po





2m po



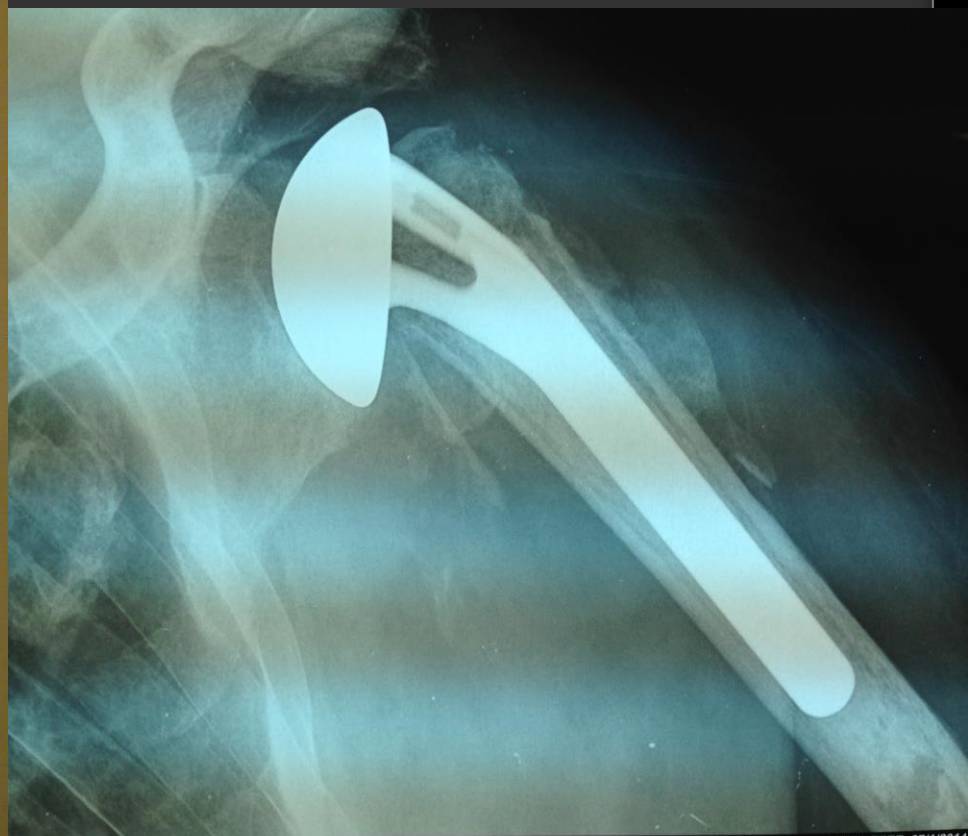
4 m po

5 W PO

10 W PO



# 4 part



ΟΝΟΜΑ: ΓΕΩΡΓΙΟΣ  
ΕΠΙΘΕΤΟ: ΣΚΟΡΔΑΛΟΣ

ΠΑΝΕΠΙΣΤΗΜΙΑΚΟ ΓΕΝΙΚΟ ΝΟΣΟΚΟΜΕΙΟ " ΑΤΤΙΚΟΝ "  
Β' ΕΡΓΑΣΤΗΡΙΟ ΑΚΤΙΝΟΛΟΓΙΑΣ

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Thank You