

Periprosthetic Humeral Fractures: Fractures and Approaches What and When to Do Something

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Medical Group.**

Creighton
UNIVERSITY
HEALTH SCIENCES
PHOENIX

Keys to Success

- Patient Selection
- Room Set Up
- Imaging/Visualization
- Approach/Dissection
- Reduction/Soft Tissues
- Implant Insertion/Optimization
- Rehabilitation

Patient Selection

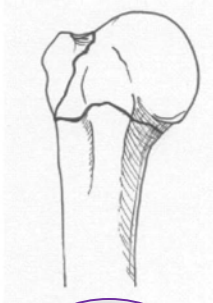
#1

Proximal Humeral Fractures: What Does Evidence-Based Medicine Tell Us?

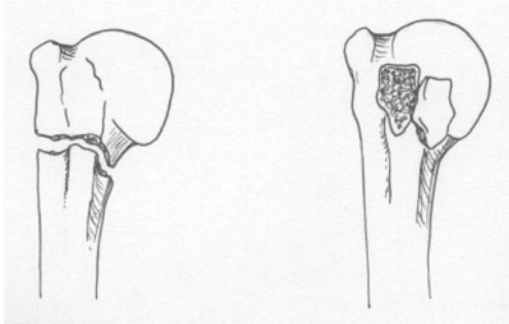
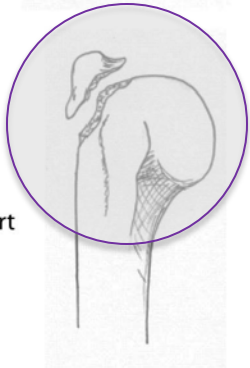
Conclusion:

- Do NOT operate → Majority
- Unable to Determine Which Implant is Best
- Tailor:
 - Patient Expectations
 - Fracture Pattern
 - Surgeon Skill/Experience

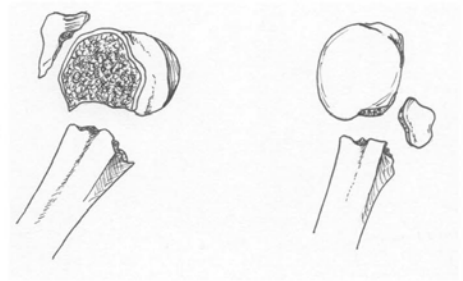
Non-displaced



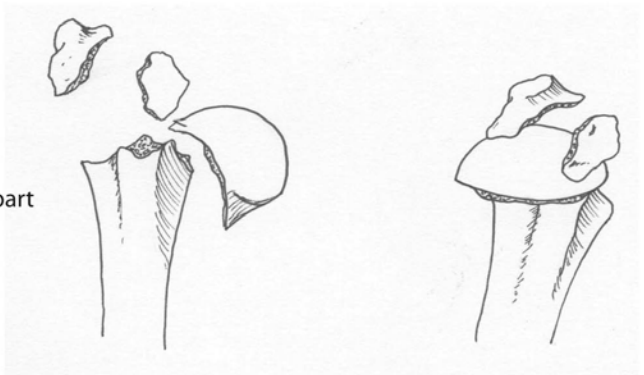
2-part



3-part



4-part



Non-

Operative

Any early immobilization

=

Timing & Type of therapy

=

Probably
Operative

No clear better method

Better outcomes @ 2 yr

Risk higher & worse complications

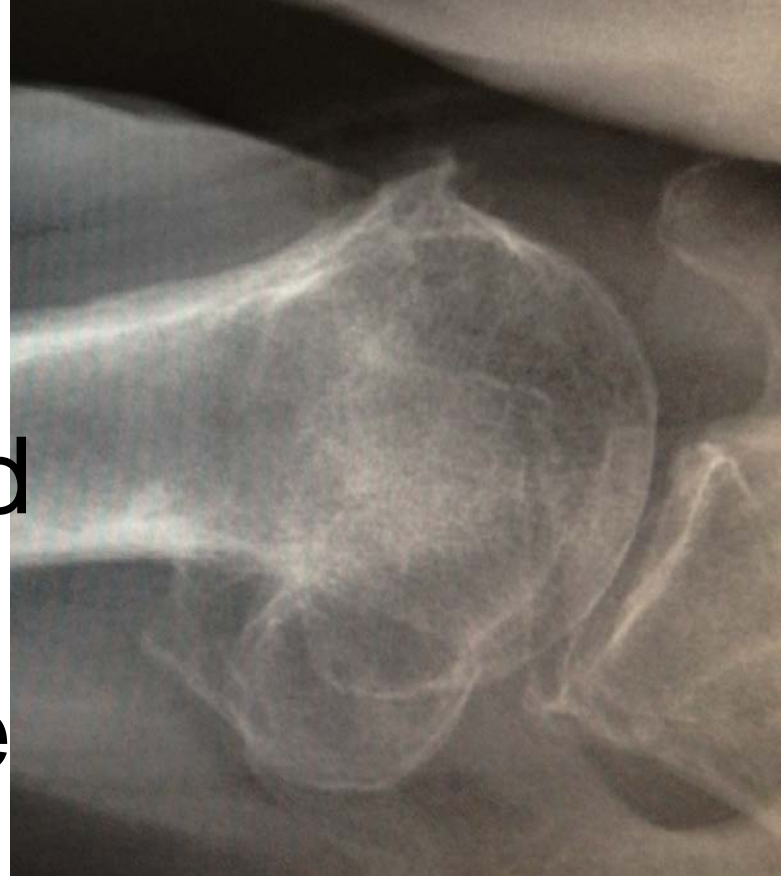
Non-Operative

- **Majority** of Patients
- Especially Elderly → 90-100% FF, IR loss
- All have pain for weeks (op and non op)
- *Tailor patient & surgeon abilities*
- Especially:
 - **Alcoholics**
 - **Drugs**
 - **Dementia/Non-Cooperative**

79F
2 Part
Impacted
Stable
Fracture



72F
3 Part
Impacted
Stable
Fracture



69 IDDM, Painless 2-Pt Nonunion Renal Dialysis, Ipsilateral Shunt/Port



Set Up

Diving Board Backwards

Some Reverse
Trendelenburg

Tuck Contralateral Arm

C-arm Perpendicular

Padded Radiolucent Arm
Board, Lessens Apex
Anterior Fracture Deformity



Imaging & Visualization



Internal Fixation/Operative

- **Younger compliant patients**
- Shared patient and surgeon expectations
- **Unstable** Fracture pattern
 - *Not impacted, translated esp. anterior shaft translation, head split, associated dislocation*
- **Skilled experienced surgeon**
- Expectation:
 - 90-100° FF
 - Higher complications:
 - Intraarticular screws 10-15%
 - Scarring & Atrophy ^ %
 - Re-Operation 10-20% → worse conversion outcomes

Set Up

Diving Board Backwards

Some Reverse
Trendelenburg

Tuck Contralateral Arm

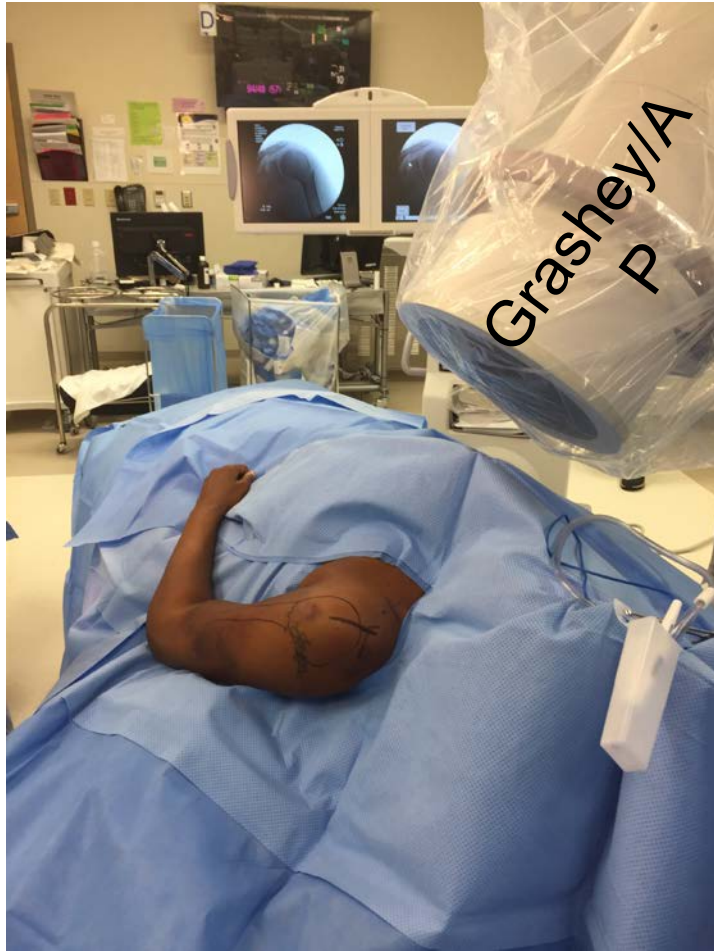
C-arm Perpendicular

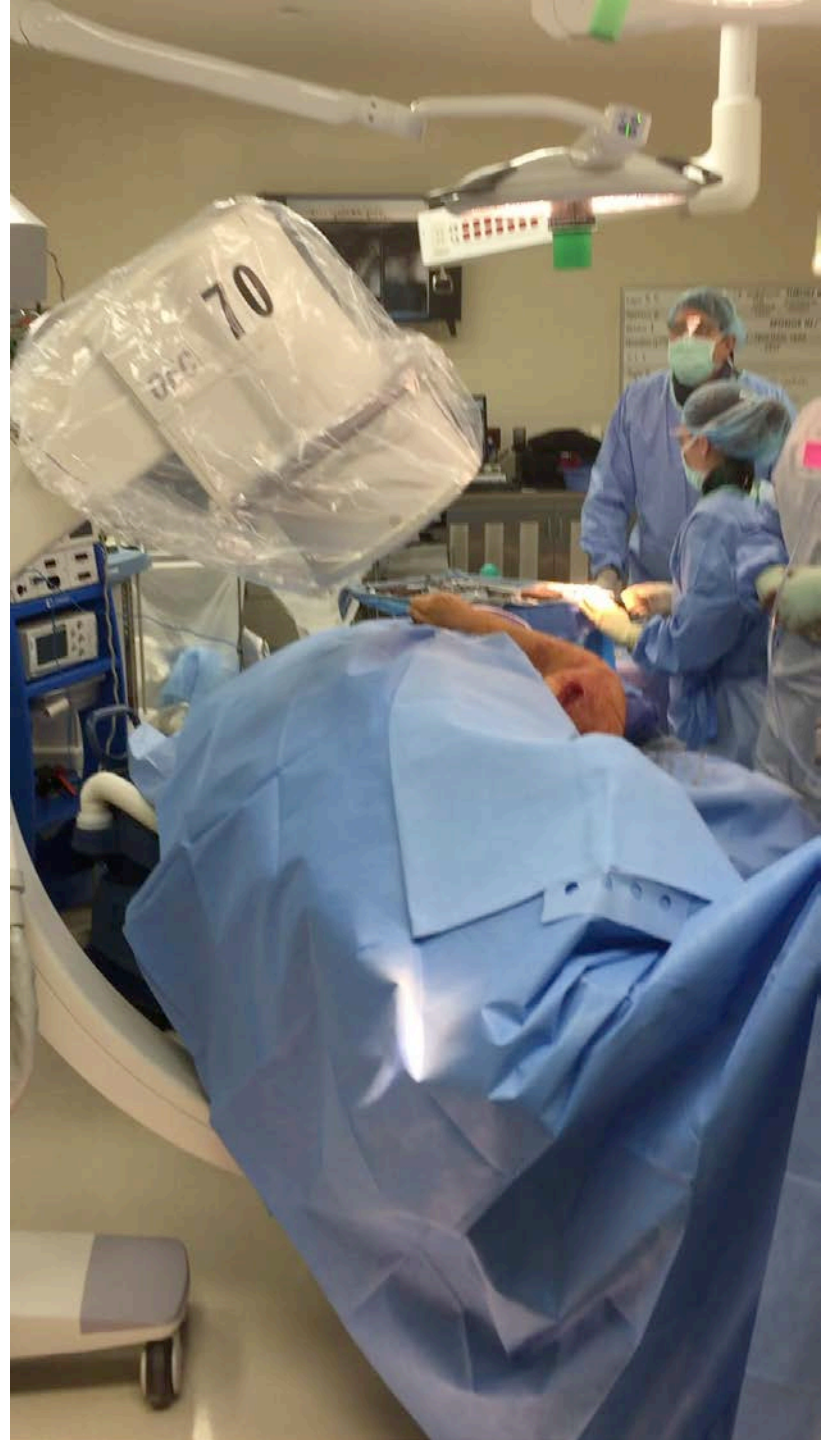


Padded Radiolucent Arm Board,
Lessens Apex Anterior Fracture

Deformity

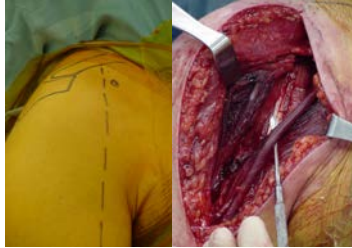
Imaging & Visualization





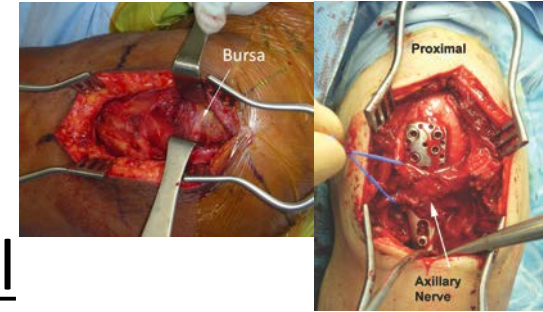
Approach & Dissection

Deltopectoral



- + Traditional
- + Anterior Approach for Lateral Plating
- + Anterior Injury (LT)
- + Intraarticular Injury
- Deltoid Retraction
- Screw Trajectory
- Tuberosity Reduction

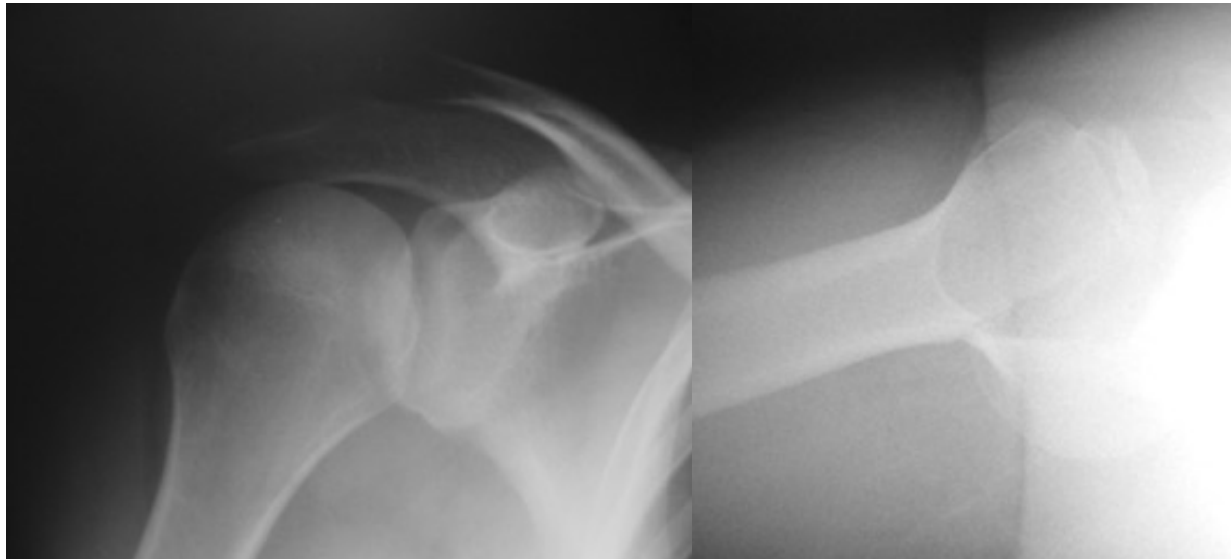
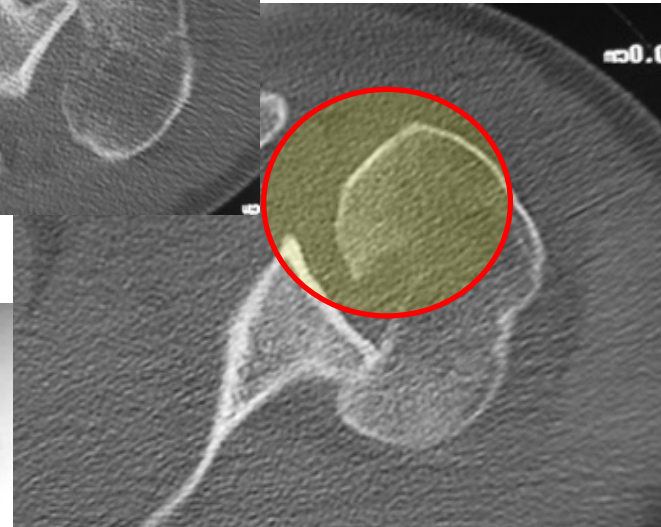
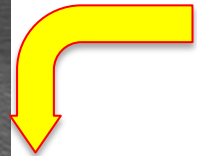
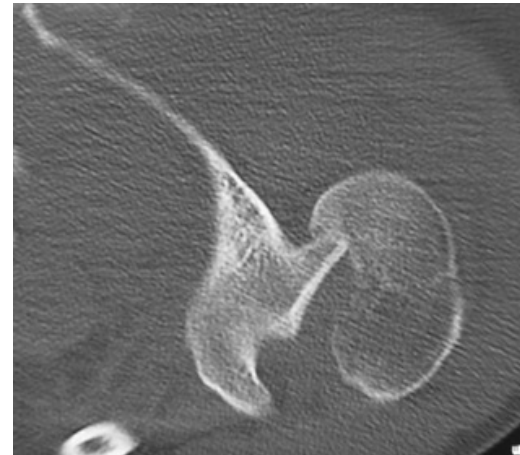
Anterolateral

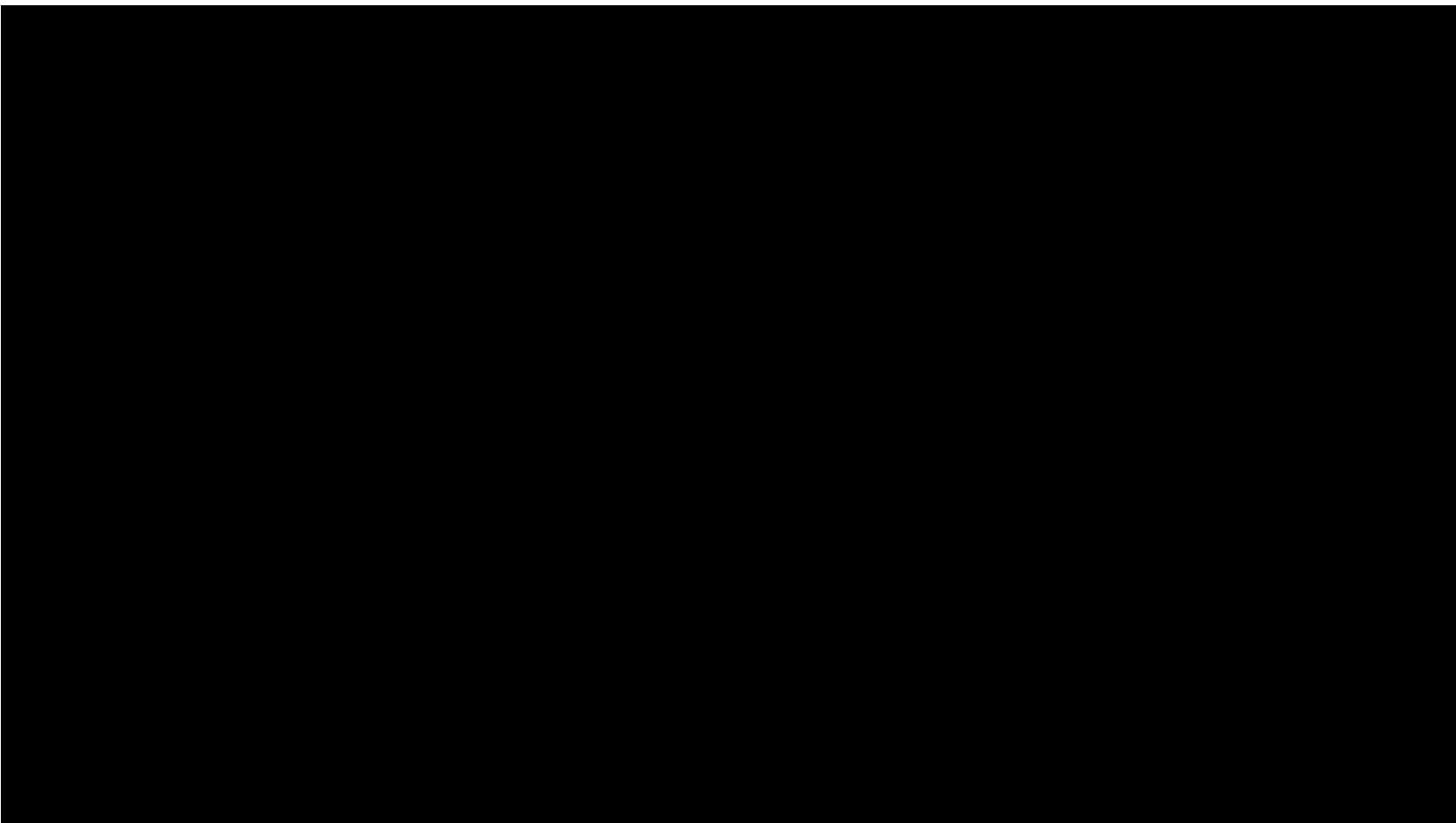


- + Direct Approach
 - Lateral Approach for Lateral Plating
- + Minimal Retraction
- + Posterior Injury (GT)
- + Standard Fracture
- Axillary Nerve
- Revision to Arthroplasty

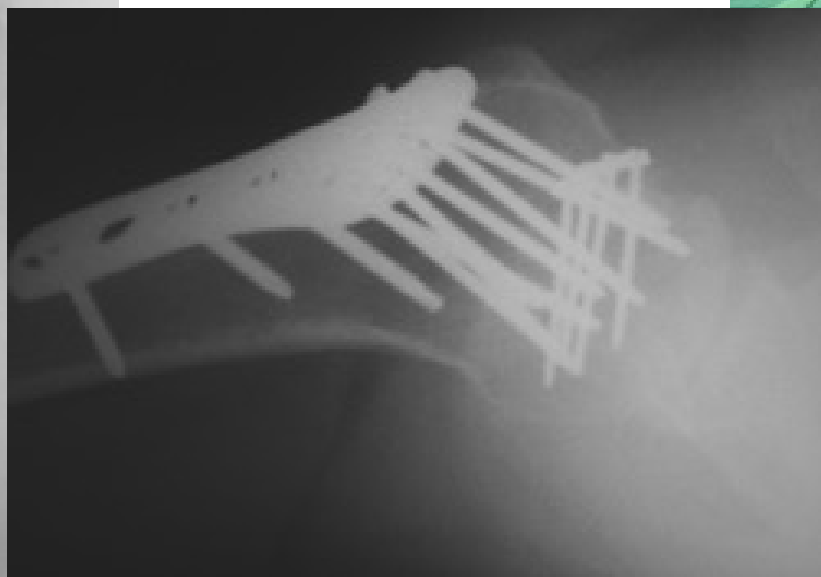
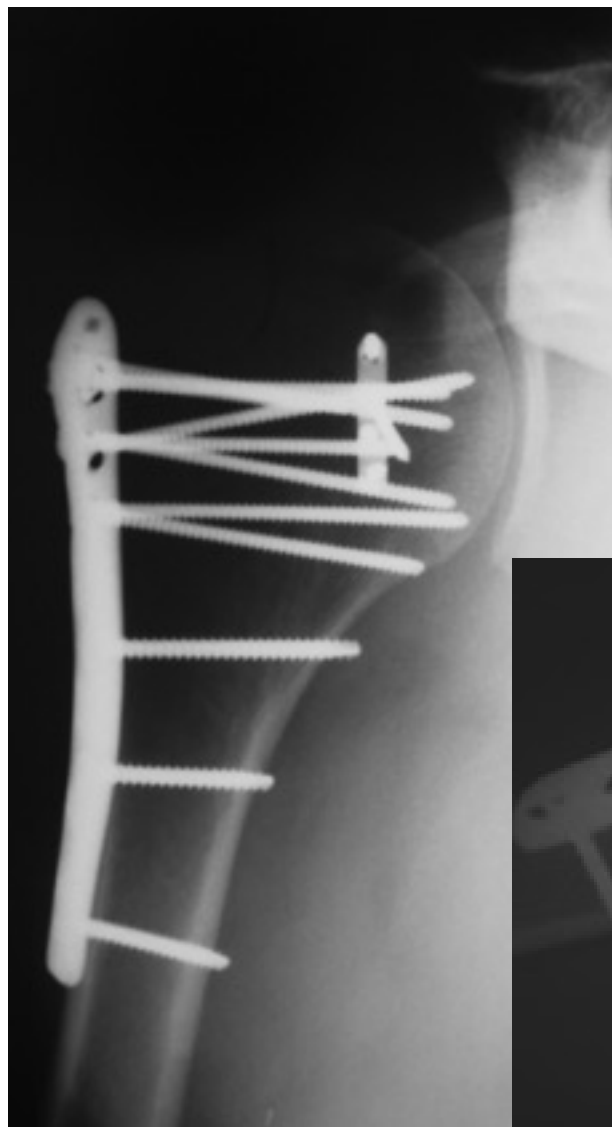
Injury: Posterior Fracture – Dislocation Seizure Disorder

- 25 M
- 5 days ago
- Pain & Stiff Shoulder

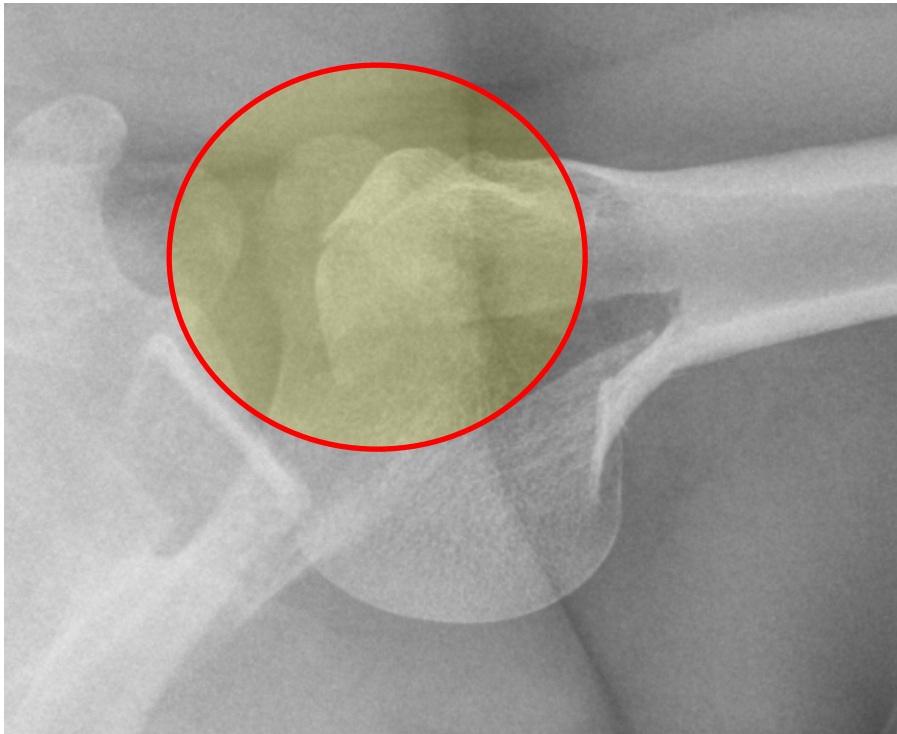
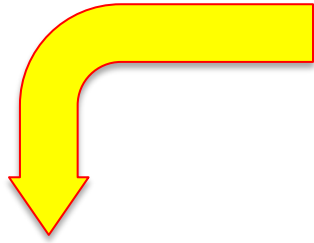




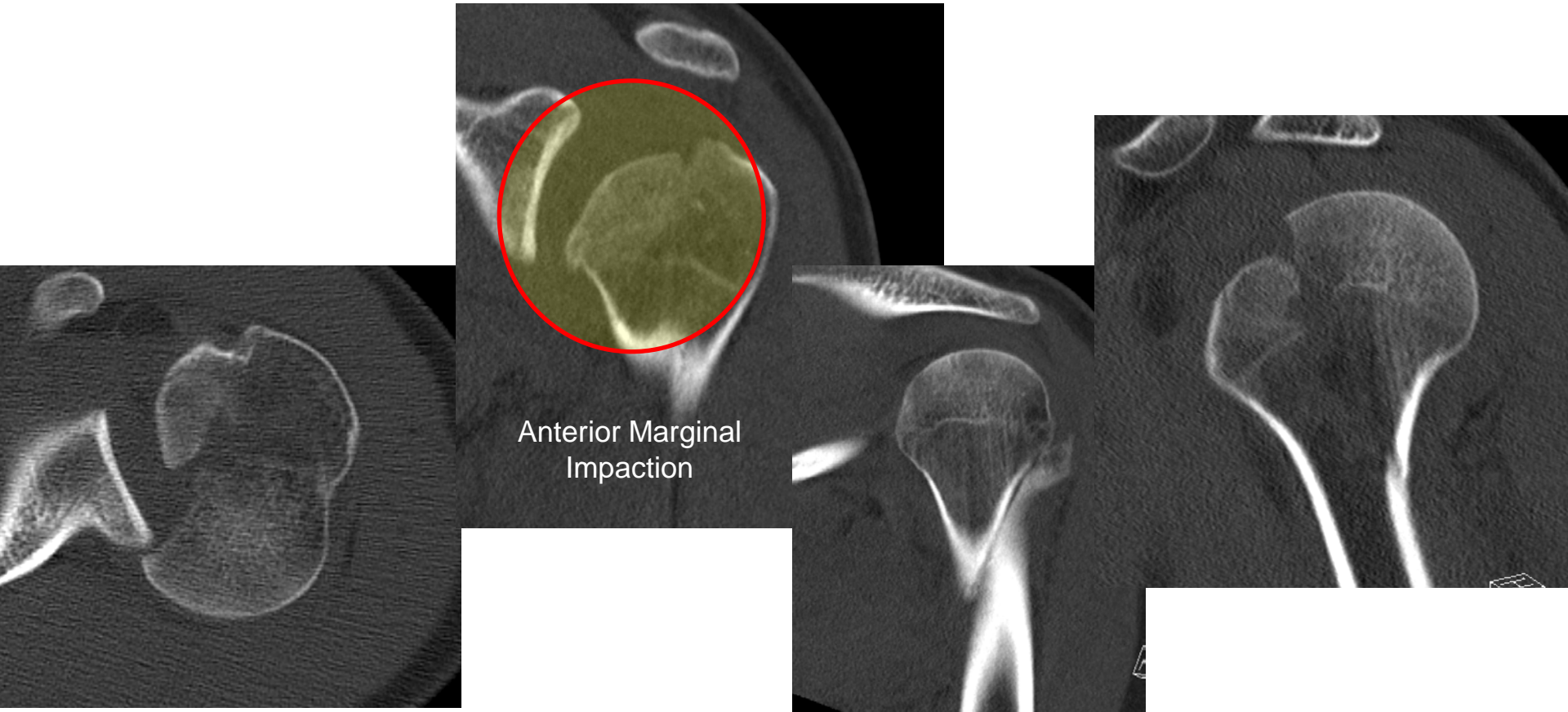
3 Months Postoperative



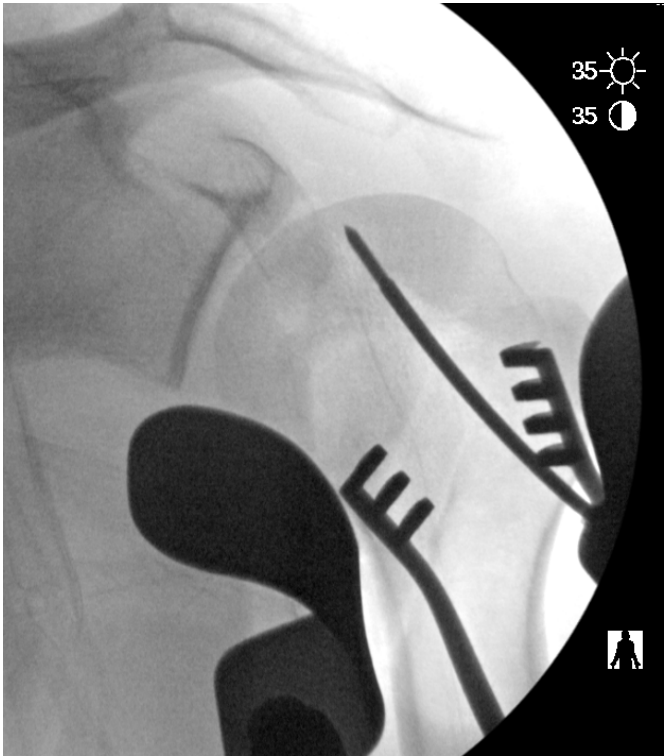
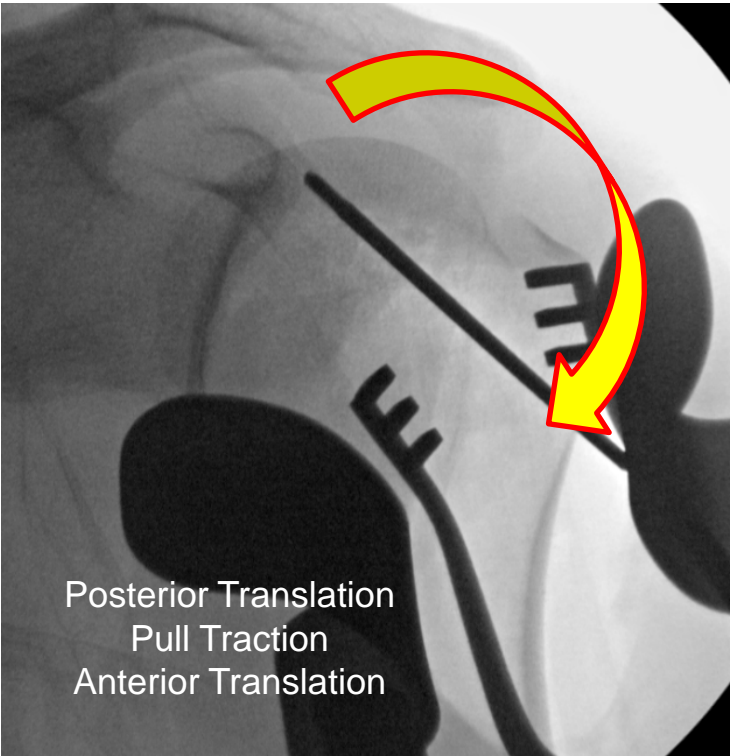
Posterior Fracture - Dislocation



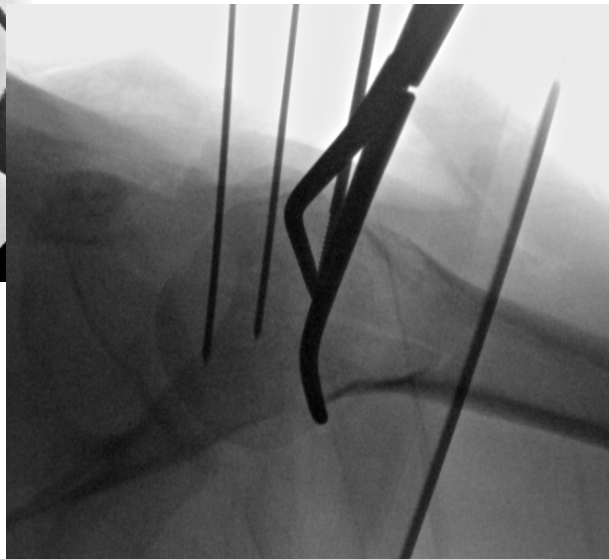
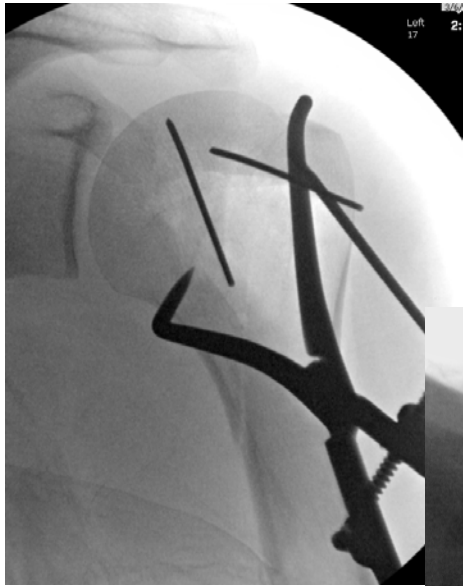
Imaging → Anterior Deltpectoral Approach

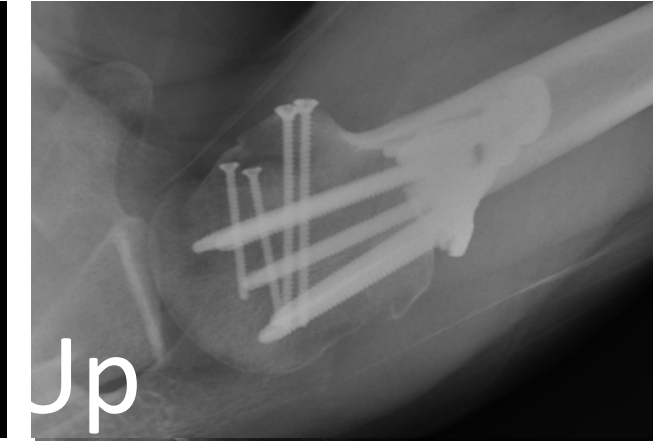
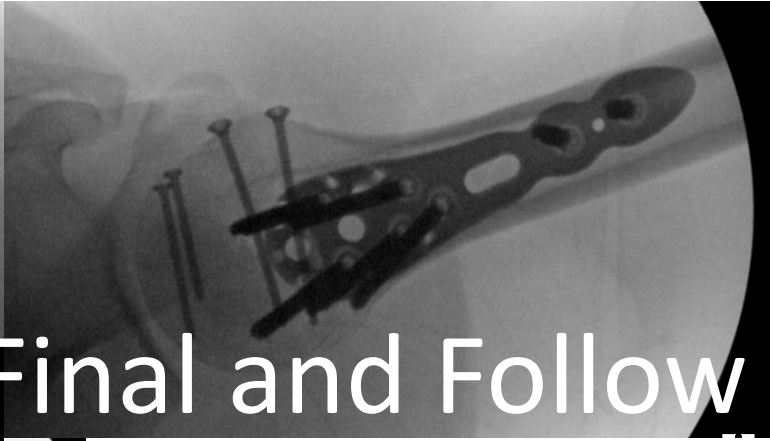


Intra-op Joy Stick Head Reduction

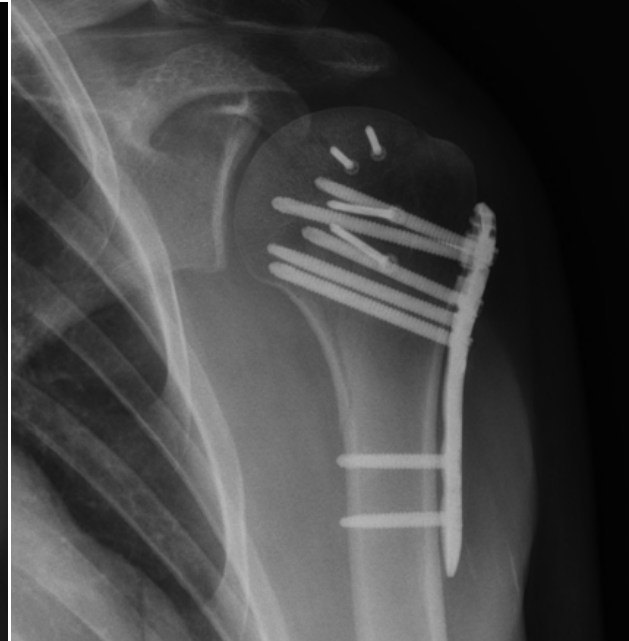


Head & Tuberosity Reduction, Plate Application





Final and Follow Up



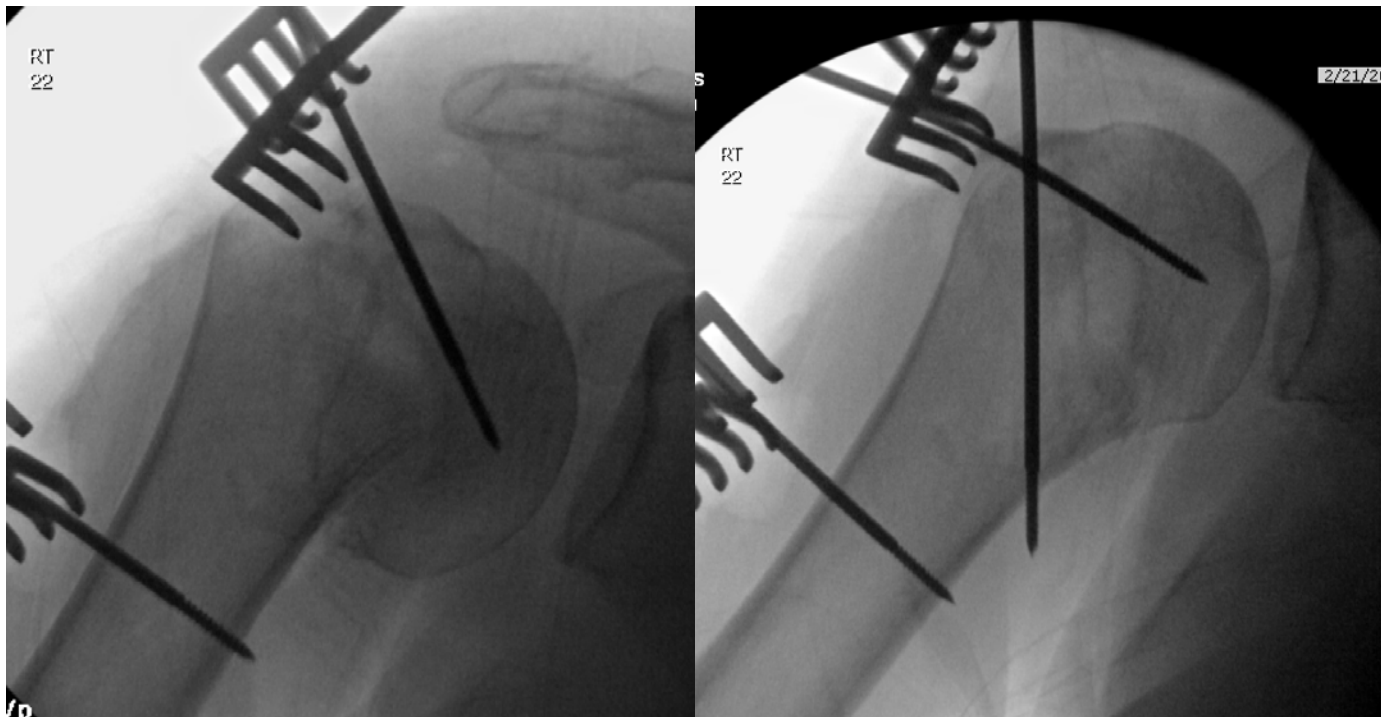


Extended Acromial Approach

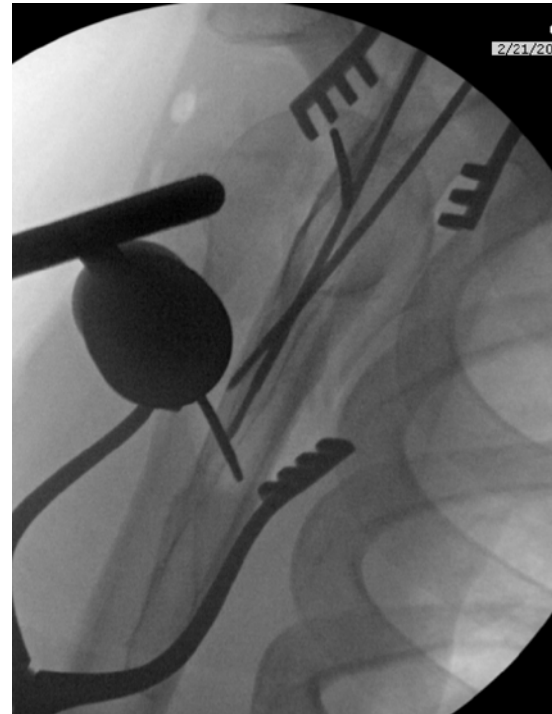
- 61 M
- Active RHD
University
Professor
- No Comorbidities



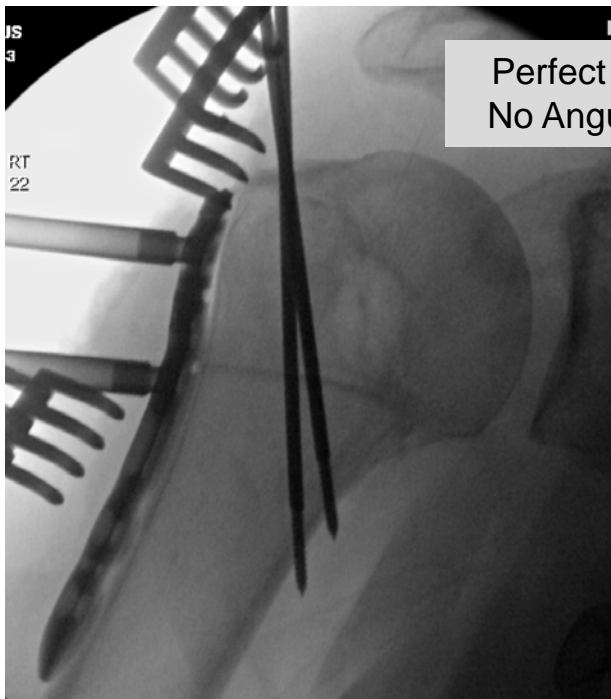
Joy Stick Reduction



Joystick Pinning of Fracture



Symmetrical Plate Application

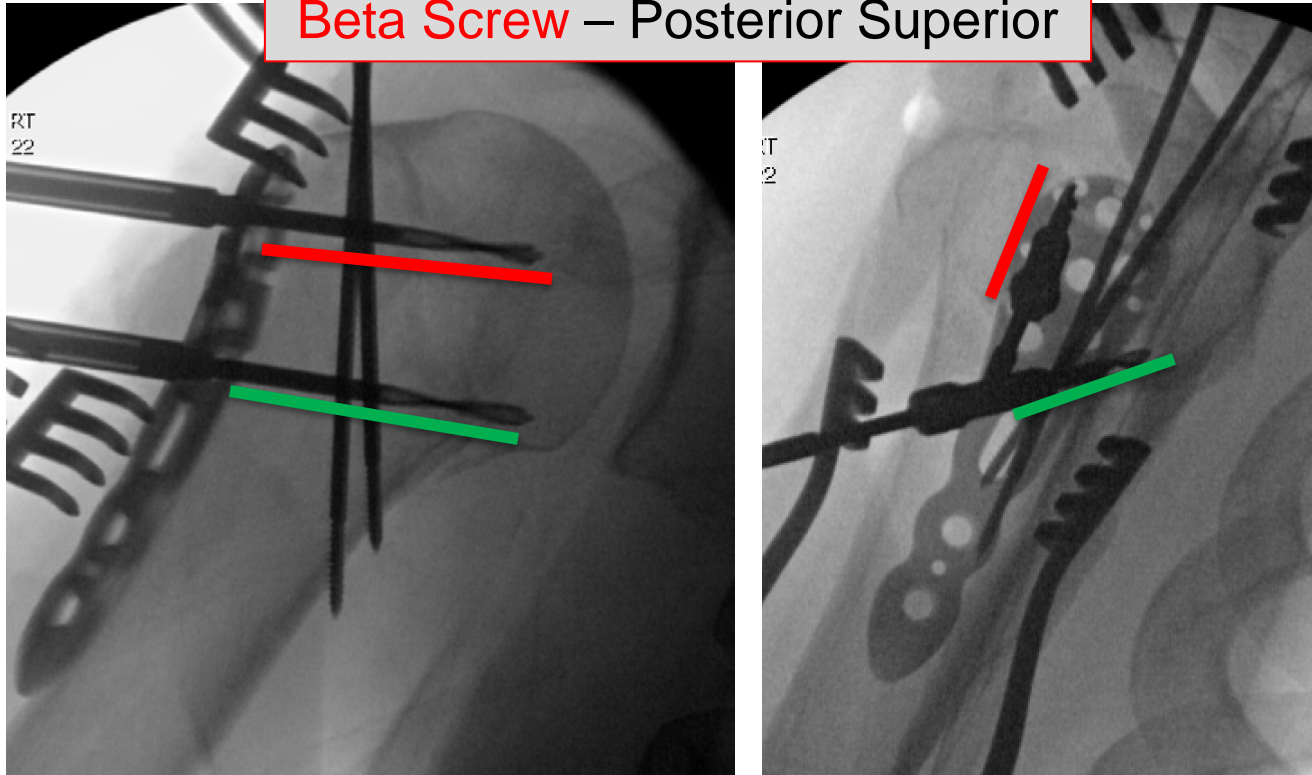


Perfect Lateral On Bone
No Angulation on Lateral



Optimize Screw Position with Plating

Alpha Screw – Anterior Inferior
Beta Screw – Posterior Superior



- Perfect Calcar “Kickstand” Screws
- Symmetrical Location of Screw Position in Head
- Equal Screw Length to P and A aspects of

Final Screw Insertion

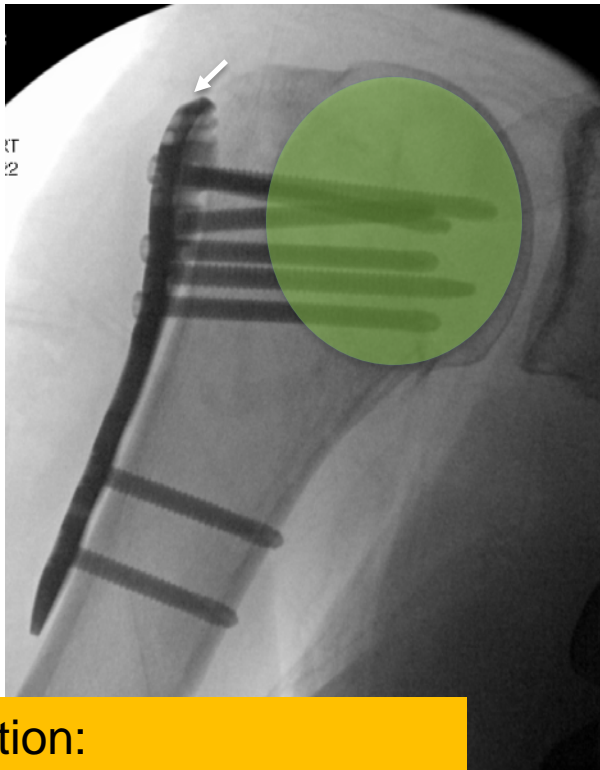
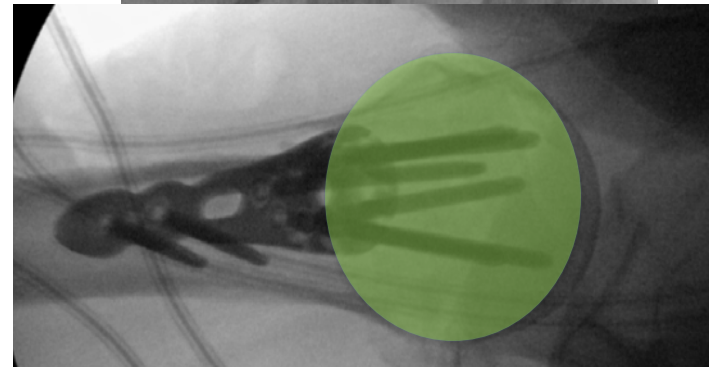


Plate Position:

Distal GT Tip

Avoid Impingement

Allows for Deep Distal Calcar Screws



Screw Insertion :

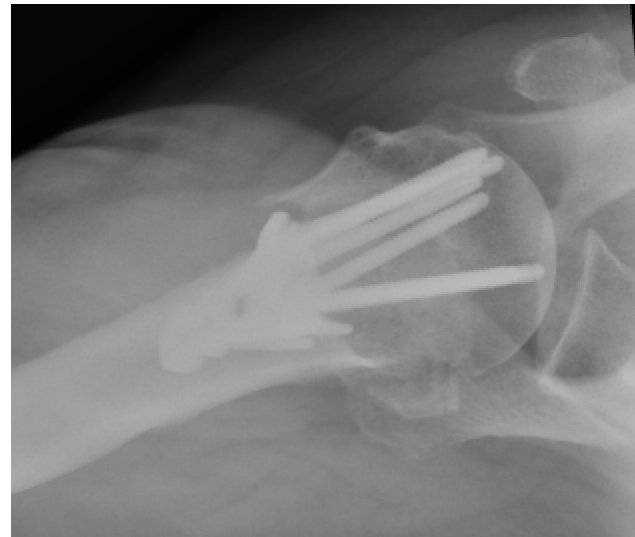
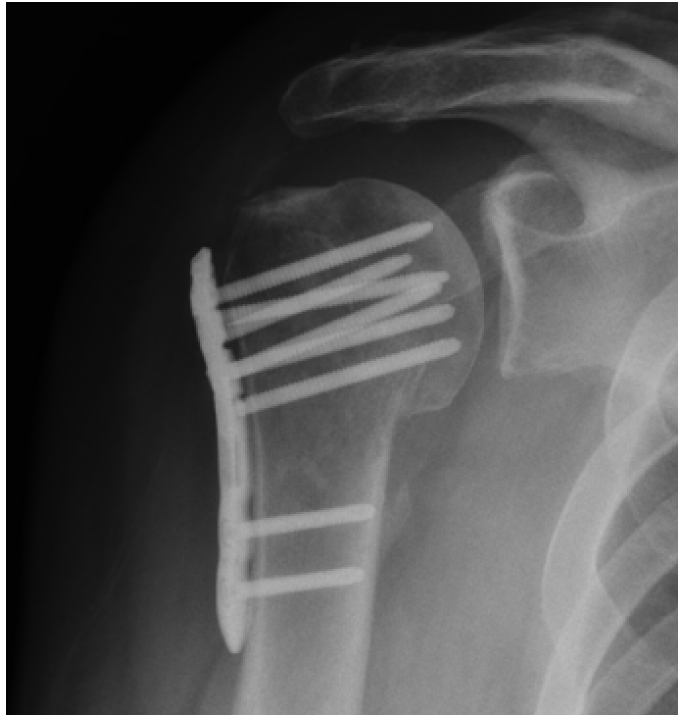
Drill Lateral Cortex, Insert Drill Until End Point

Do NOT Penetrate Head, NEVER > 50 mm

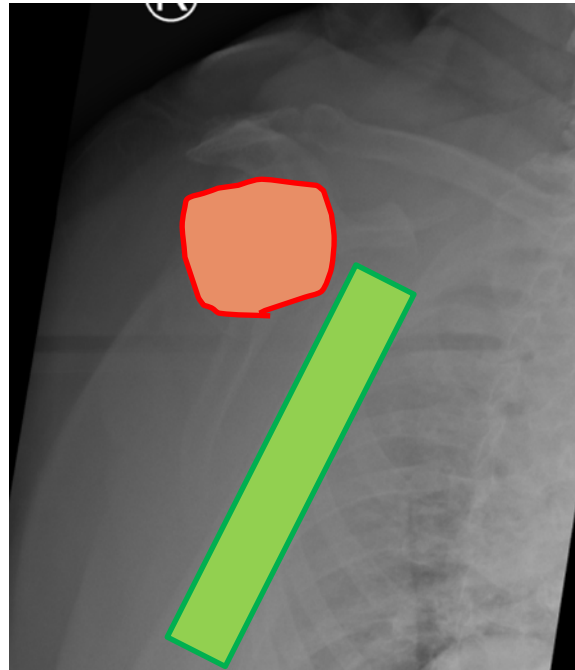
Symmetrical Position in Head

Axillary to Confirm No Screw Depth

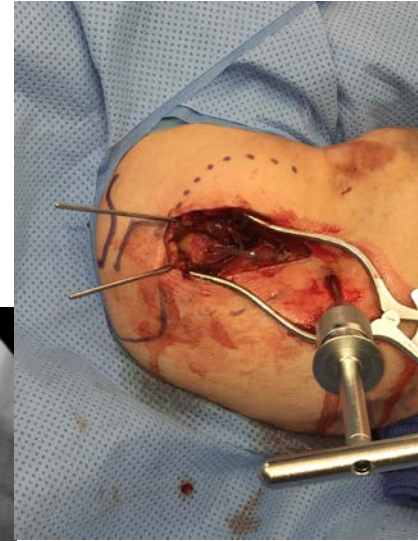
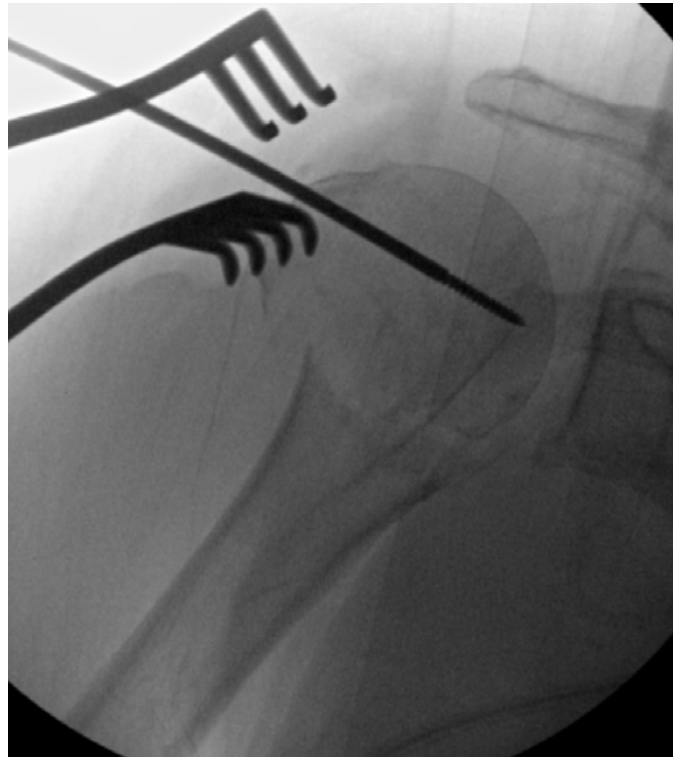
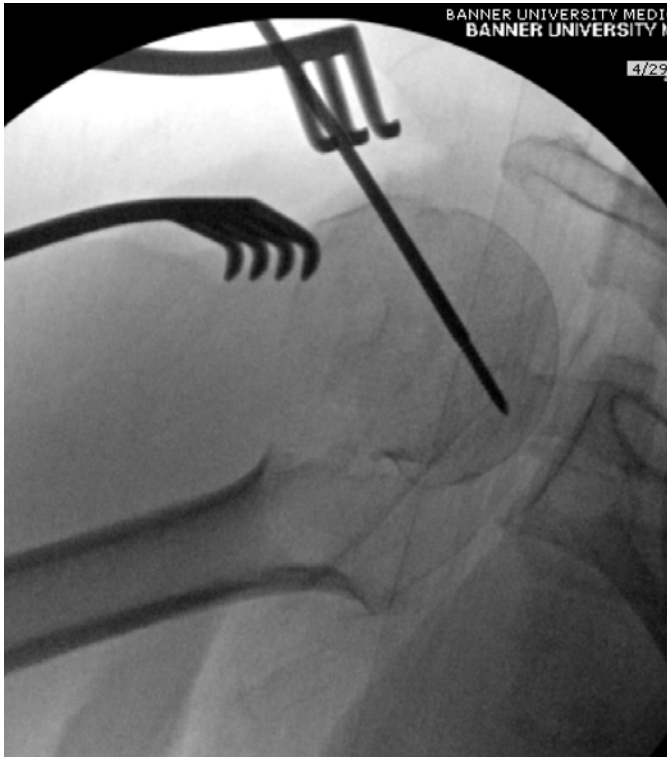
Final Healed Follow Up 3 Months



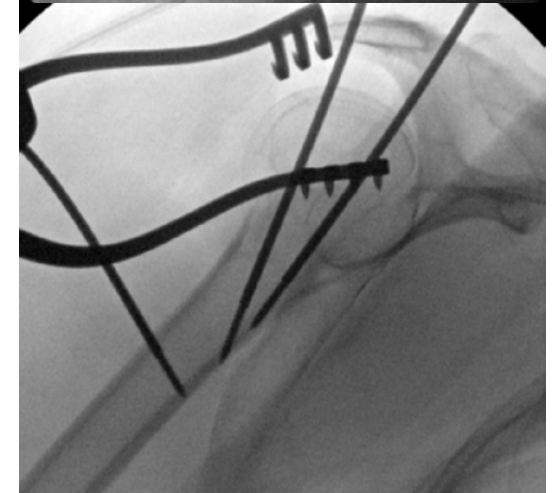
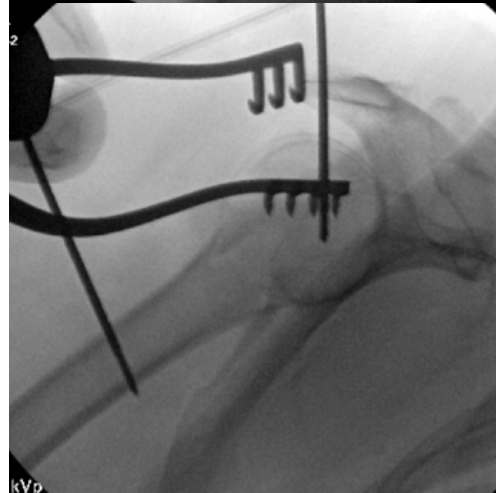
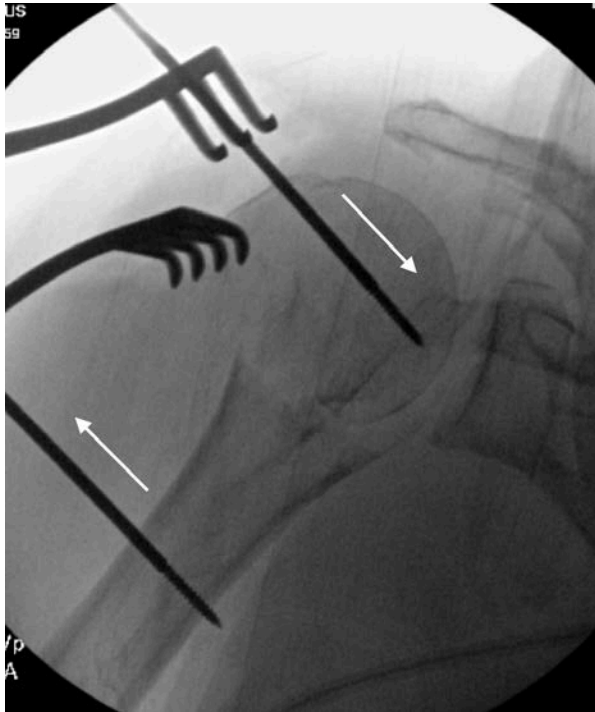
Unstable Injury



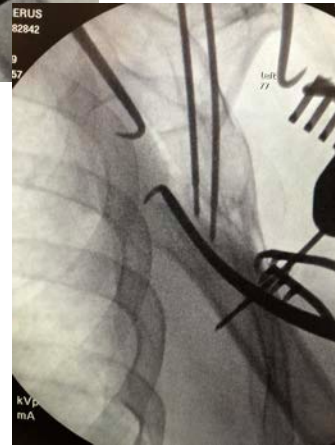
Joy Stick Reduction



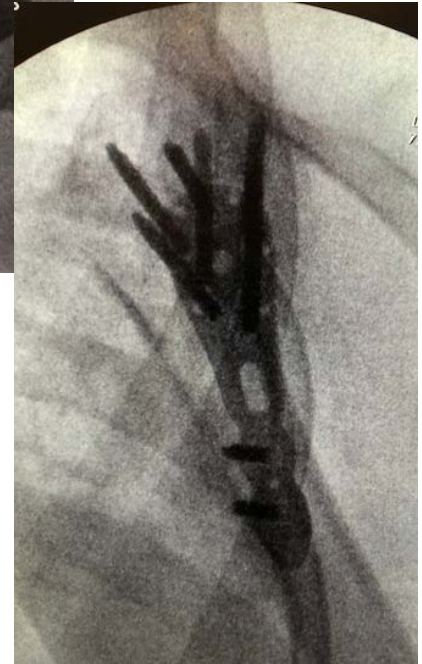
Joy Stick Pinning



Unstable 3-Part



Initial Reduction and Plate Application



Hook Plate Augmentation



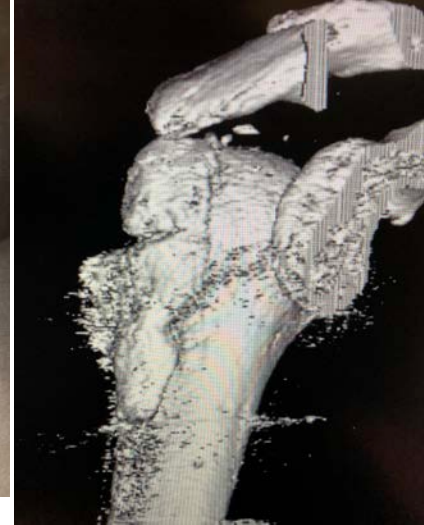
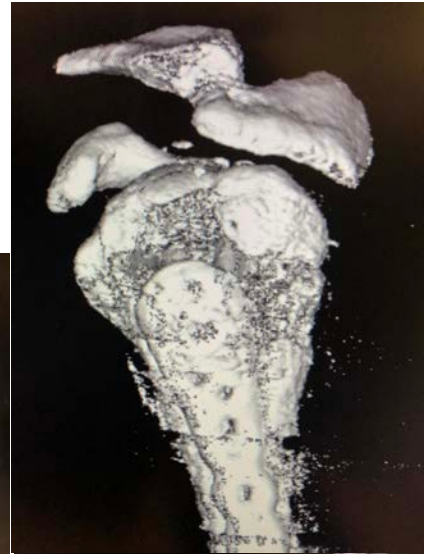
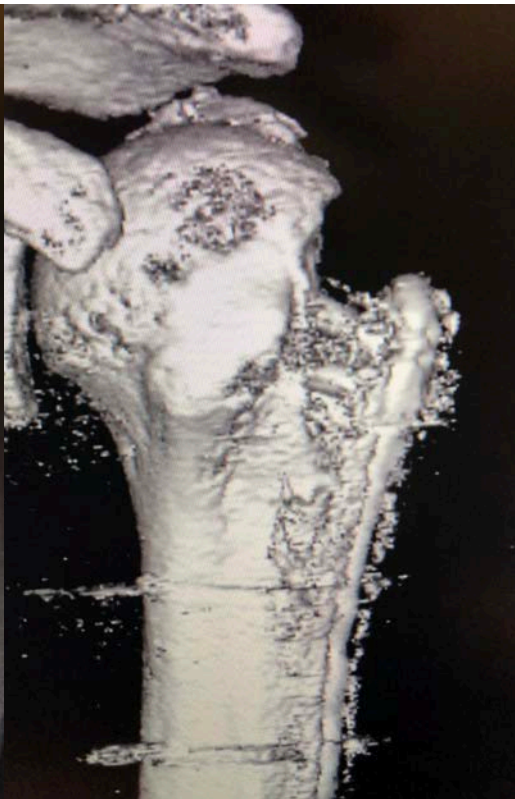
Anterior Fracture - Dislocation



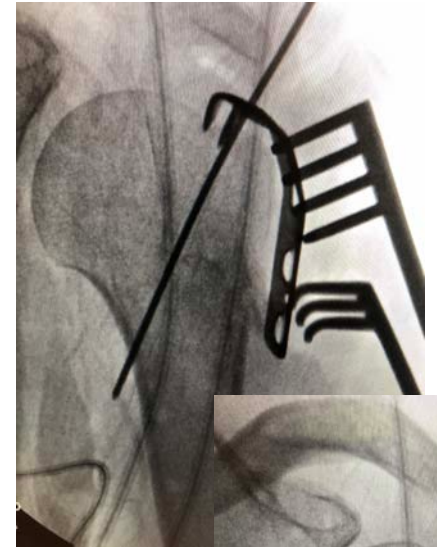
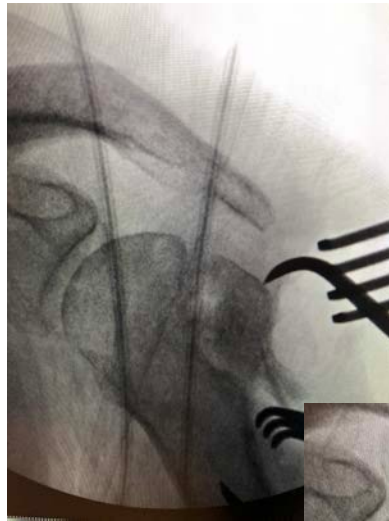
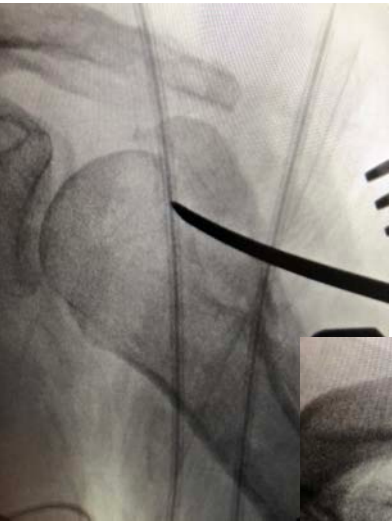
Joy Stick Reduction & ORIF



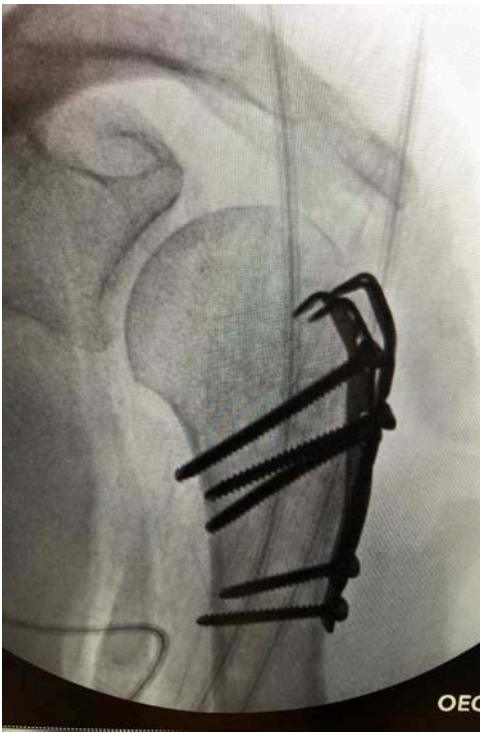
Greater Tuberosity Escape: Pseudoparalysis



GT Escape, Osteotomy, Hook Plate Fixation/Salvage



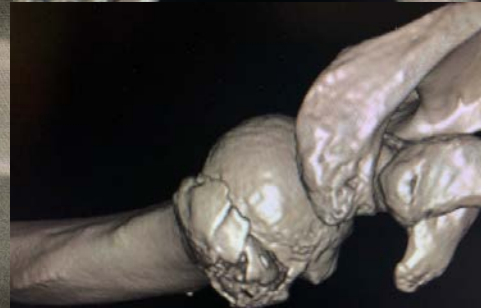
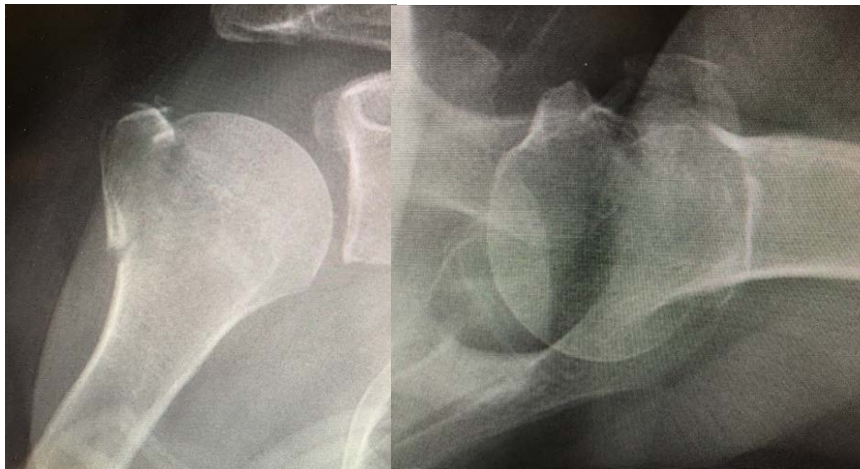
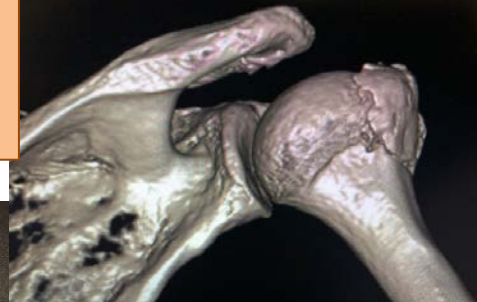
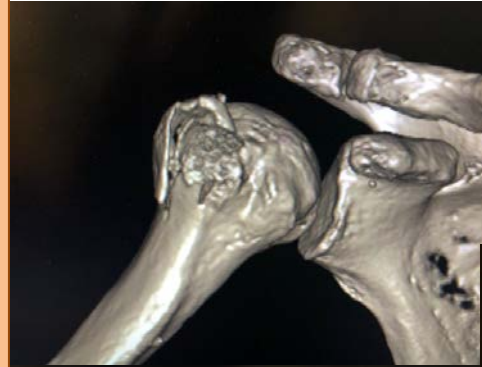
Final Fixation & Result



Greater Tuberosity

Extended Acromial Lateral Approach

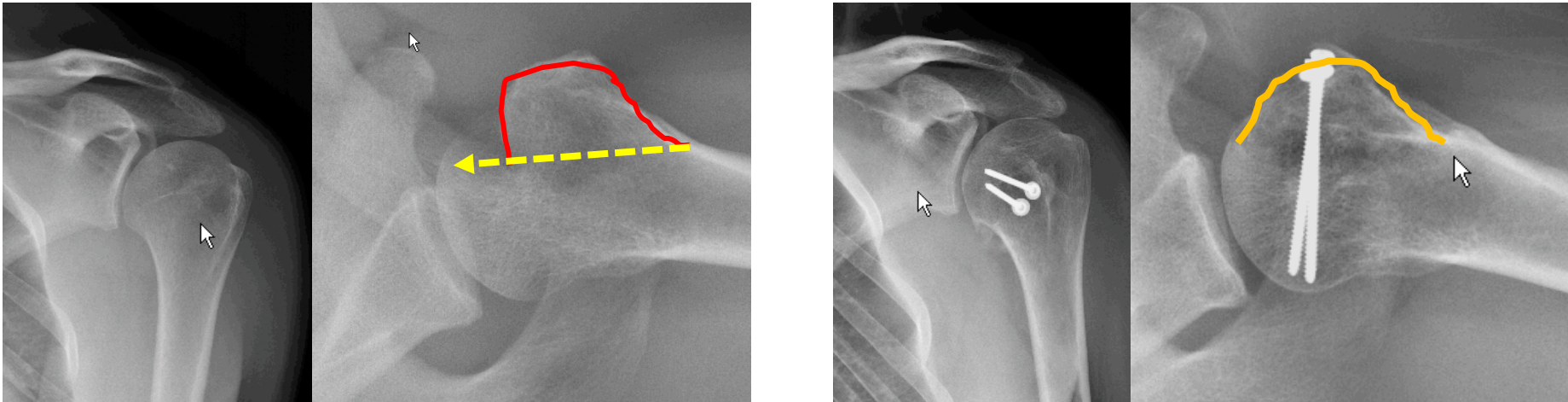
- Reduce Cranial & Posterior GT
- Prelim Fixation
- Hook Plate Fixation



Lesser Tuberosity

Deltopectoral Approach

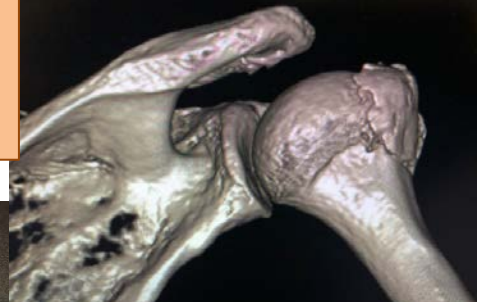
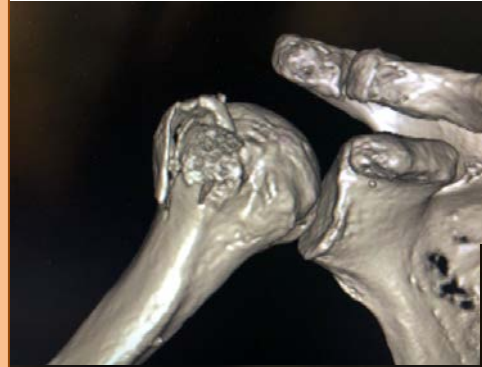
- LT Osteotomy
- Screw Fixation



Greater Tuberosity

Extended Acromial Lateral Approach

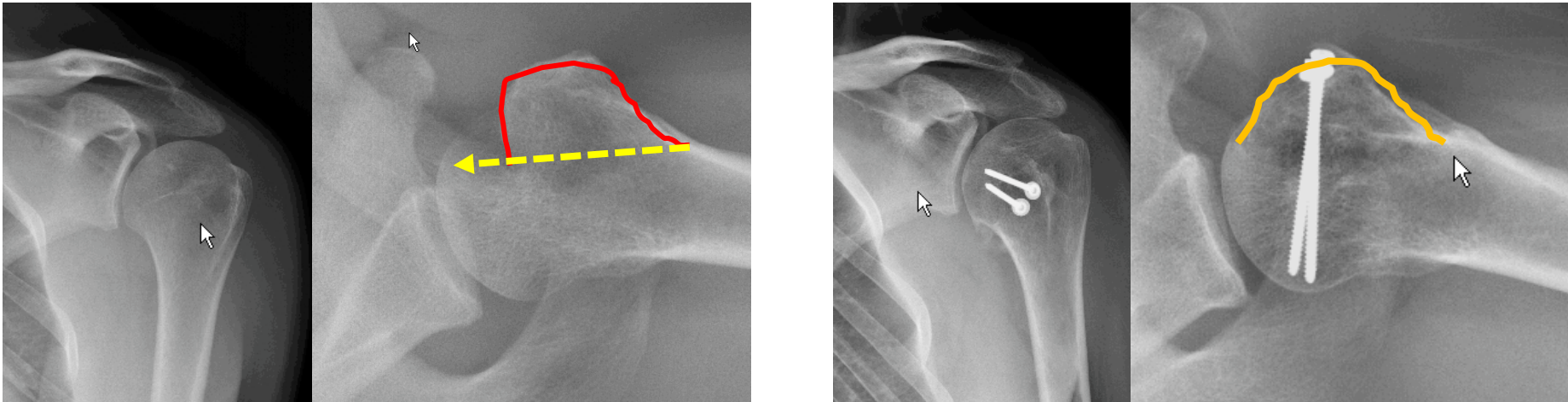
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Lesser Tuberosity

Deltopectoral Approach

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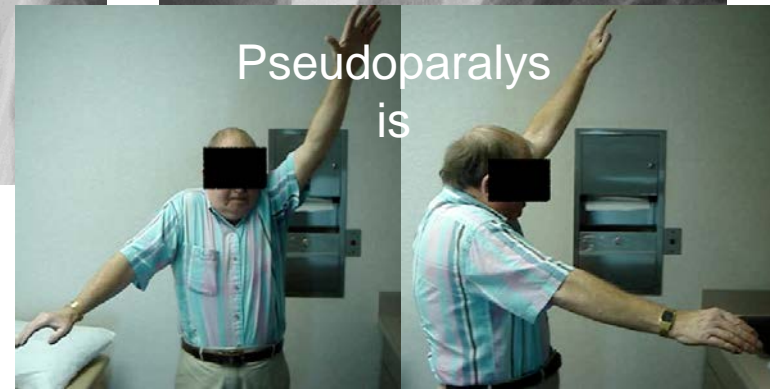
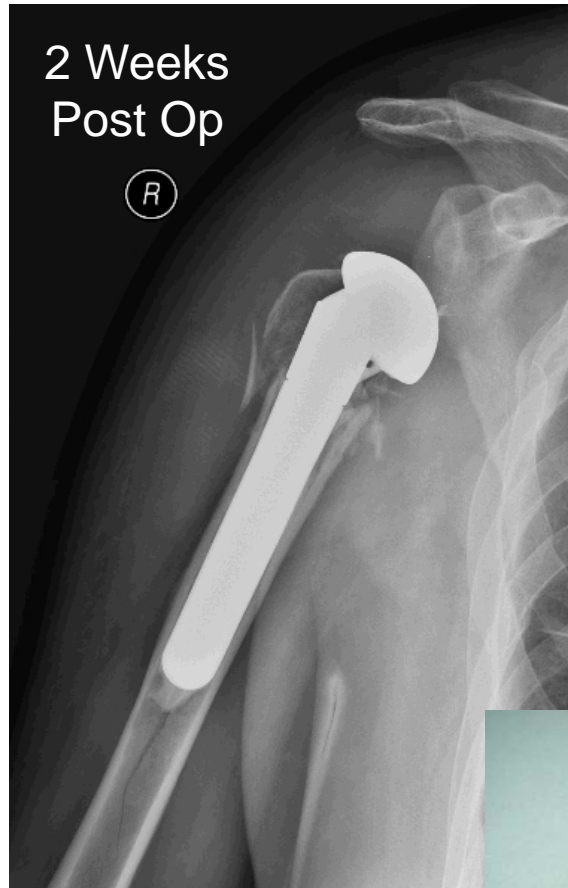
Hemiarthroplasty

- **Elderly**, Low Demand (+/- with RSA)
- **Young**, Non Reconstructable
- Unpredictable Function:
 - 75-160° FF
 - Minimal Pain

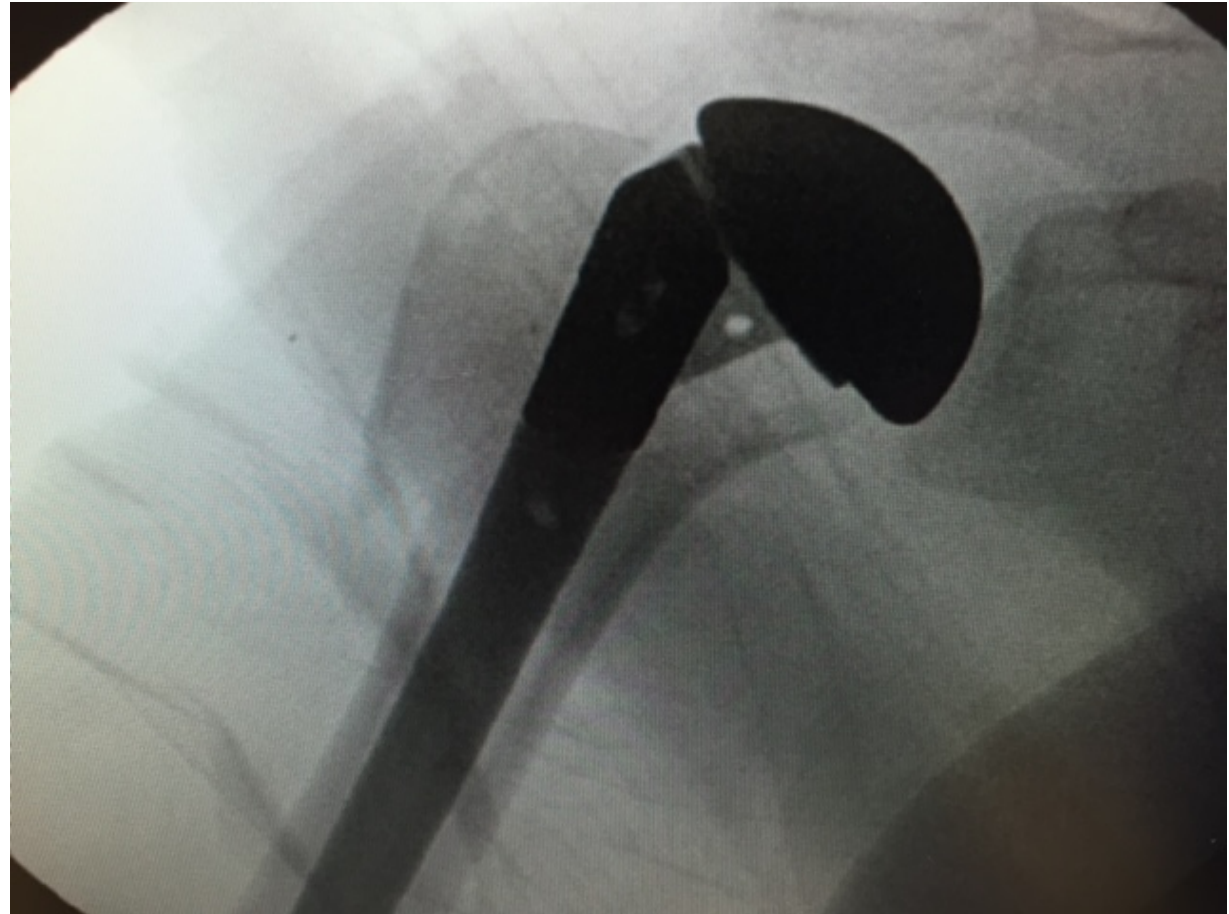
Healthy Elderly, Head
Fx/Disloc
Ipsilateral Shaft Fx
Hemiarthroplasty



Hemiarthroplasty Tuberosity Failure Pseudoparalysis



Young Non Reconstructable



Reverse Shoulder Arthroplasty (RSA)

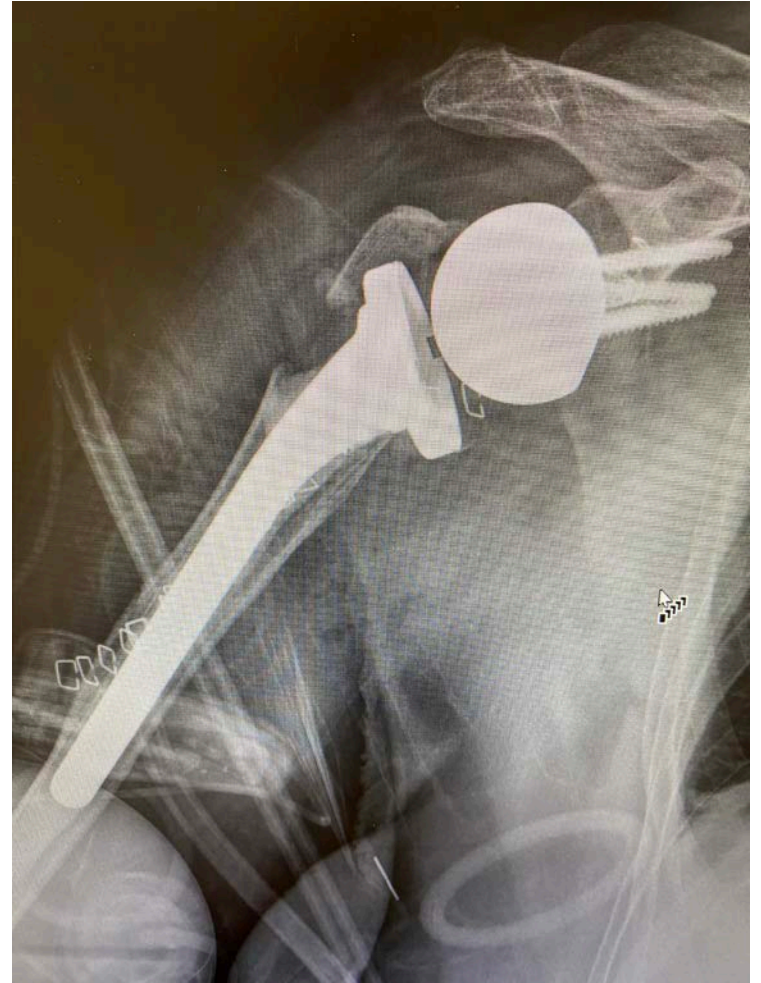
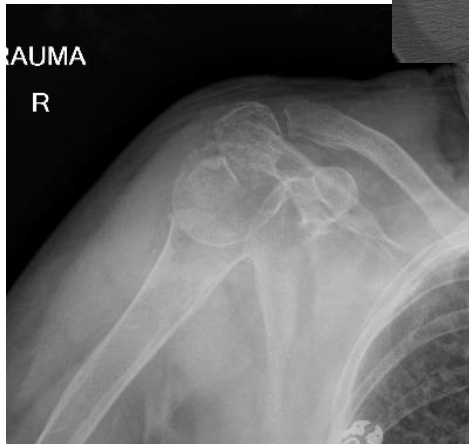
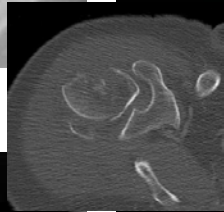
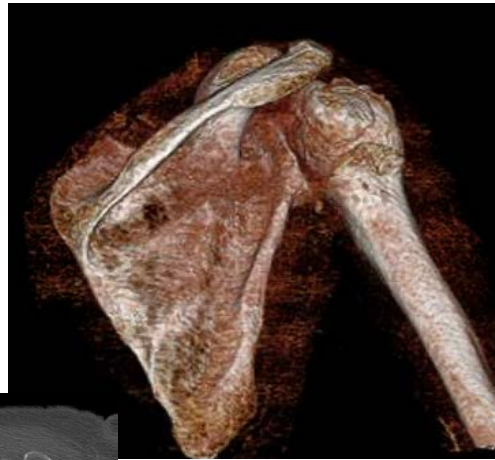
- **Elderly**, Displaced
 - Head Split
 - Fx/Dislocation
- **Younger** ??????
- Predictable:
 - 100-120° FF
 - Variable ER
 - Weight Bearing?

Elderly High Functioning Head Fx/Dislocation



Problem: Trauma → Plates/Screws; Shoulder → Arthroplasty

Elderly 4 Part Fx/Dislocation



Keys to success

1. Accurate imaging and diagnosis
 - Assess displacement and stability
2. **Careful patient selection → Psychosocial**
3. Biologically friendly dissection
4. **Reduction**, reduction, reduction
 - Tuberosities; no neck varus; restore Shenton's line & medial support
5. Deliberate **implant position**
 - Low long screws
 - Cuff sutures tied to plate
6. Consider augmentation in complex cases
7. **Refer to Arthroplasty**
 1. If failed non operative management: 4-6 months?
 2. If unable to reconstruct: don't dabble, send to arthroplasty promptly
 3. If ORIF and Failure: then arthroplasty outcomes suboptimal

Implants



Percutaneous Pinning

Arthroplasty

Cloverleaf plate

Periarticular plate

Blade plate

Custom Blade plate

Locking Plate

Intramedullary Nail (IMN)



Complications

Prominent HW

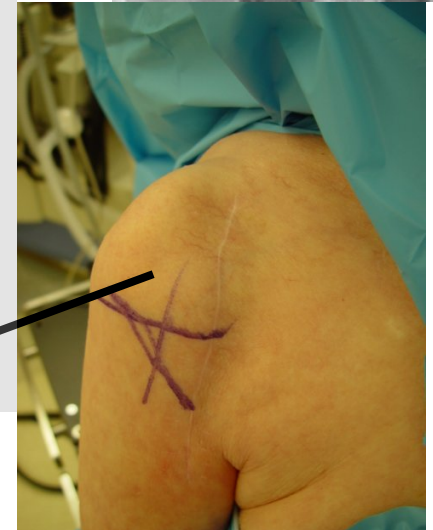
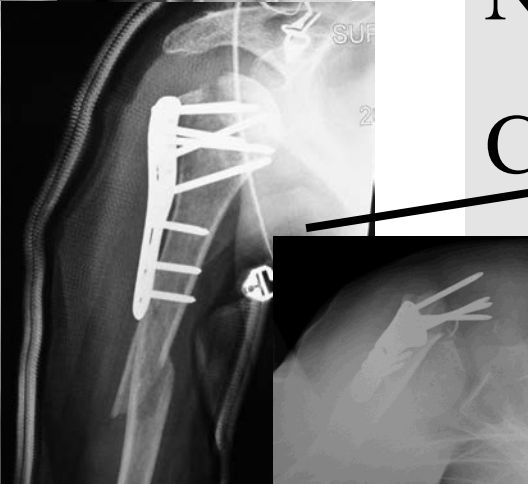
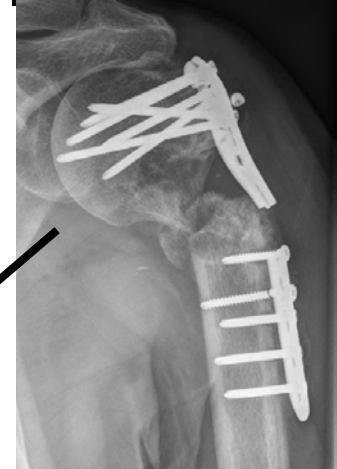
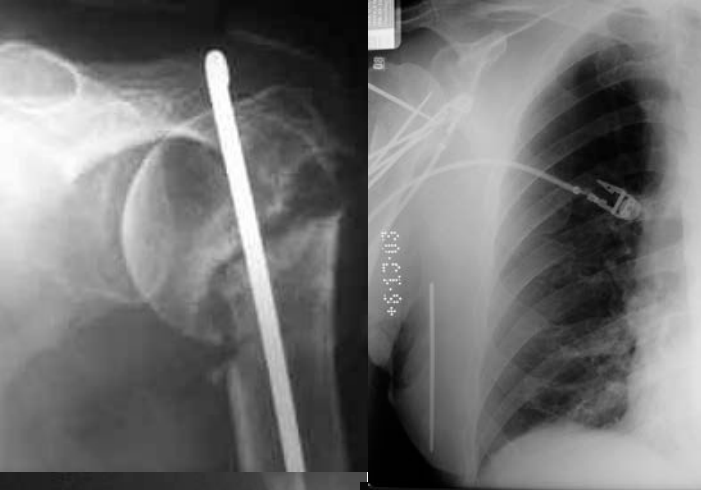
Devascularization/
AVN

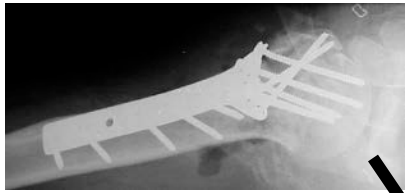
Technique

Nonunion/Malunion

Catastrophic Failure

Atrophy/Scarring



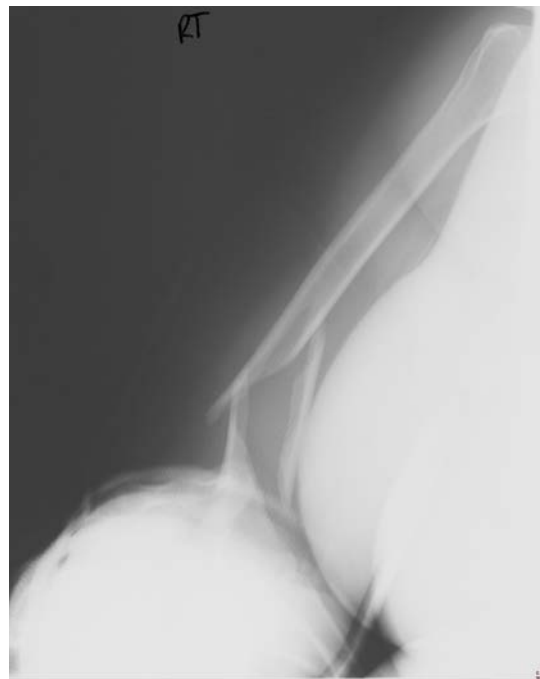


Keys to Success Tips & Tricks

- Patient Selection
- Room Set Up
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- Reduction/Soft Tissues
- Implant Insertion/Optimization
- Rehabilitation

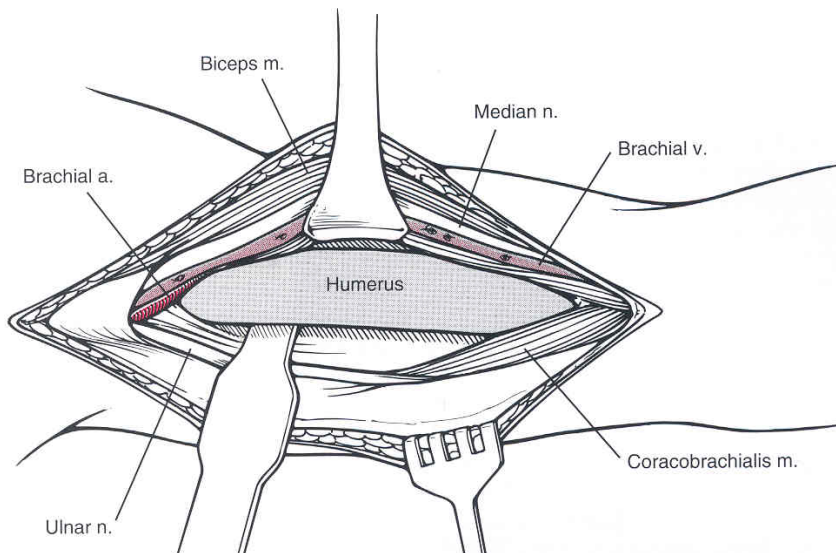
Humeral Diaphyseal Approaches

- Anterior
- Posterior Triceps Splitting
- Posterior Lateral Intramuscular
- Lateral Intramuscular
- Medial

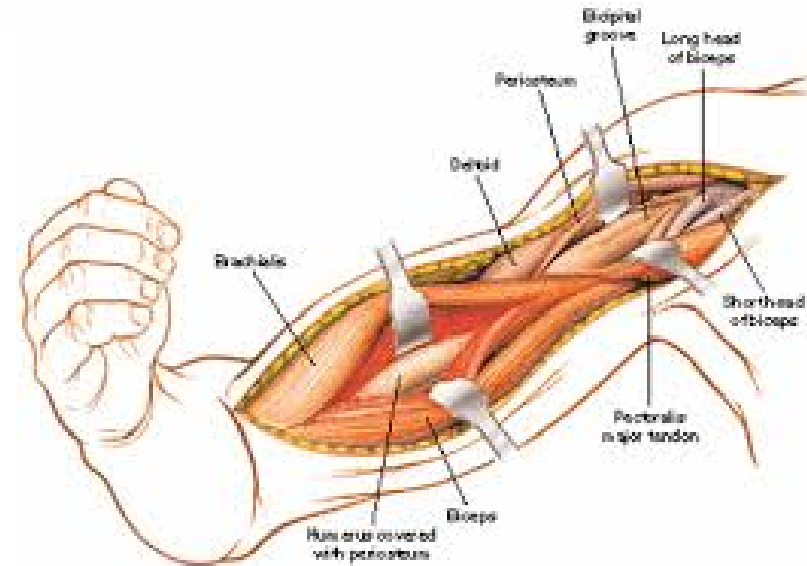
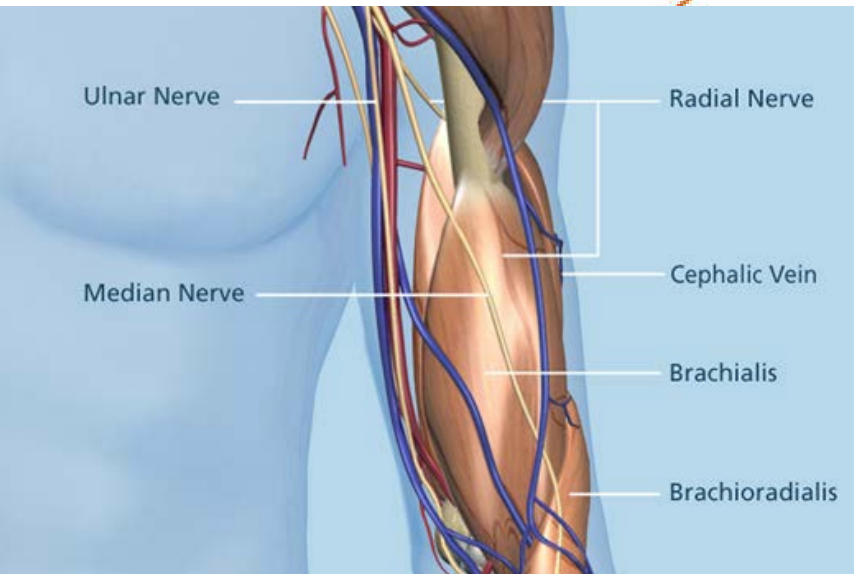
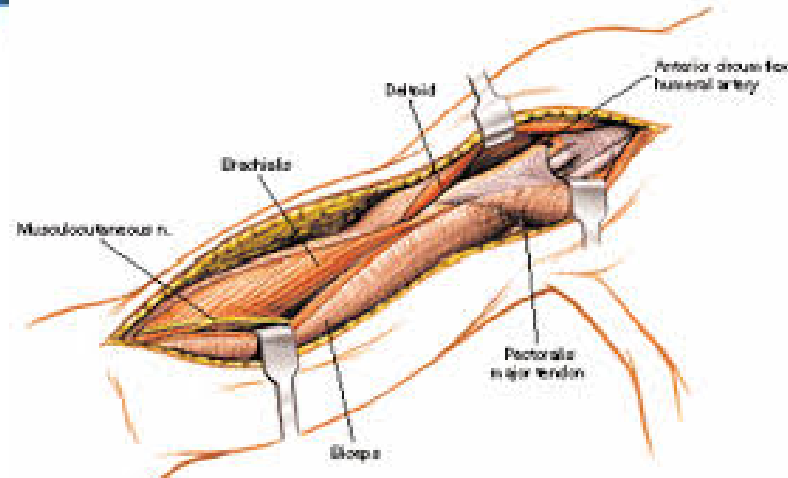
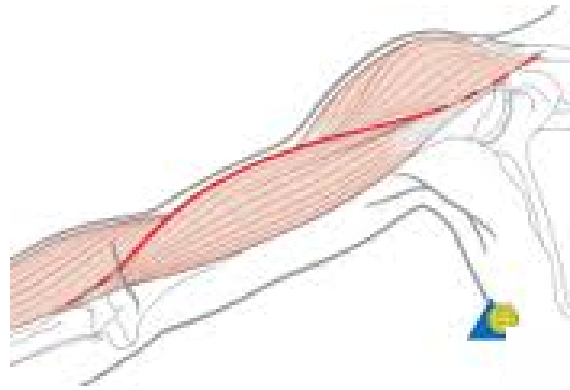


Anterior Approach

Polytrauma – supine position
Proximal & Mid 1/3
Anterior flat aspect of humerus



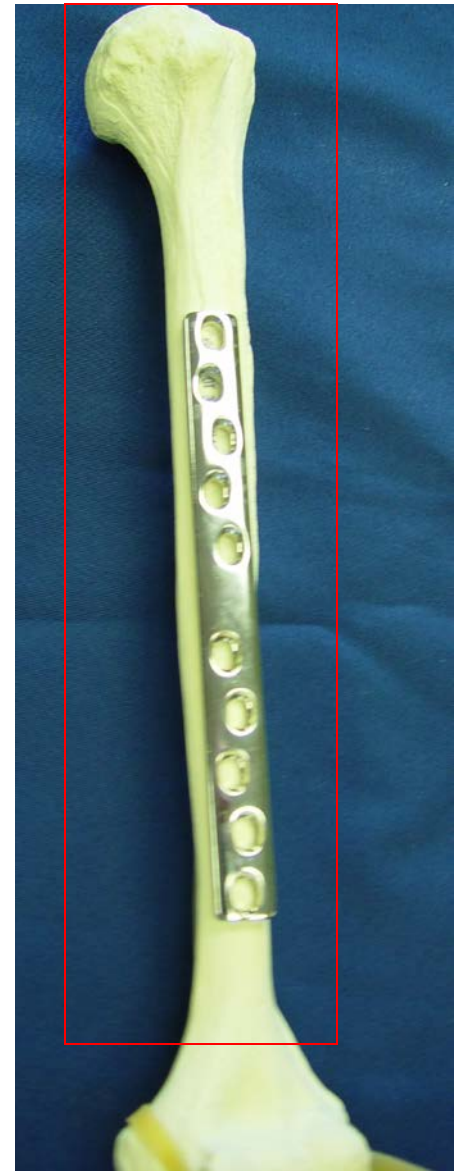
Anterior Approach

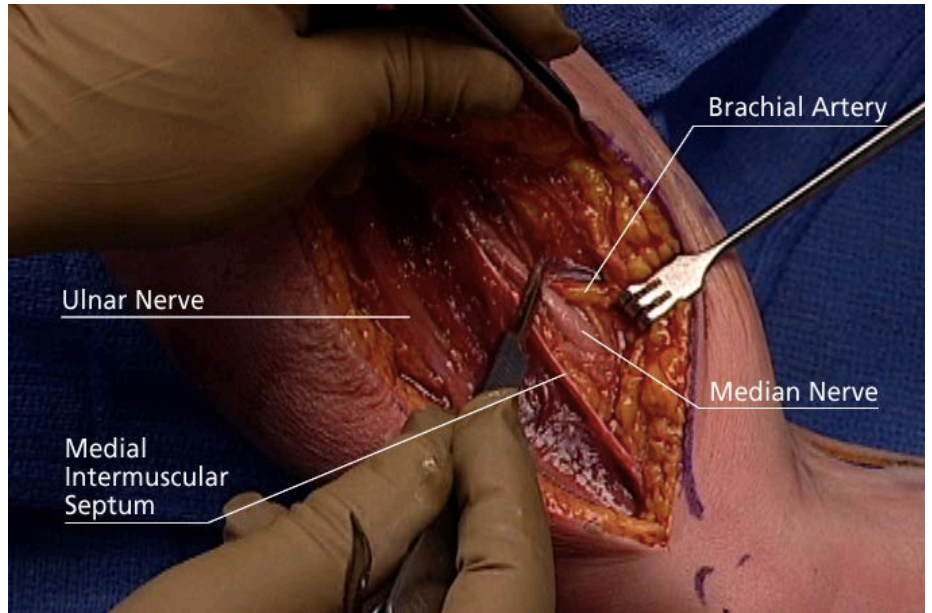
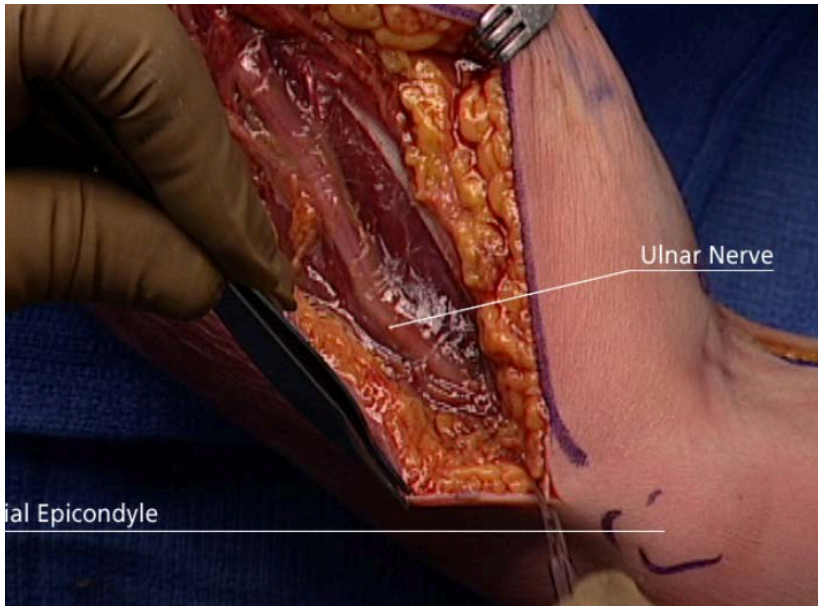
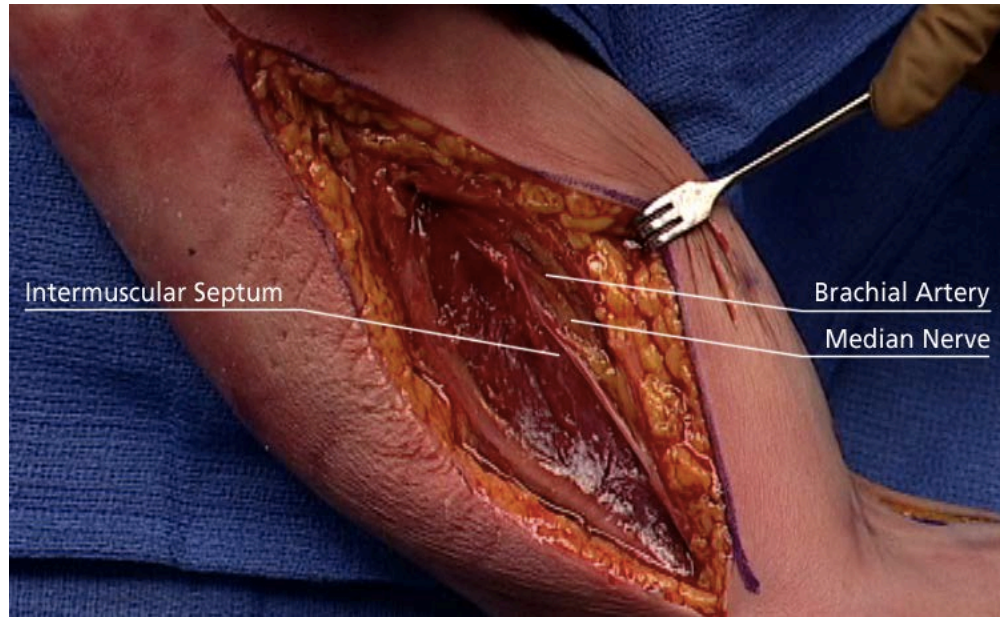
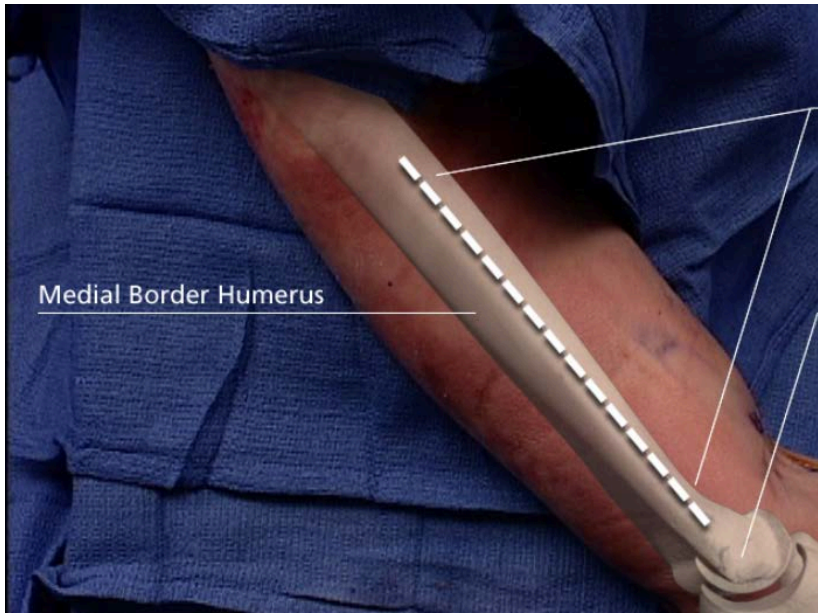


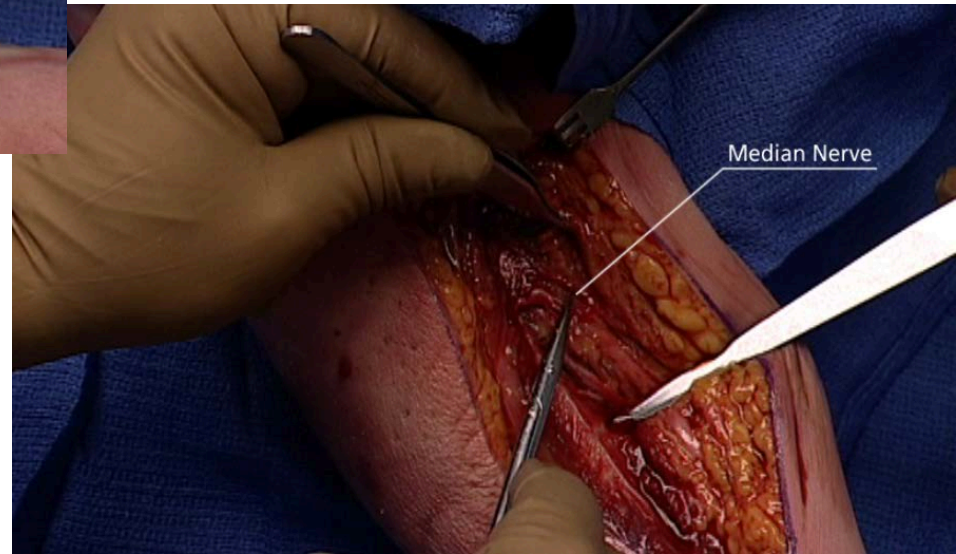
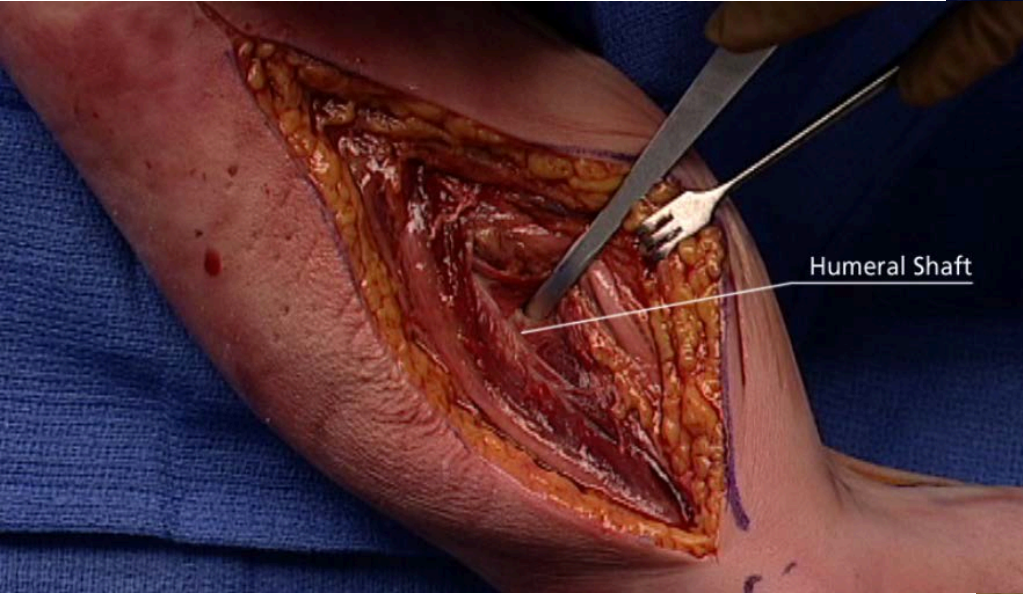
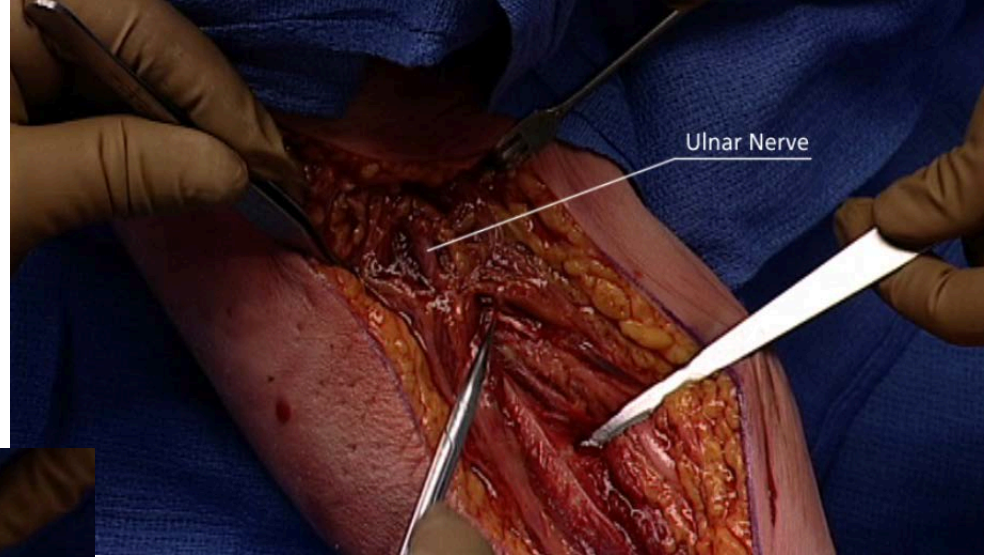
Medial Approach

Polytrauma – supine position
Mid & Dist 1/3

Usually Combined Vascular Repair

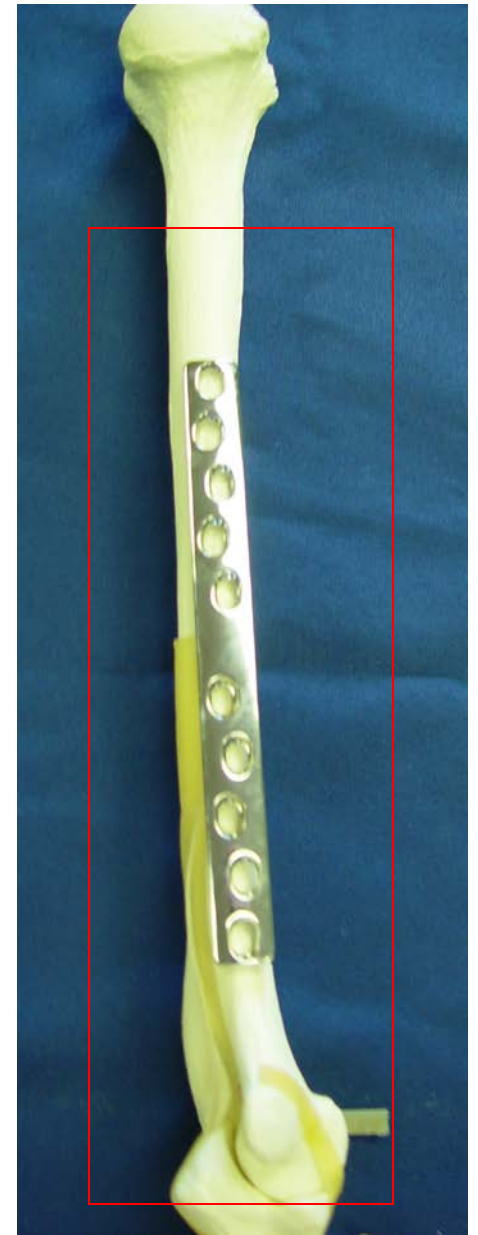


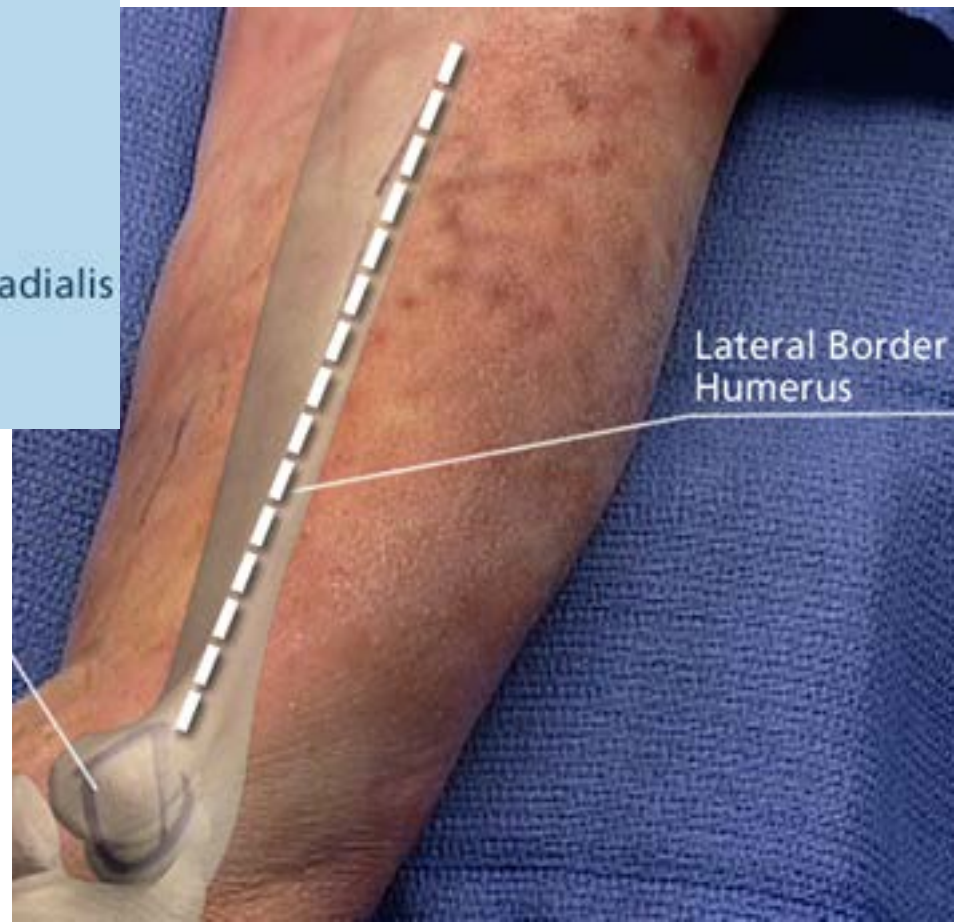
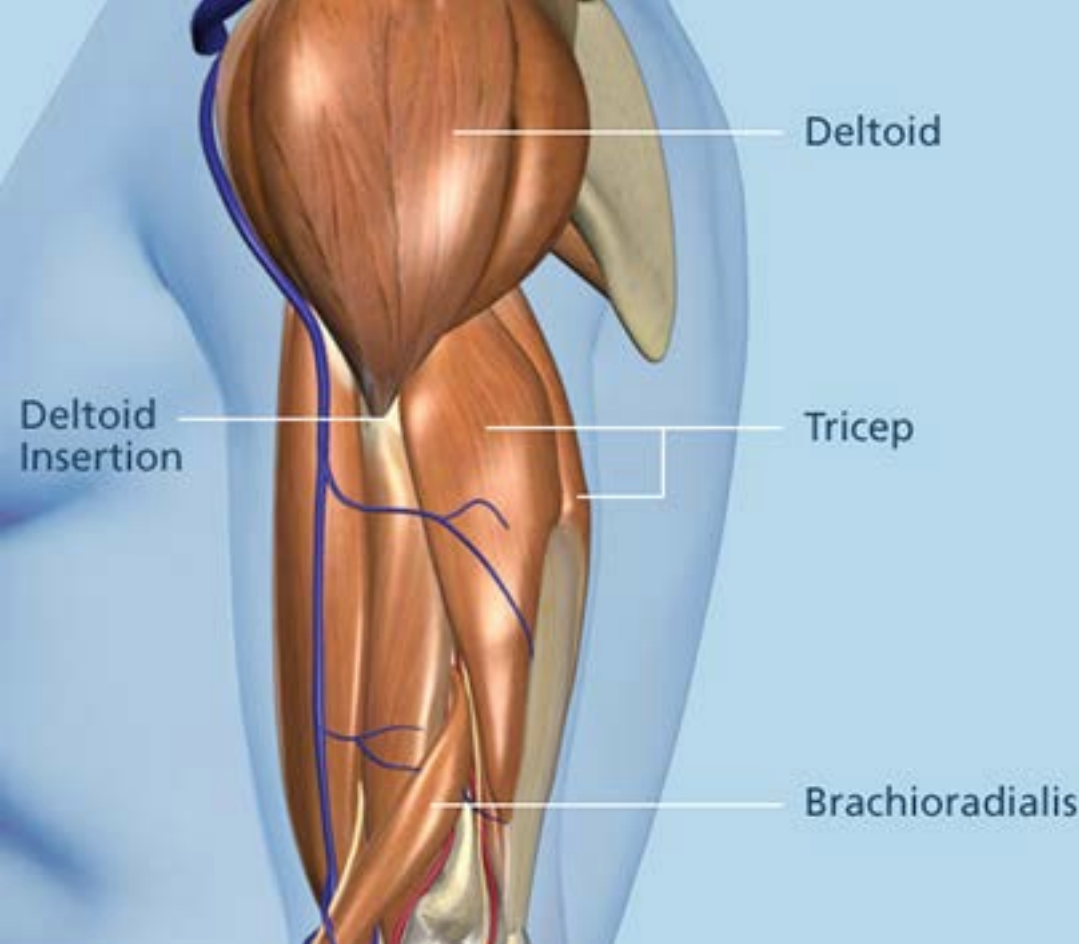


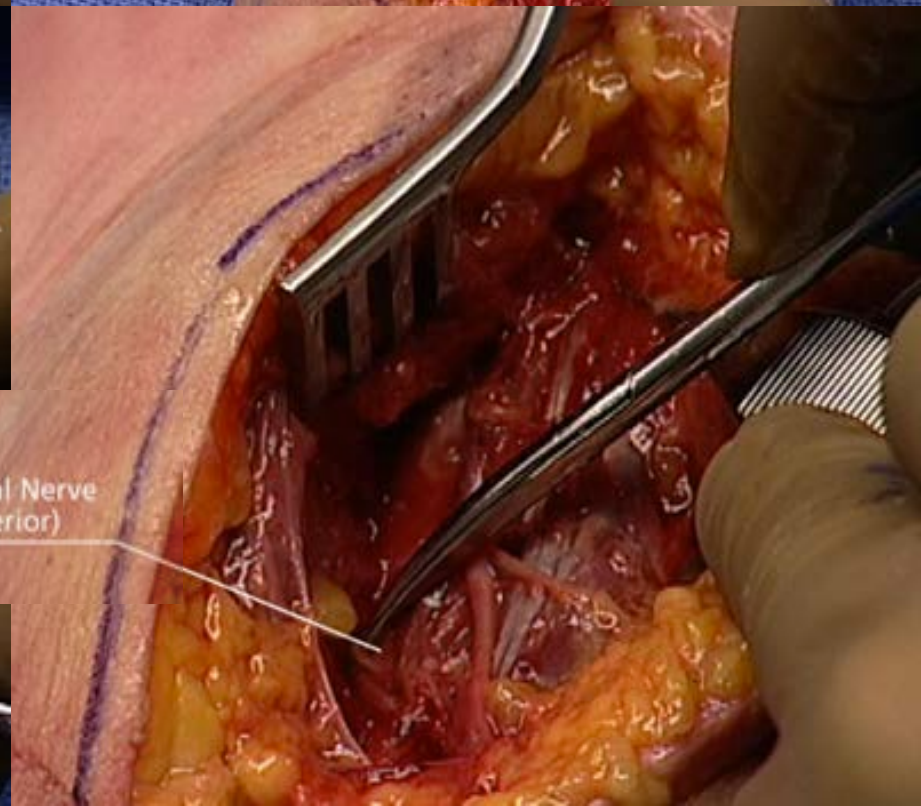
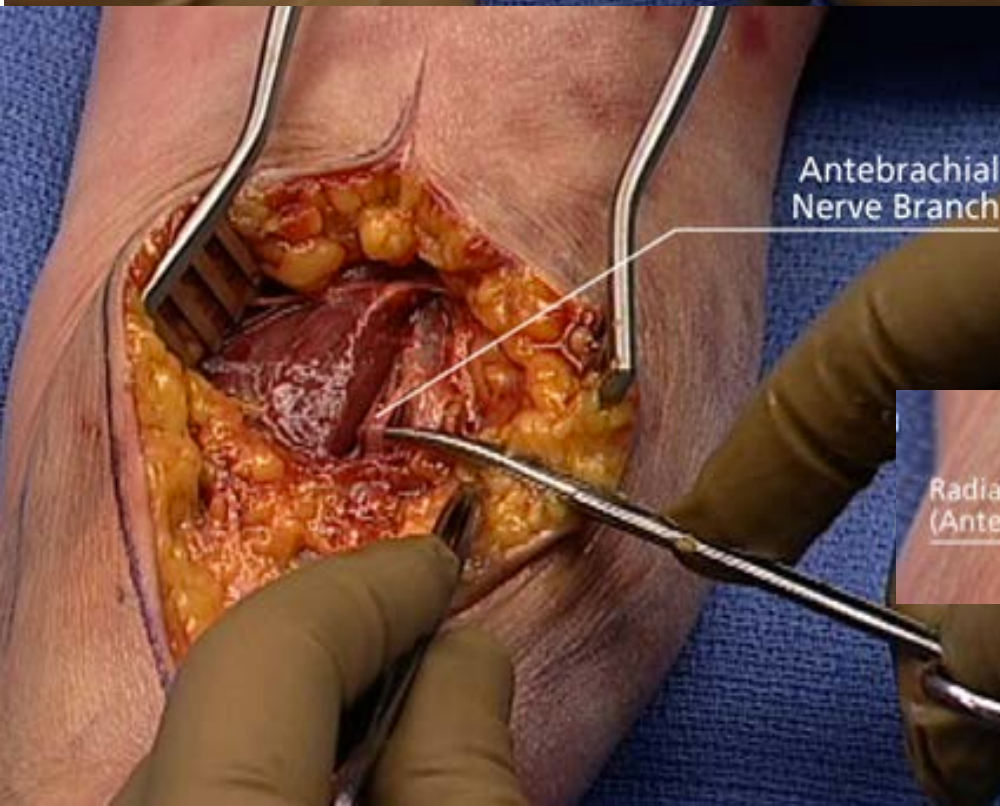
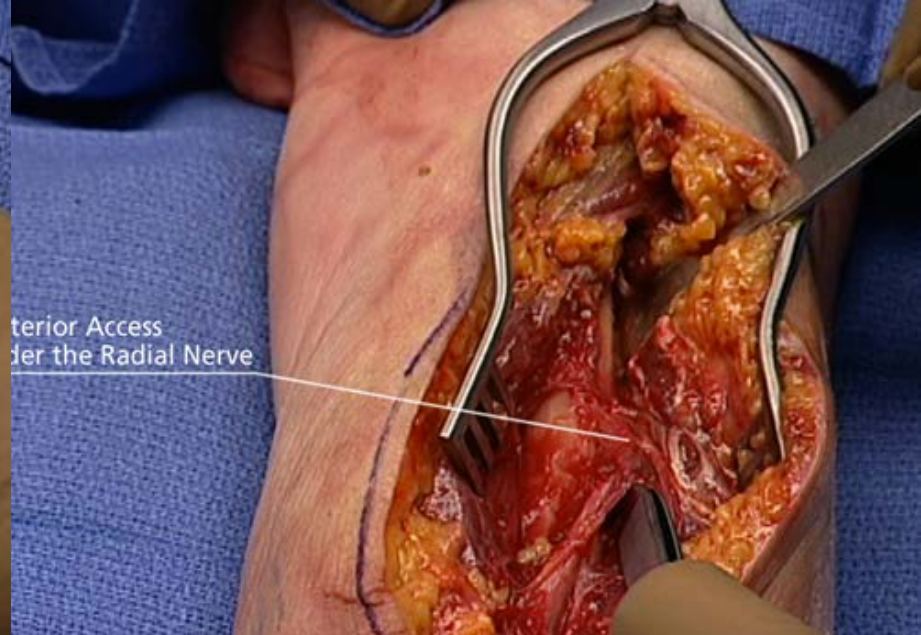


Lateral Approach

Polytrauma – supine
Combined with Prox Hum
Not muscle splitting
Narrow aspect of bone
Explore radial nerve



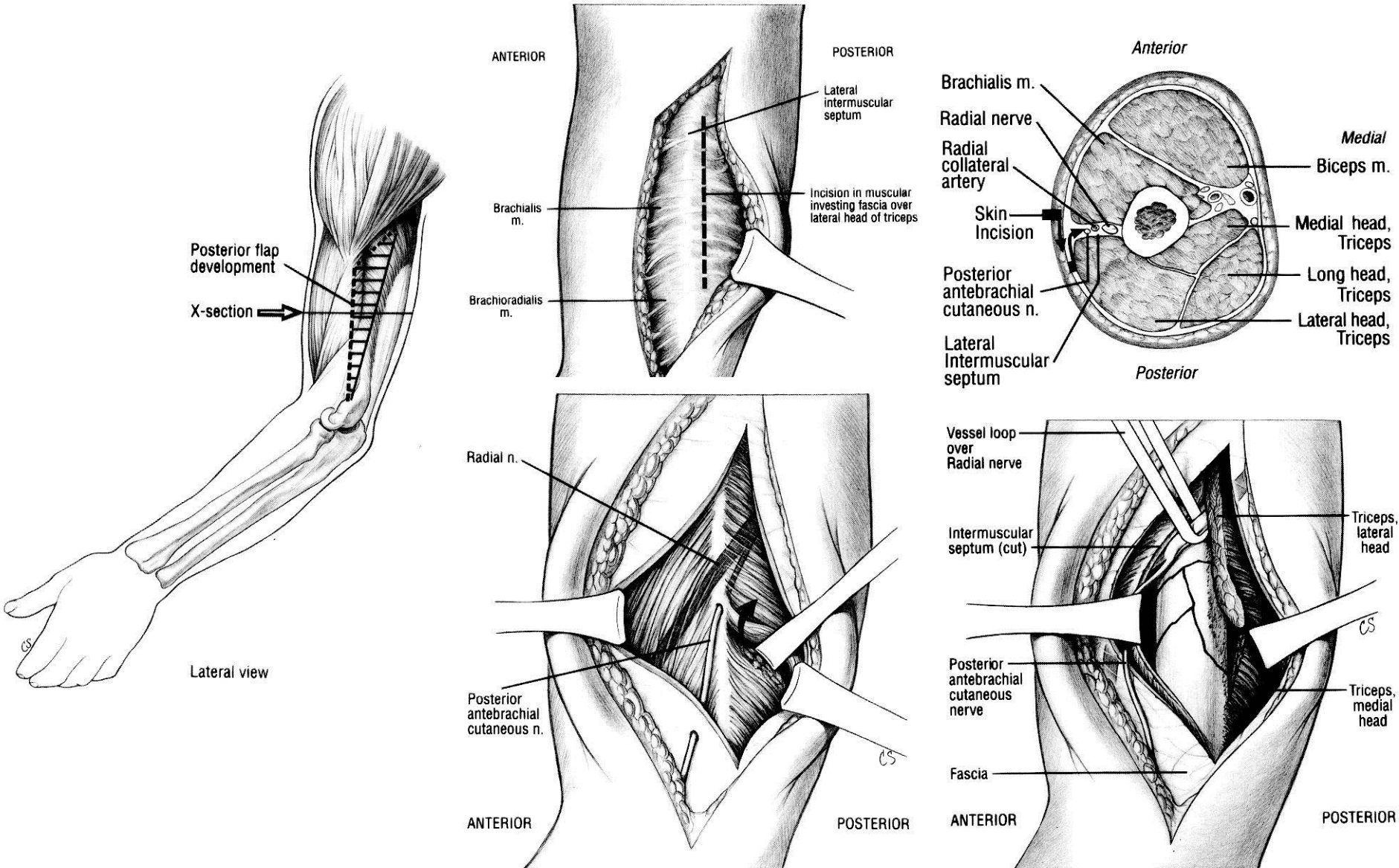




Lateral Approach to the Humeral Shaft: An Alternative Approach for Fracture Treatment

Mills, William J.; Hanel, Douglas P.; Smith, Douglas G.

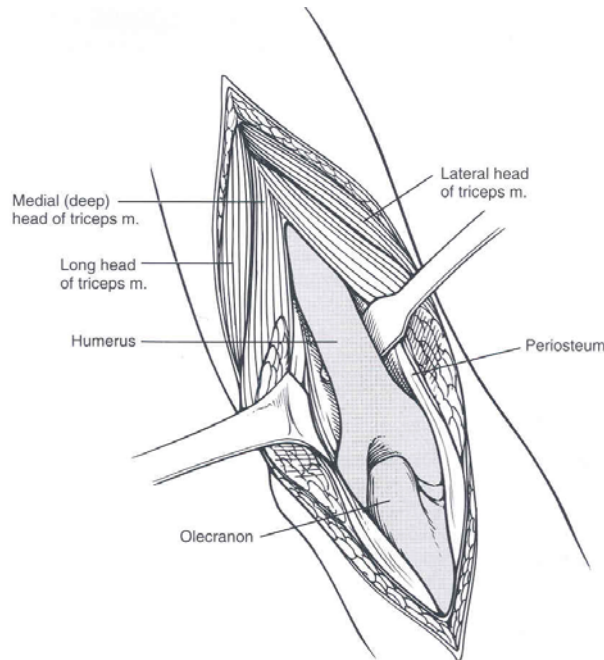
Journal of Orthopaedic Trauma, 10(2): 81-6, 1996.



Posterior Approach

Potential problems with polytrauma
Biomechanically on tension side
Mid & Distal 1/3

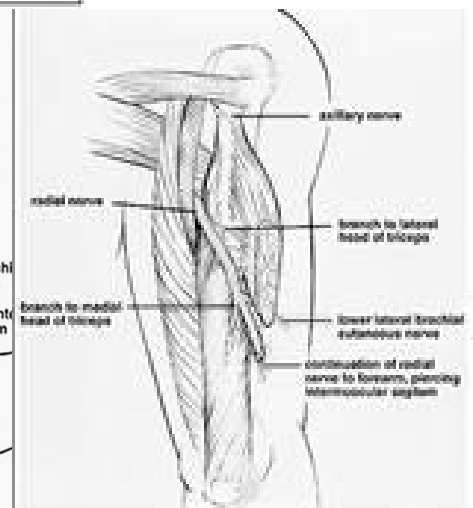
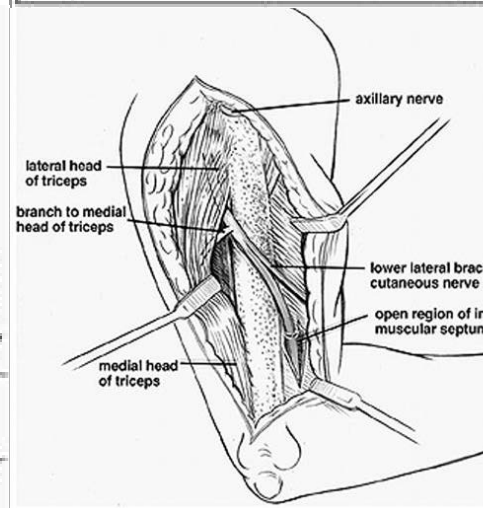
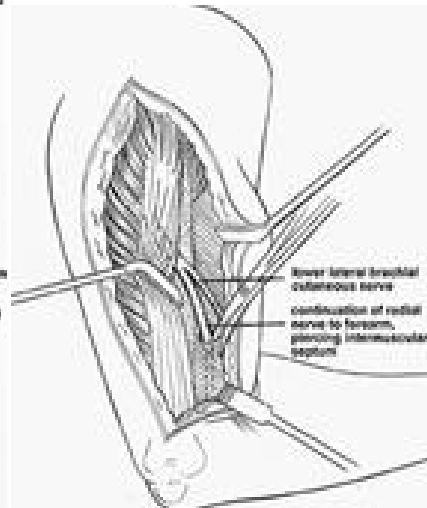
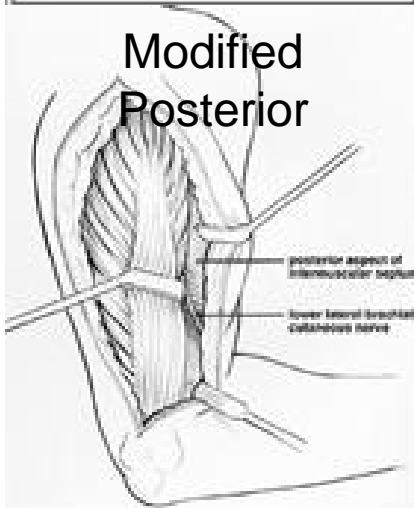
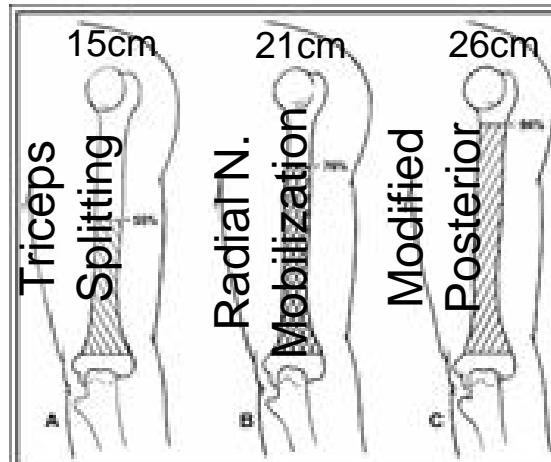
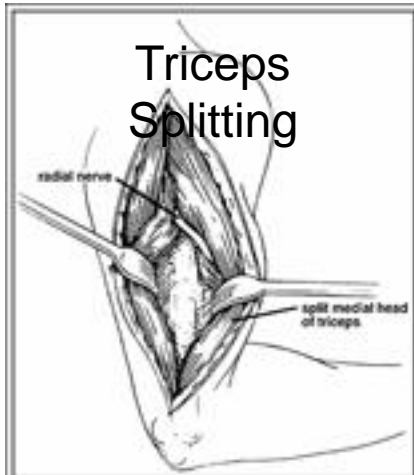
Radial nerve visualization – good & bad



Alternative Operative Exposures of the Posterior Aspect of the Humeral Diaphysis. With Reference to the Radial Nerve*

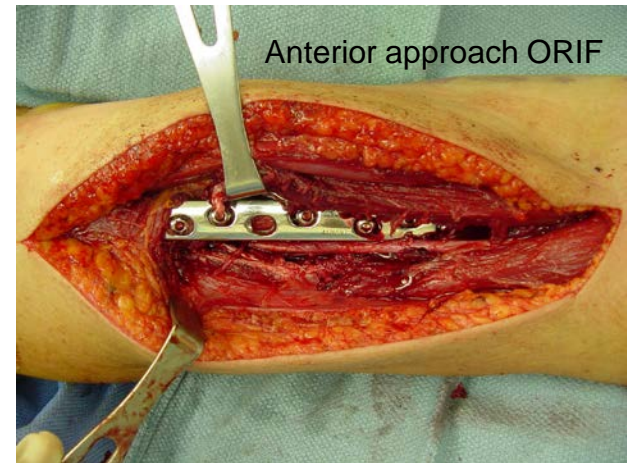
MICHELLE GERWIN, ROBERT N. HOTCHKISS, ANDREW J. WEILAND

J Bone Joint Surg Am, 1996 Nov 01;78(11):1690-5



Implant & Nerve Injury

ORIF allows for exploration of nerve

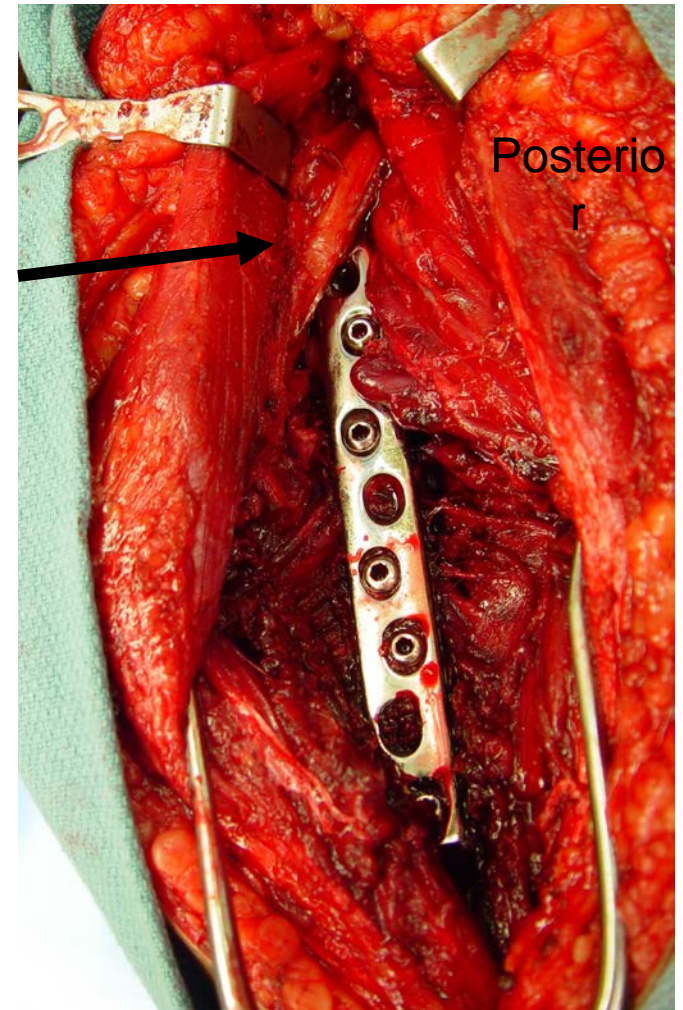
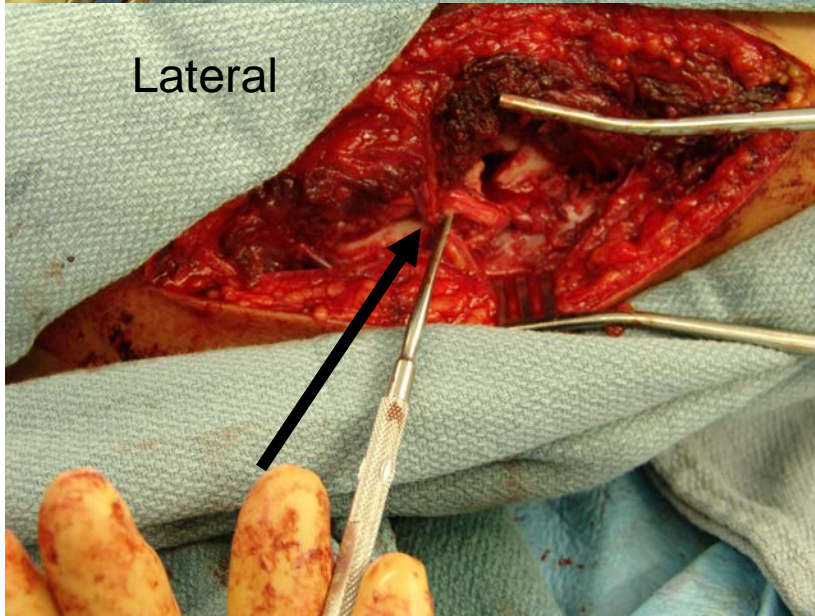
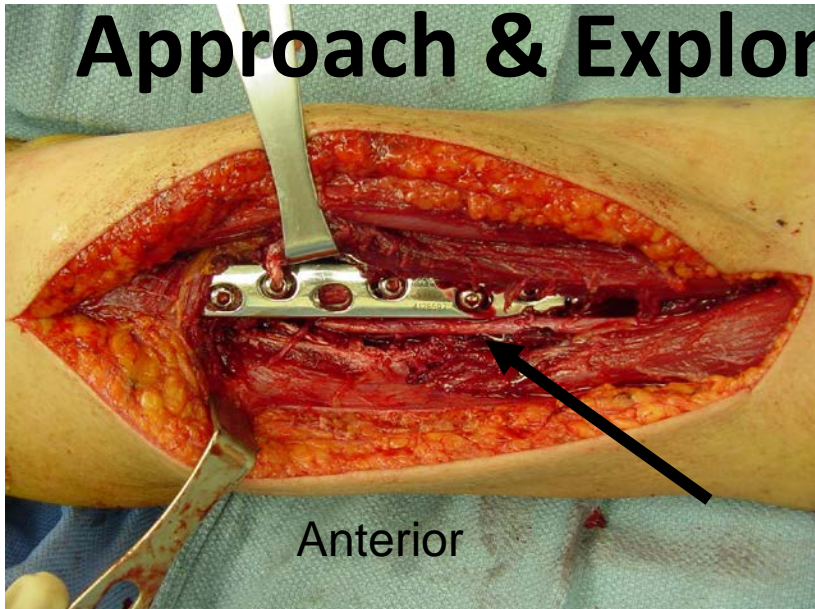


IMN requires an additional incision (esp. TBI)

- SSEP changes, 27% of pts, *Mills, JOT, 2000*



Approach & Exploration of Radial Nerve



Extensile Lateral

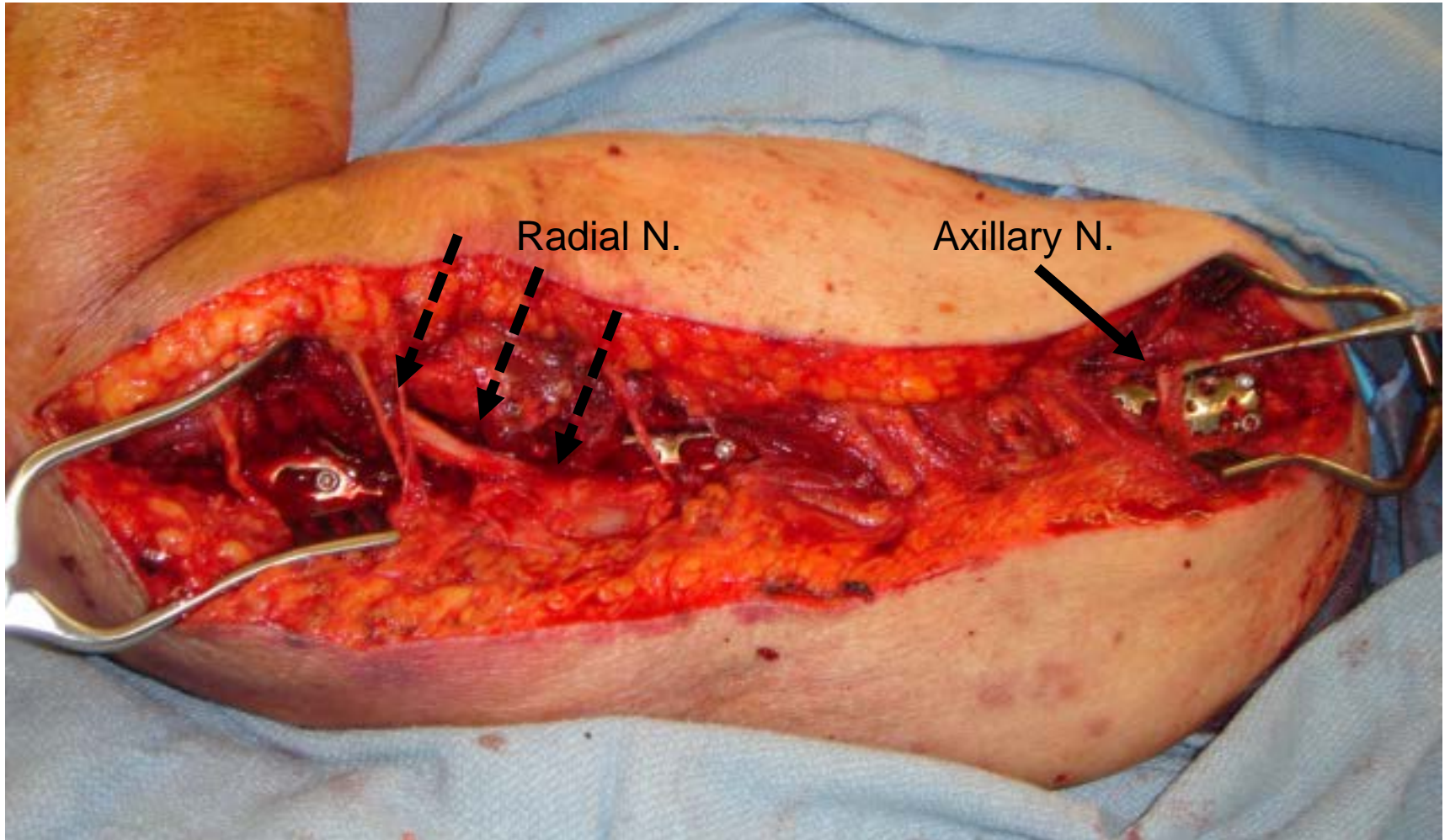


Plate Fixation

Interfragmentary screws – +/-

Plate Options – “fit to patient”

- 3.5 DCP

- **4.5 narrow**

- 4.5 broad

Double Plating

- Segmental bone loss

- Distal extension



Plate Fixation

Acute Fx – **6-8 cortices**

Nonunion – **8 cortices**

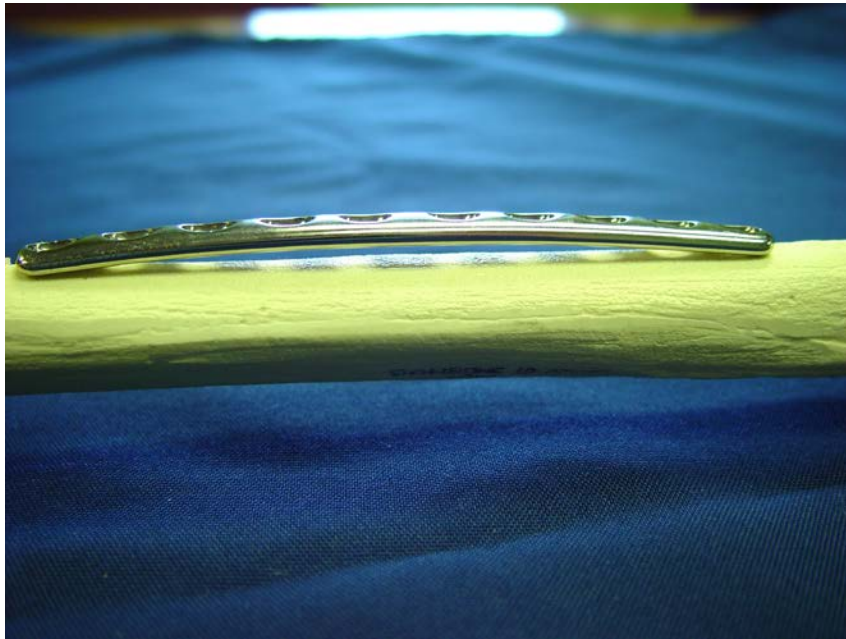
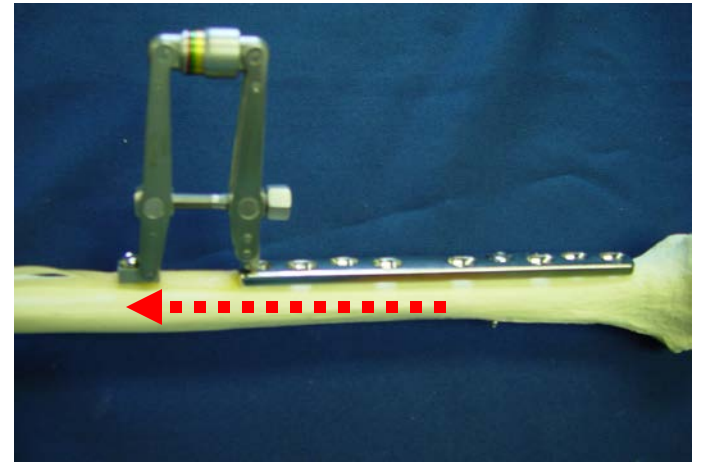
Modern Techniques

Longer plates, less screws

Hybrid/Locking plates

Bone quality

Plate Fixation



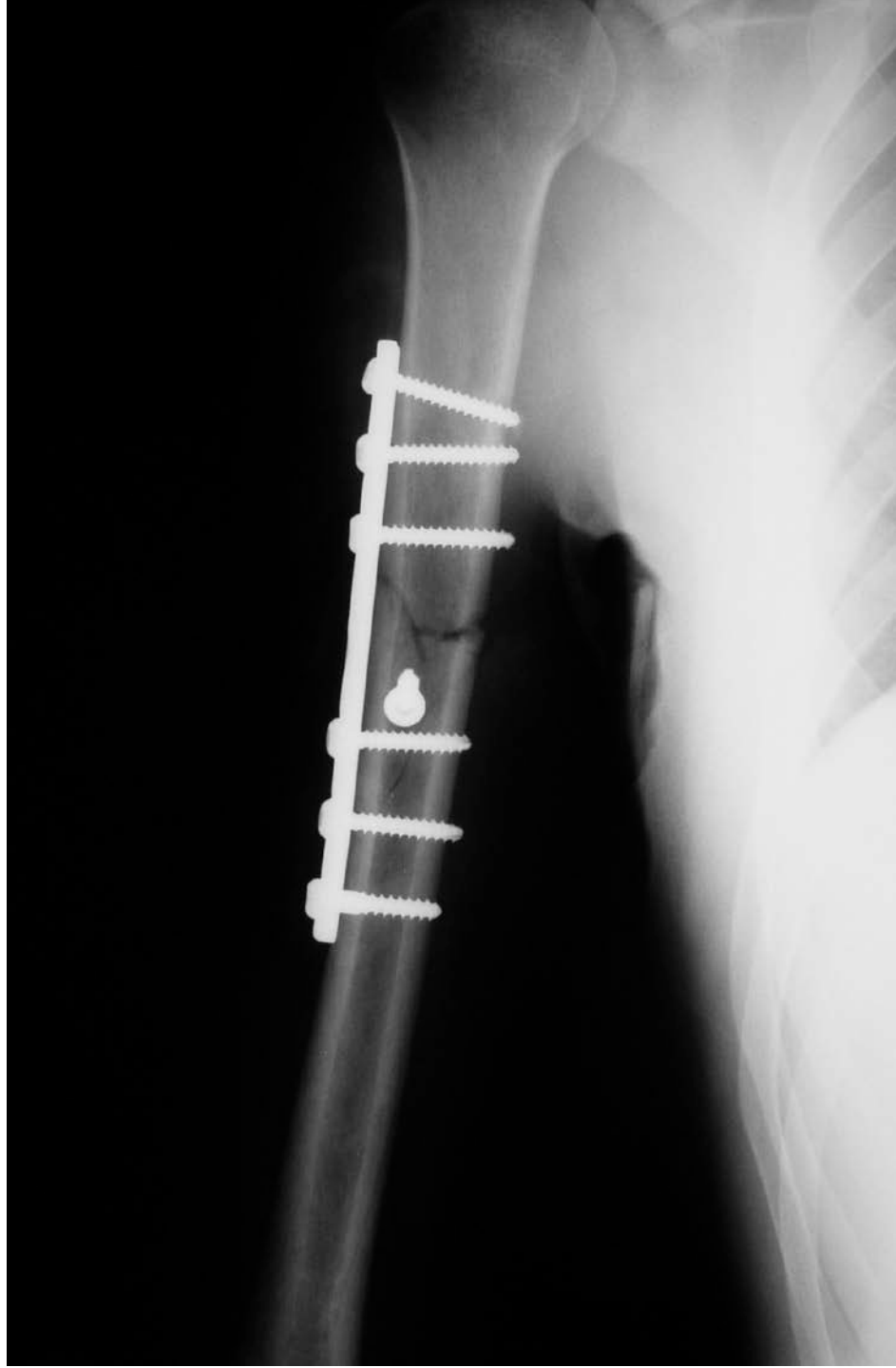
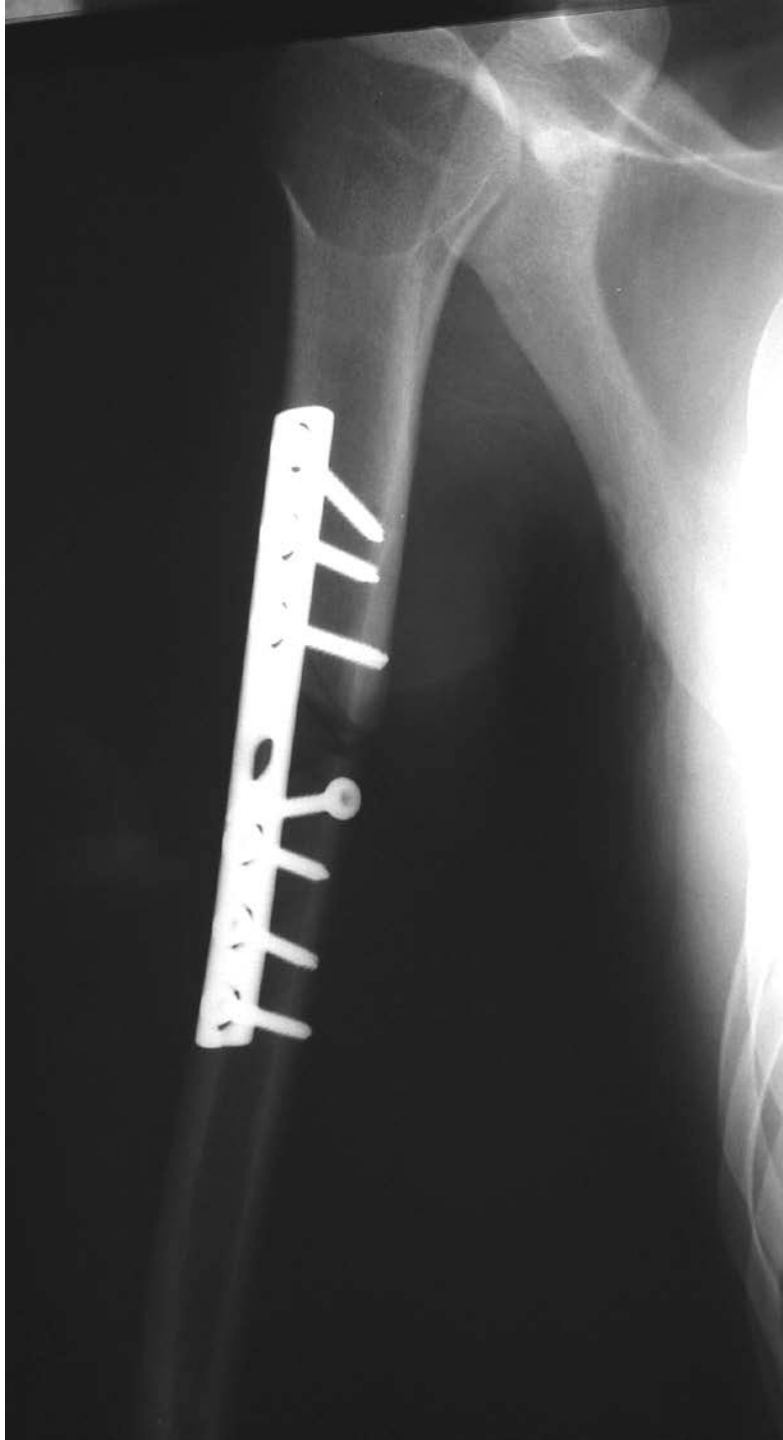
Pre Bend



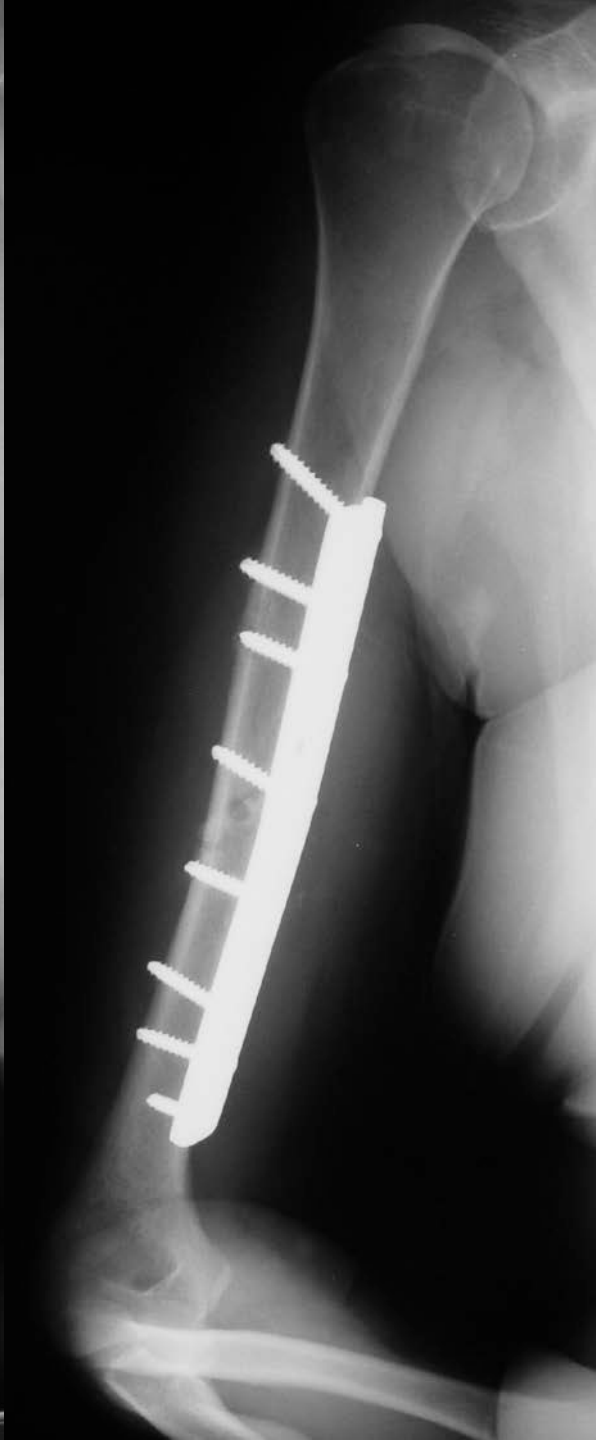
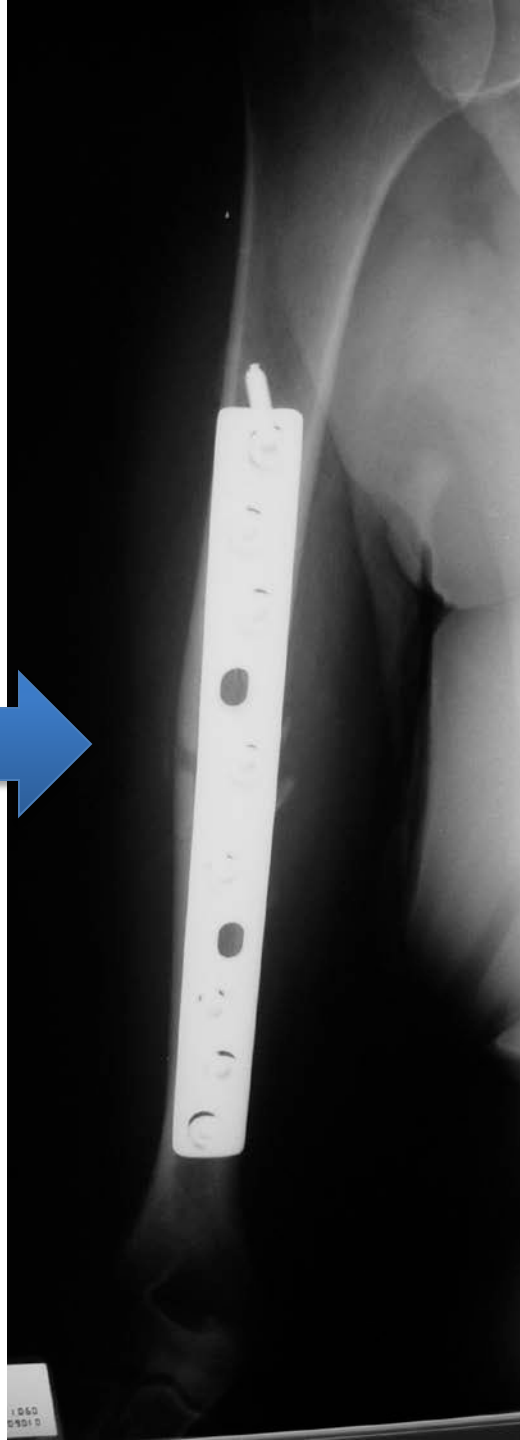
Compression Plating

48 year old Male
High Energy Fall MVA
Type II Open





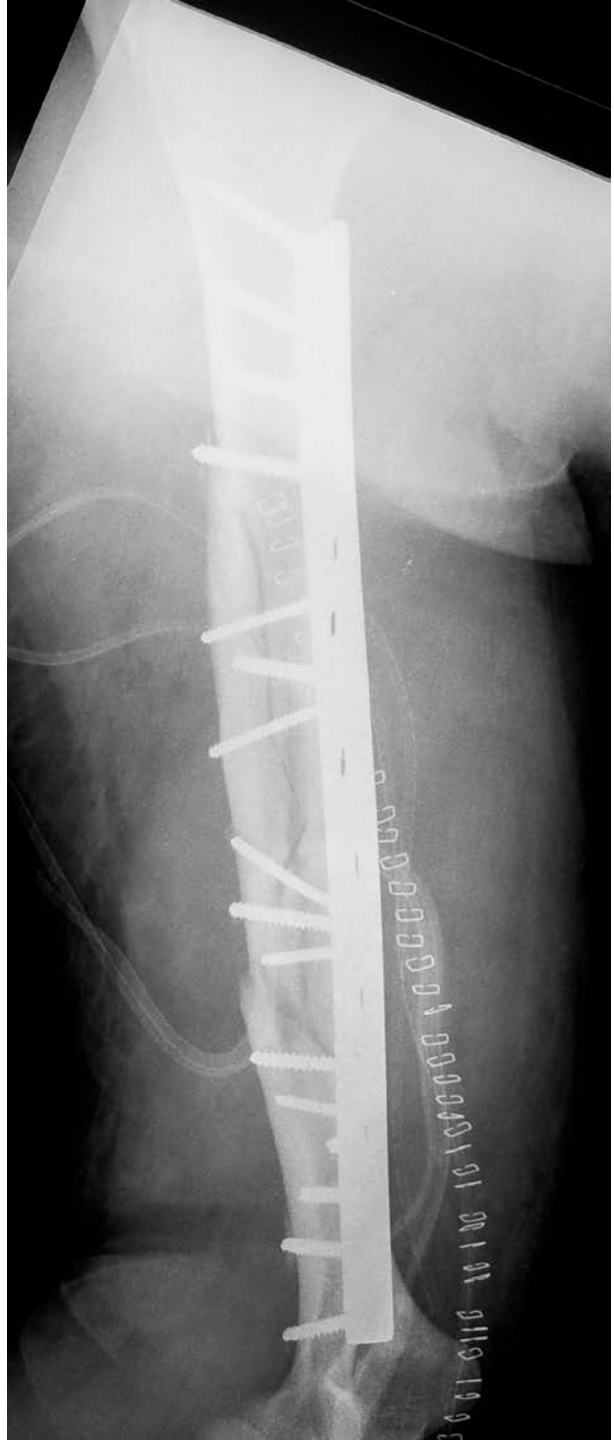
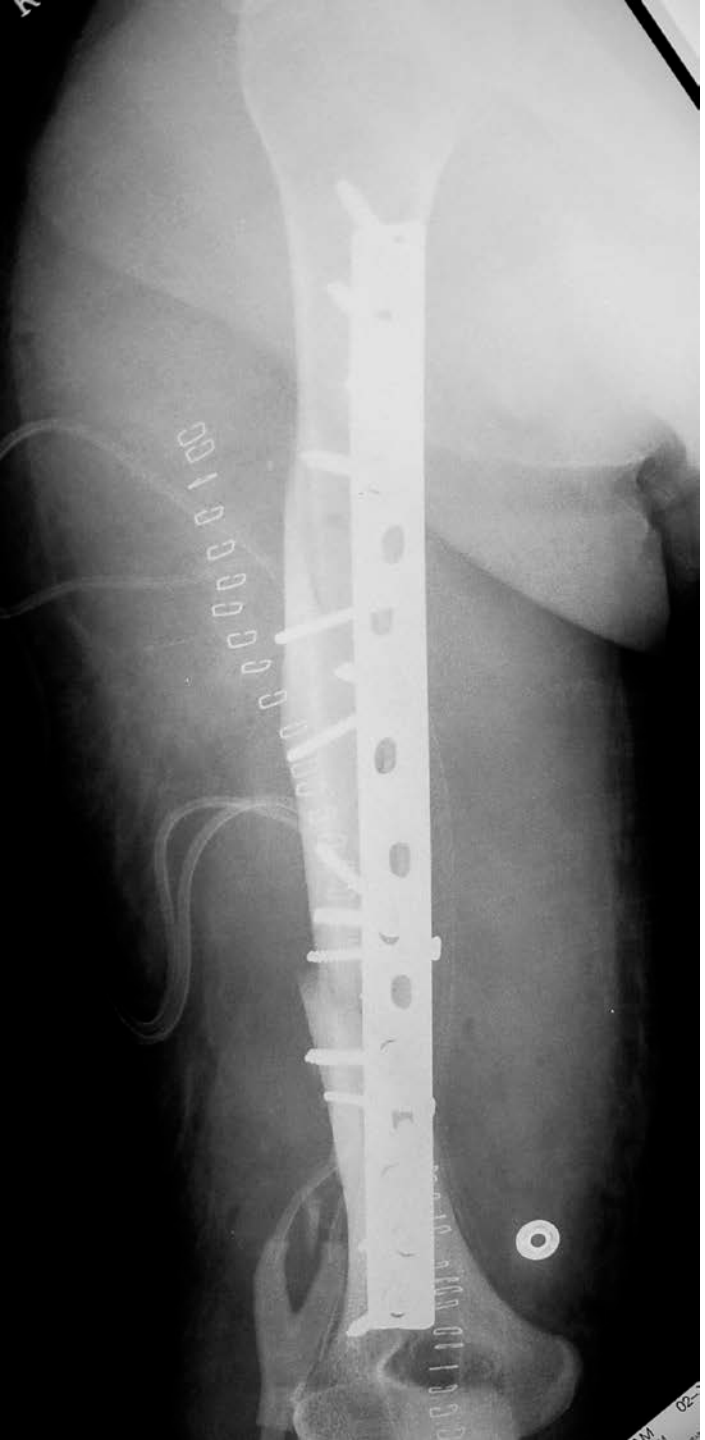




53 year old
Male
6'5" 500lbs
MVA

Coaptation Splint





Comminuted Segmental



Anterior Approach

Reduce Fracture

Oblique Positioning
of Plate

Usually, proximal
medial and distal
lateral



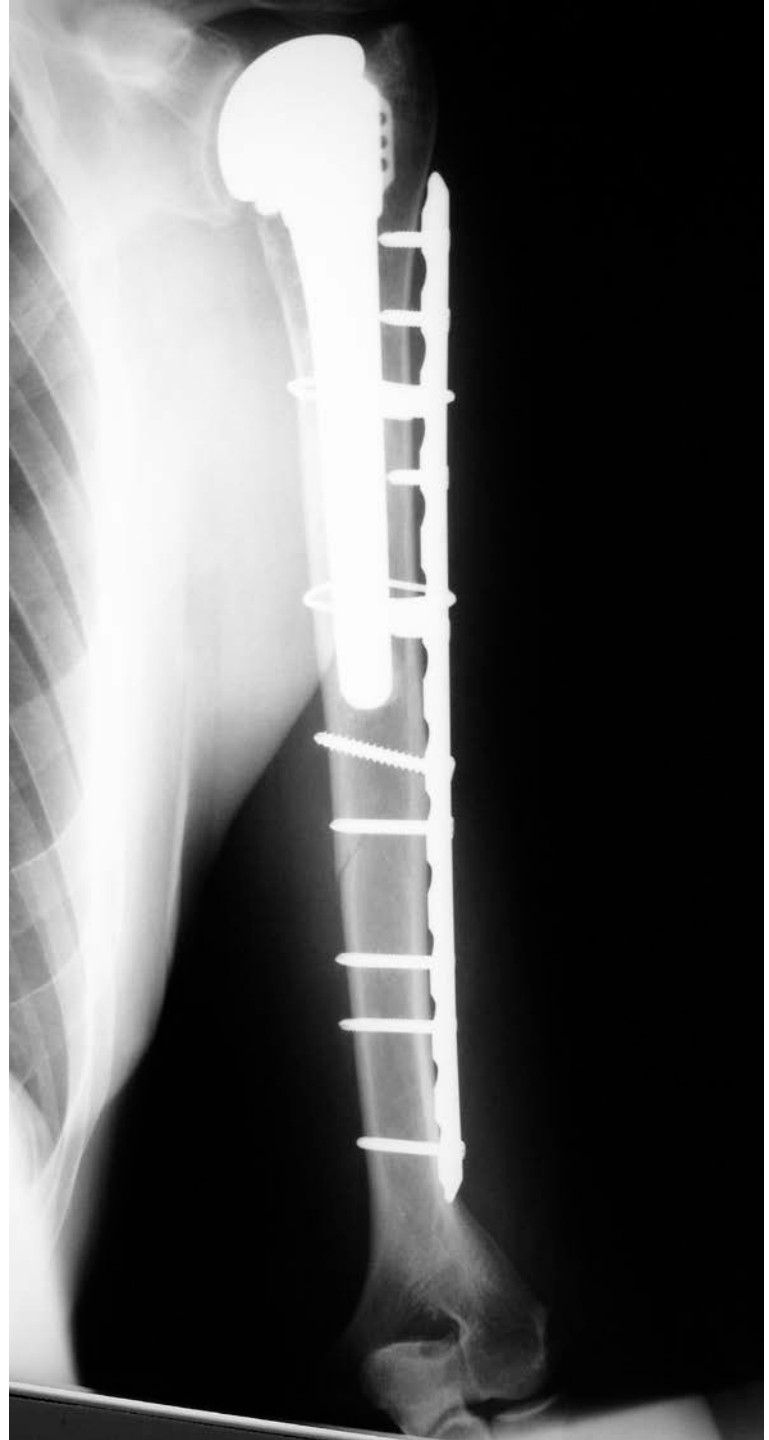
Balanced Fixation



Final Fixation & Healing







Morbid obesity

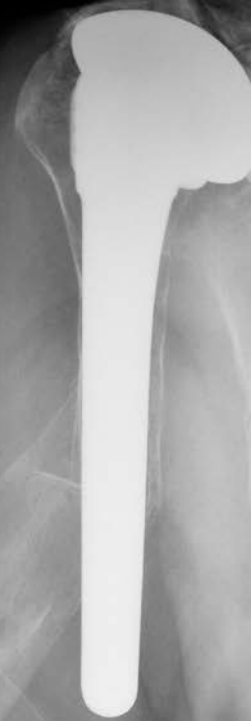
Anterior escape with
dysfunctional RC

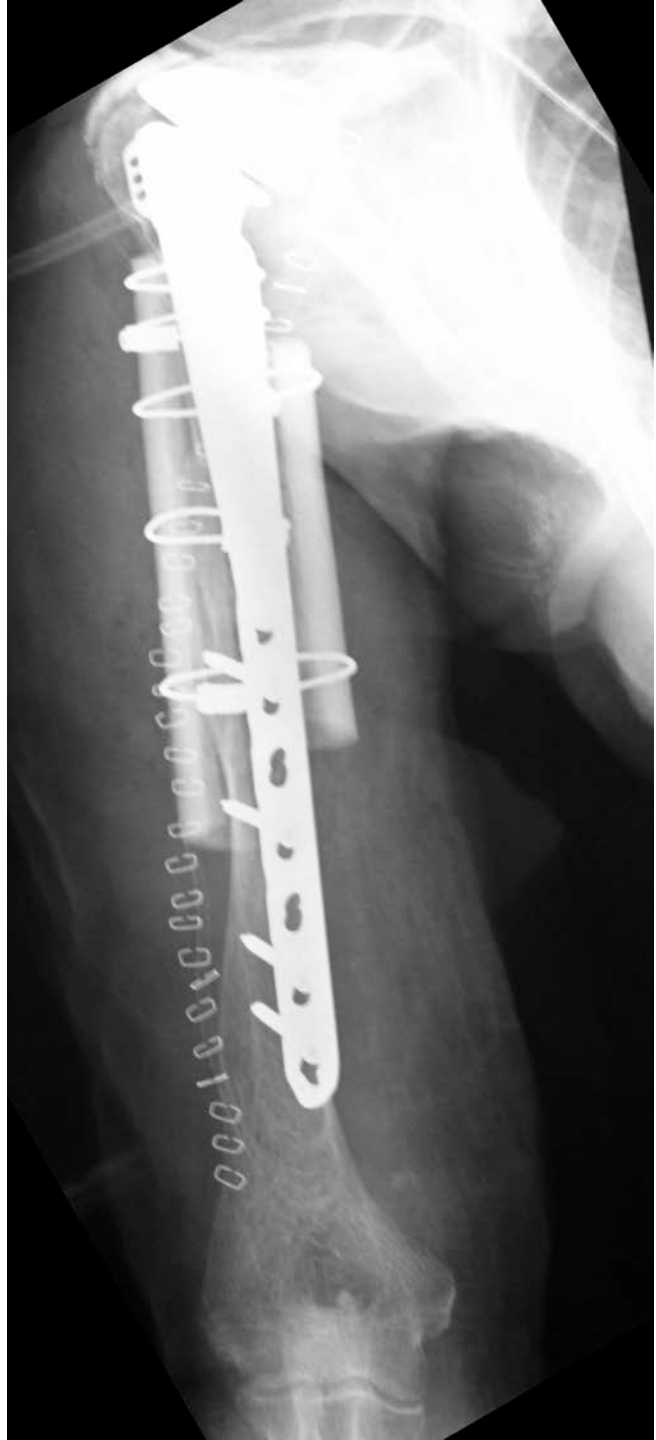
OK with ADL

No prior Pain

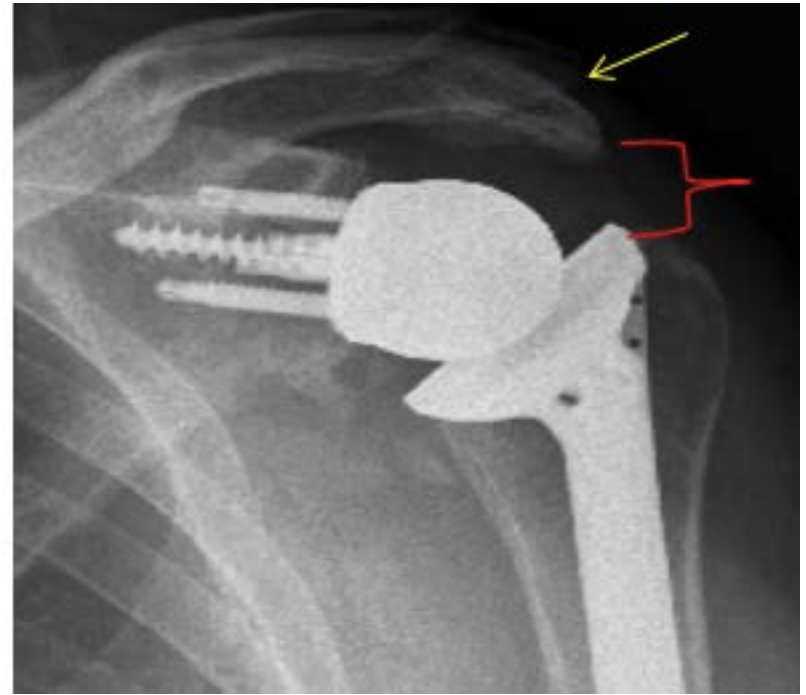
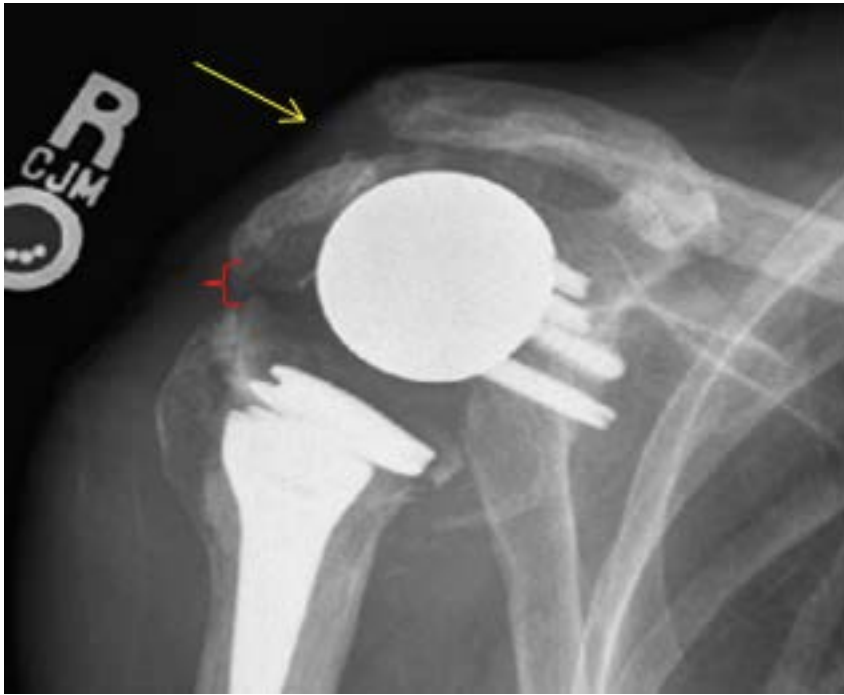


R

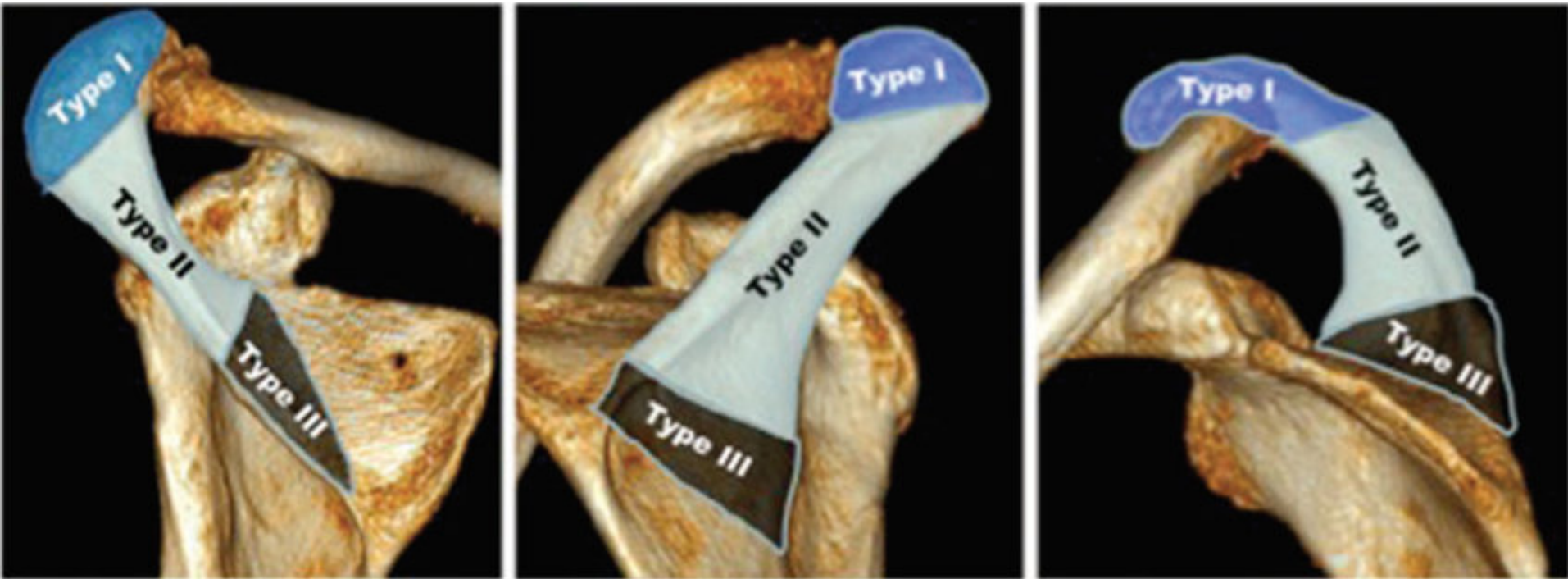




Worst Case Scenario Acromial Stress Fractures



Levy Acromial Classification



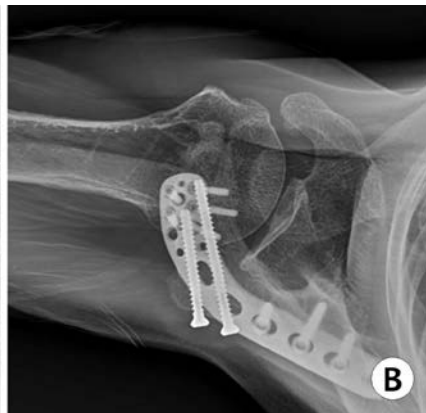
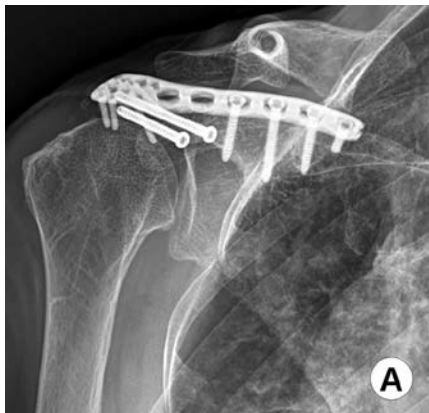
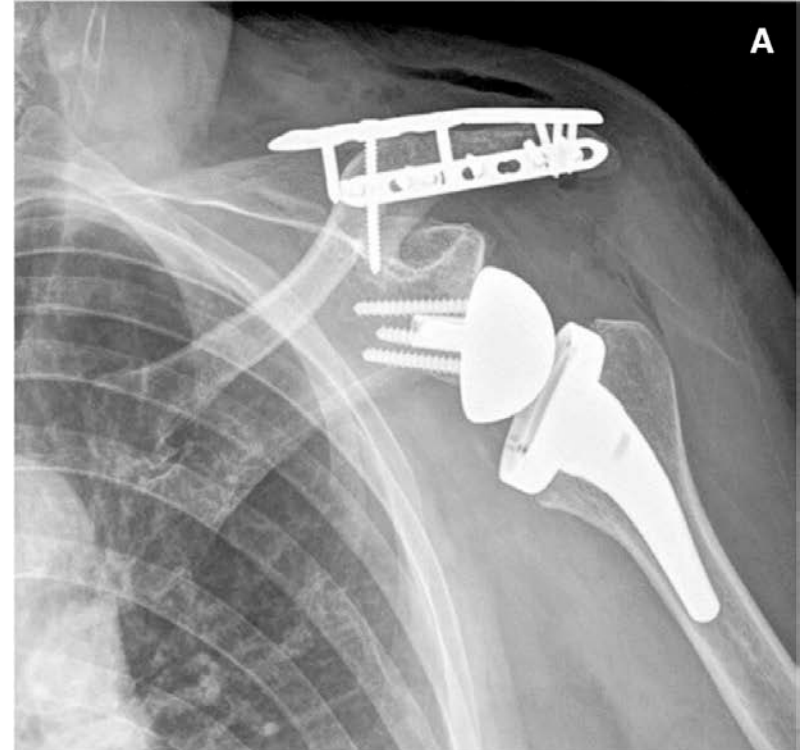
Acromial Fracture Treatment

Tensional Mini Fragment Fixation

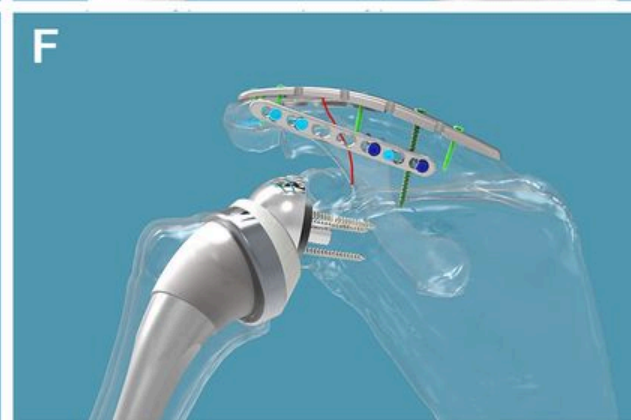
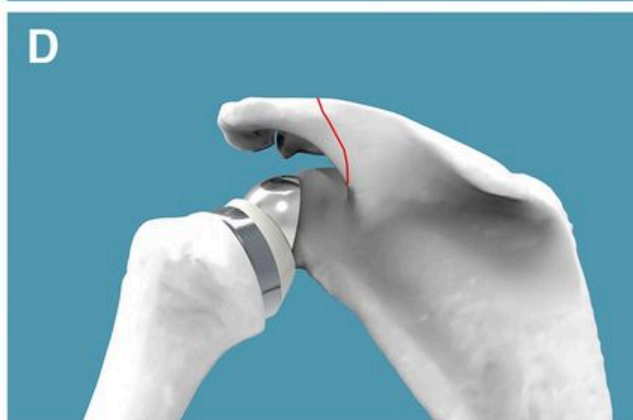
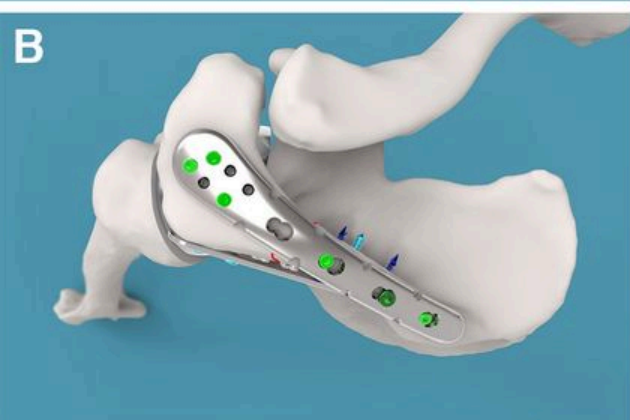
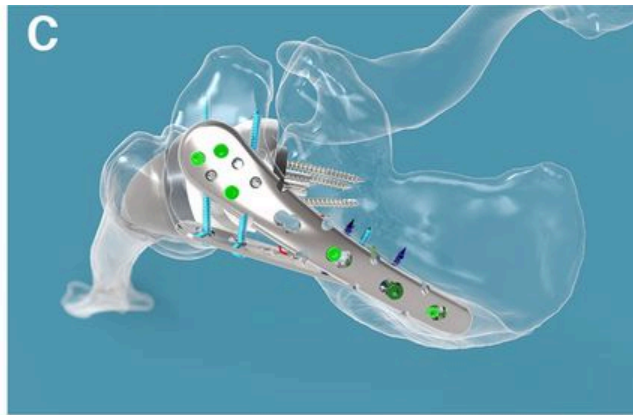
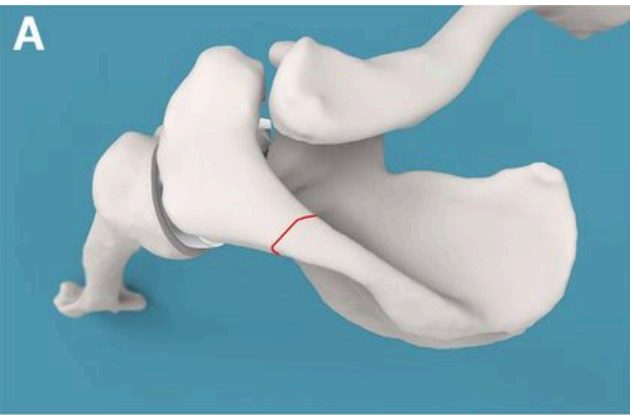
Smaller/More Screws

Don't Fracture the Fracture More (comminution) with larger screws

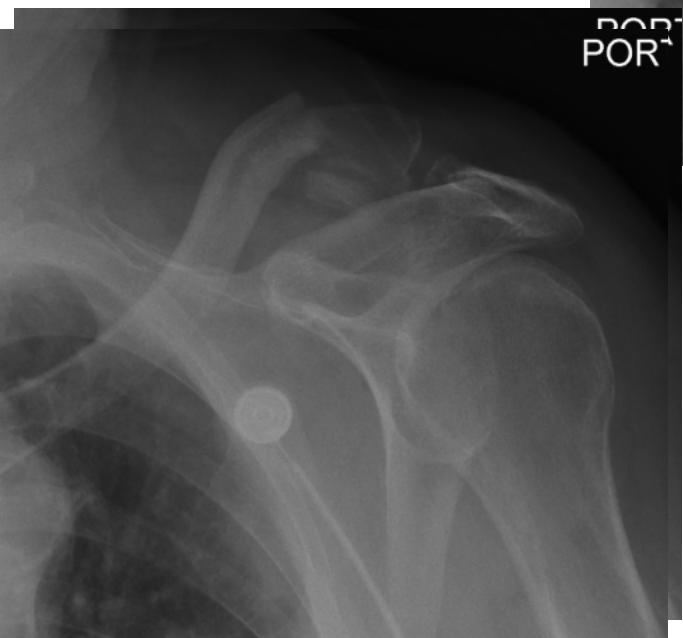
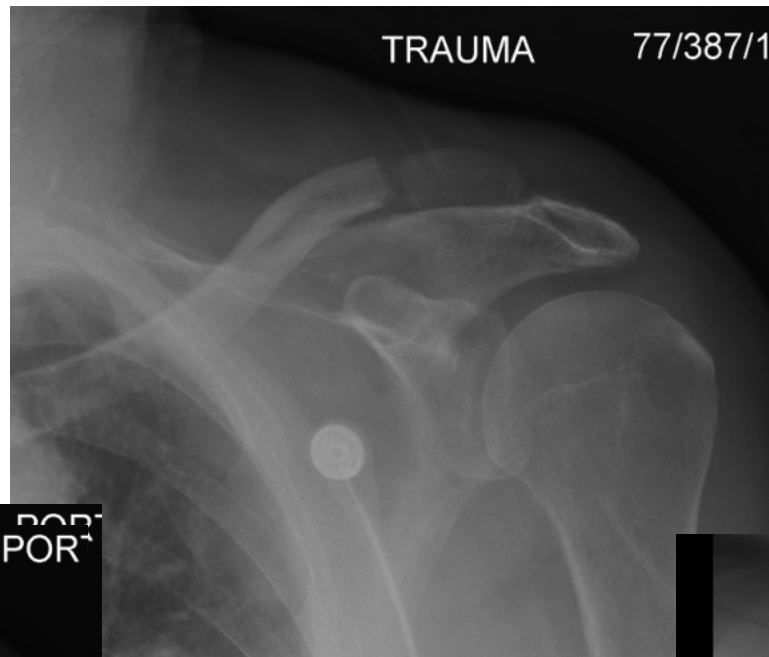
Unload Shoulder 8-12 weeks



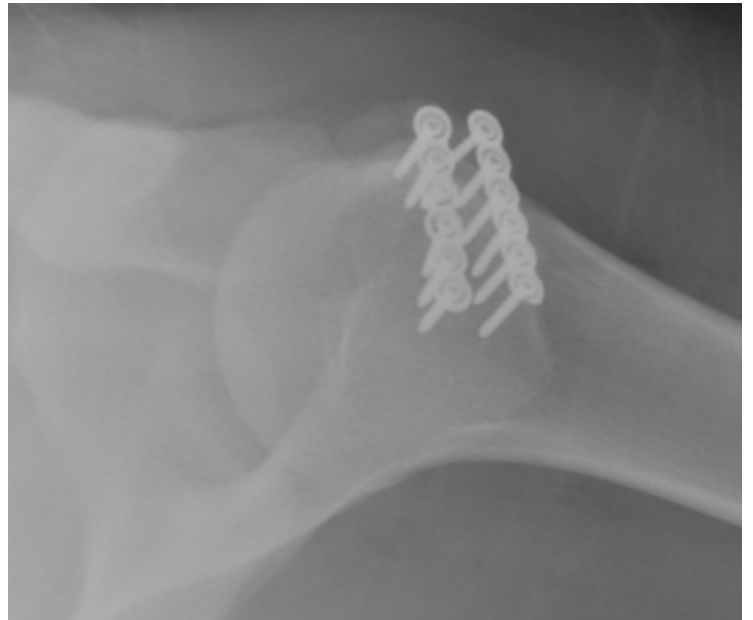
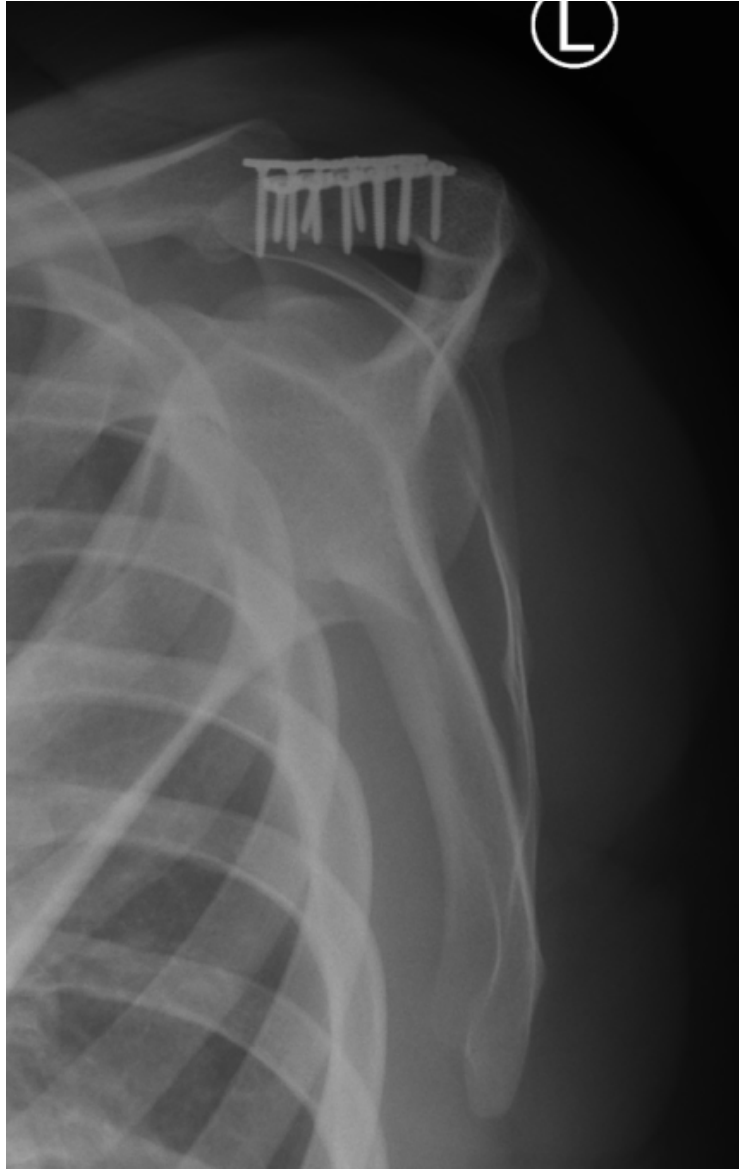
G



Acromial Tip Type 1







Thank You



**Dignity Health
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HEALTH SCIENCES
PHOENIX