

ARROWHEAD REGIONAL MEDICAL CENTER



Dept of Orthopaedic Surgery

Elbow Trauma

A Selective Review



Pink Pulseless Hand



Treatment of the “Pink Pulseless Hand” in Pediatric Supracondylar Humerus Fractures

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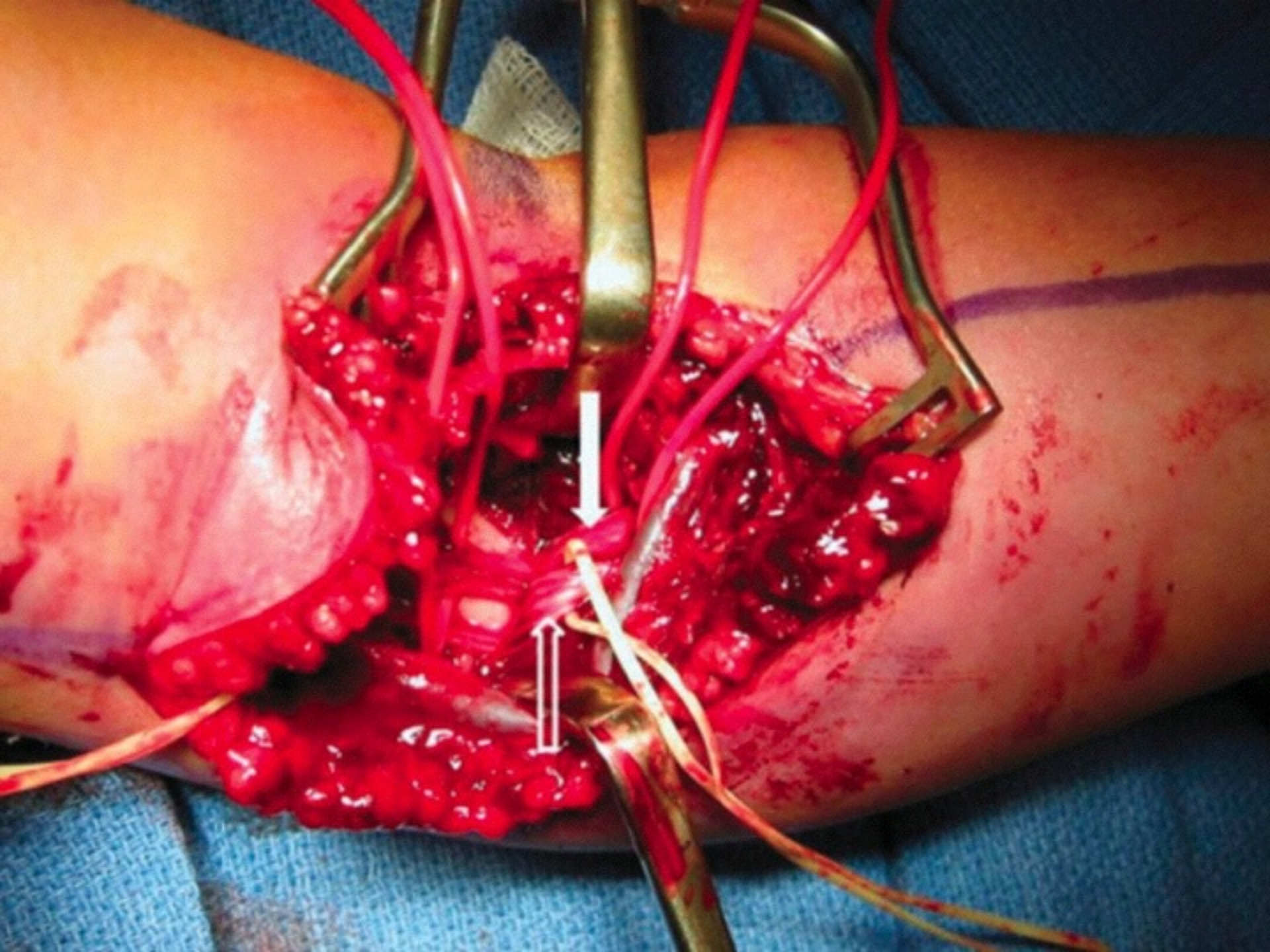
No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

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0363-5023/13/38A07-0020\$36.00/0

<http://dx.doi.org/10.1016/j.jhsa.2013.03.047>

- Incidence of NV injury in children with displaced supracondylar humerus fractures has been reported as high as 20%
- May be as high as 2/3 with extension-type fractures with posterolateral displacement (prominent spike of medial metaphysis of the proximal fragment)
- Most orthopaedic surgeons are probably underestimating the incidence of neurovascular compromise associated with SC fx's
- Potential complications of observing PPSC fx's include chronic pain, cold intolerance, exercise intolerance, weakness, decreased sensation, late ischemia and even loss of limb

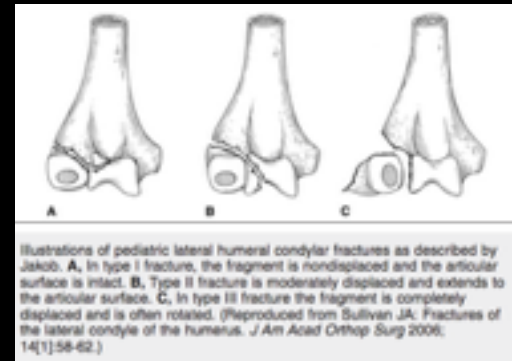


- With pulseless hand proceed with CR & PQ pin, don't wait for angiography
- Restoration of skeletal alignment returns pulses in 50-75%
- PPH is thought to represent either transient spasm and/or brachial artery injury with collateral contribution
- Nonop management includes close monitoring, proponents site high (50%) incidence of pulse return
- Op proponents have affirmed that at least 70% of PPSC fxs are due to true vascular injury as opposed to kinking or spasm
- Still no general consensus
- Trending toward surgical exploration



Lateral Condyle Fx

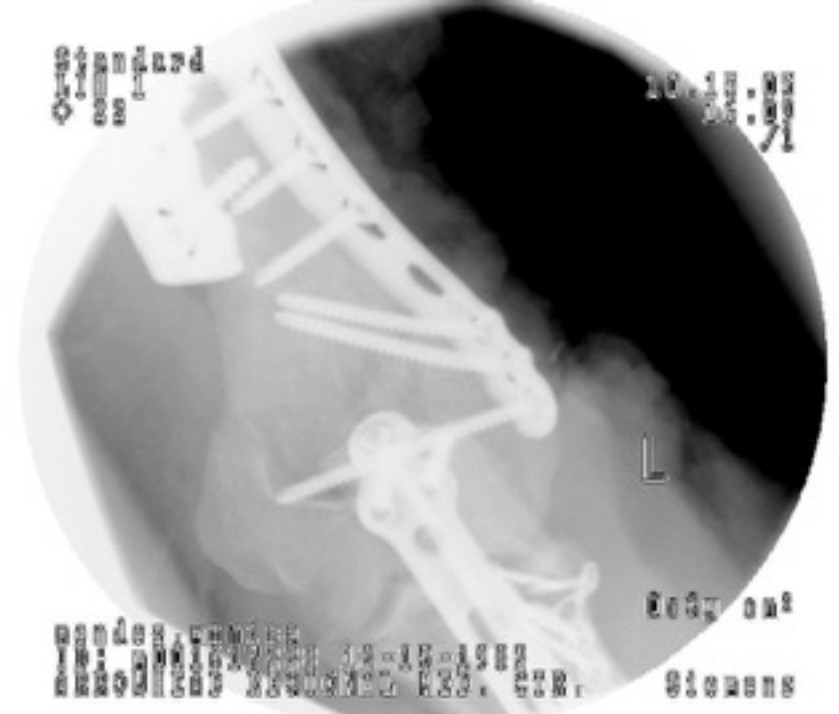
Up to 20% of peds elbow fx
Fractures are easily missed
High rate of nonunion
ORIF for >2mm displacement





**COMMINUTED INTRA-ARTICULAR FRACTURE
OF THE DISTAL HUMERUS**





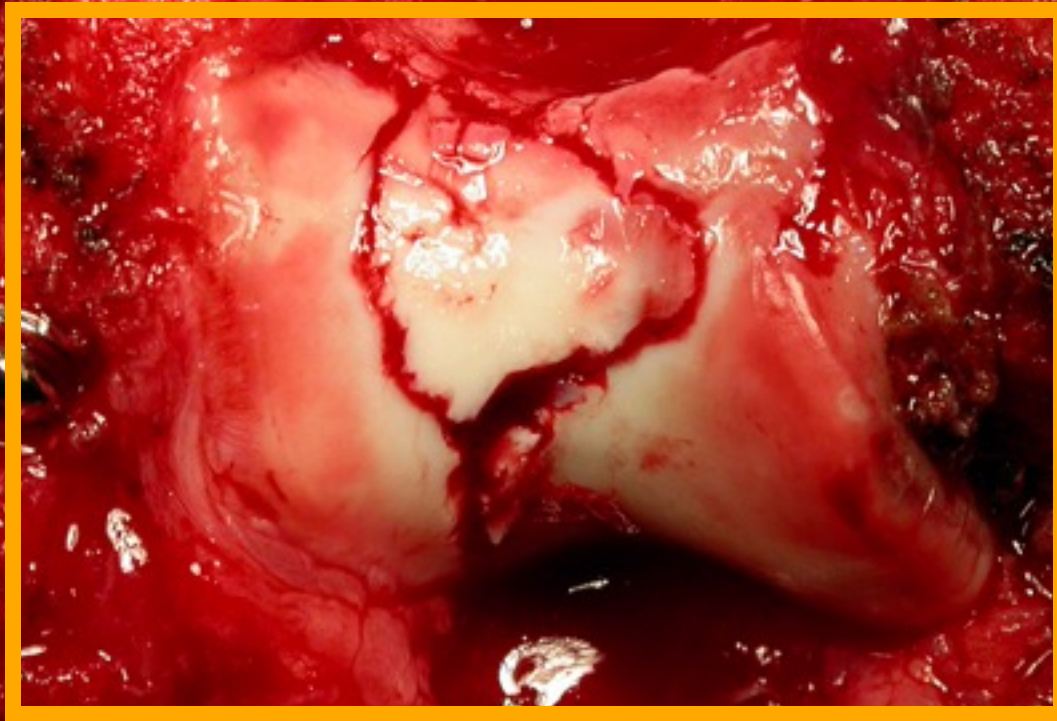
**G o o d
P r e o p
P l a n**



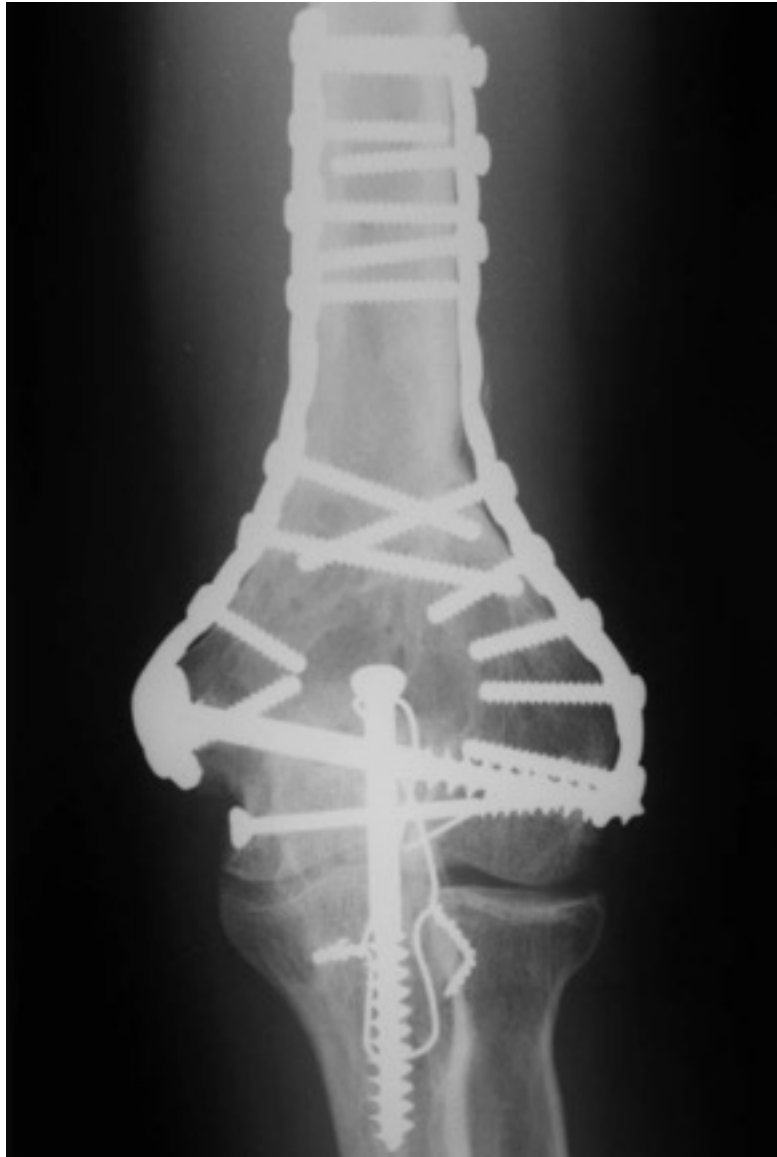
Humeral locking plates
4.5/3.5 locking plates
4.5/3.5/2.7 Recon plates
Plate benders
Headless screws
4.0/4.5 Cannulated screws
Threaded K-wires
Bioabsorbable pins

Use the right tools for the job!

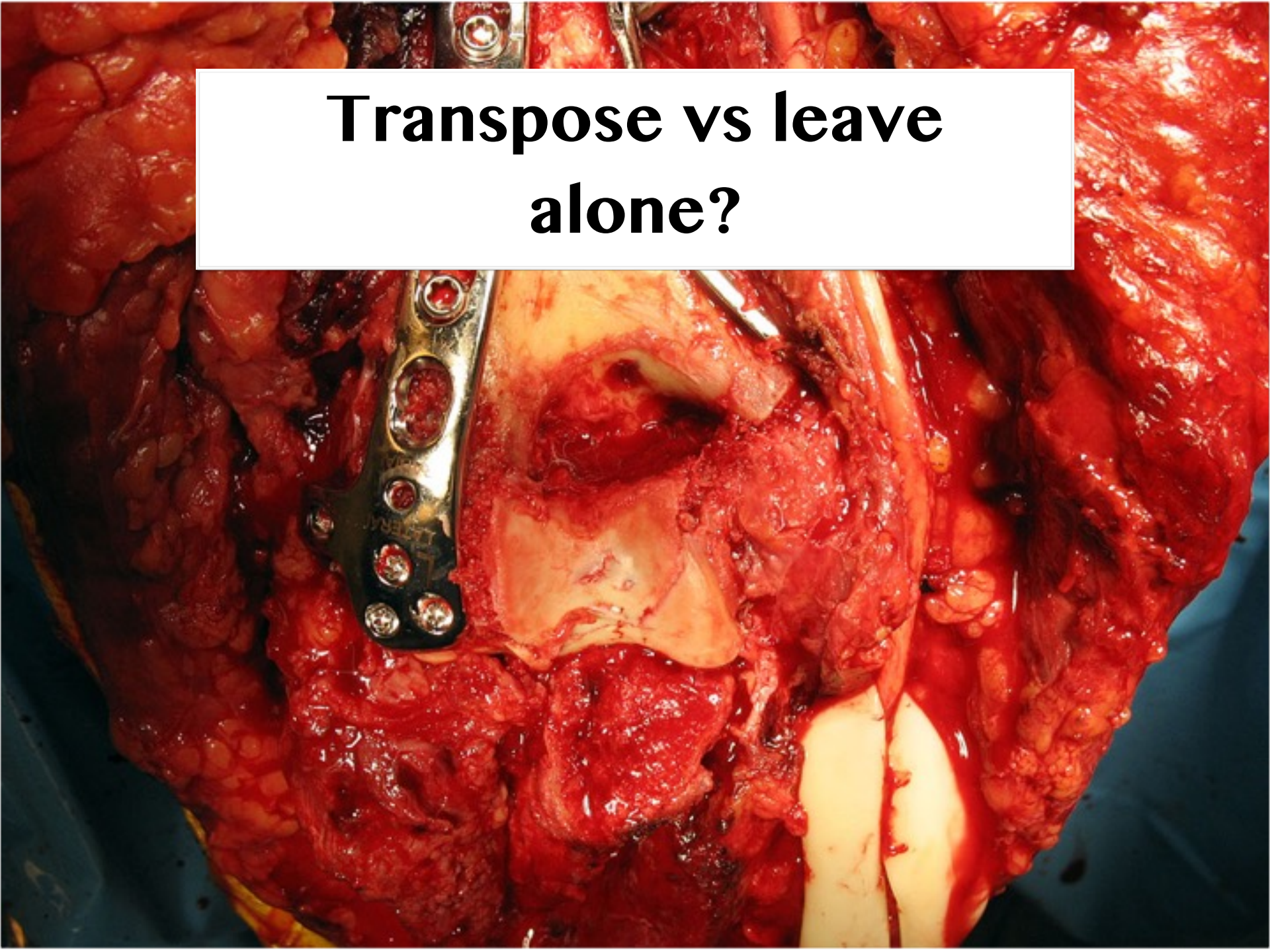
Interfragmentary compression across the trochlea has the potential to deform the ulnohumeral articulation and restrict range of motion



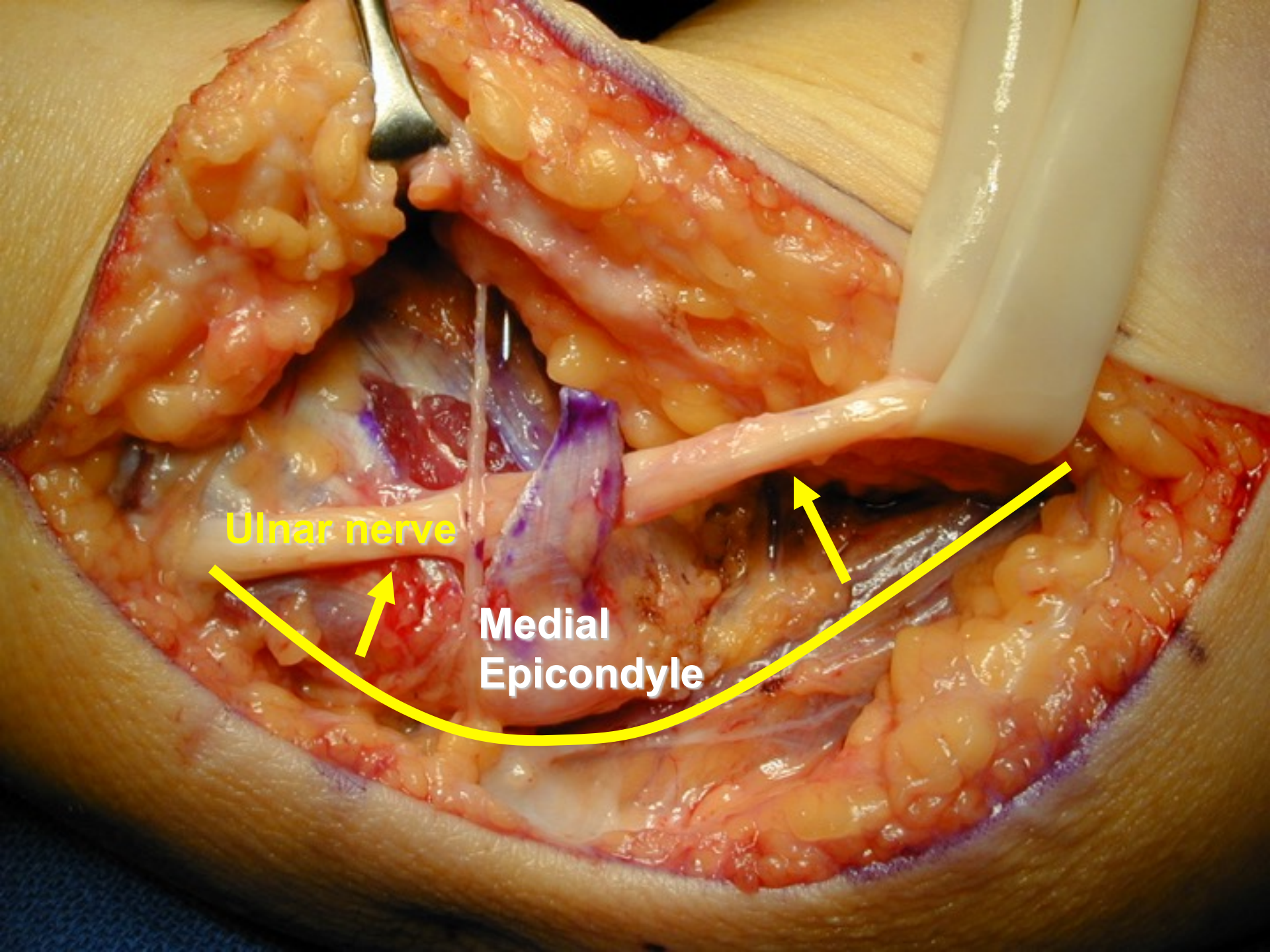
RIGID



**Transpose vs leave
alone?**



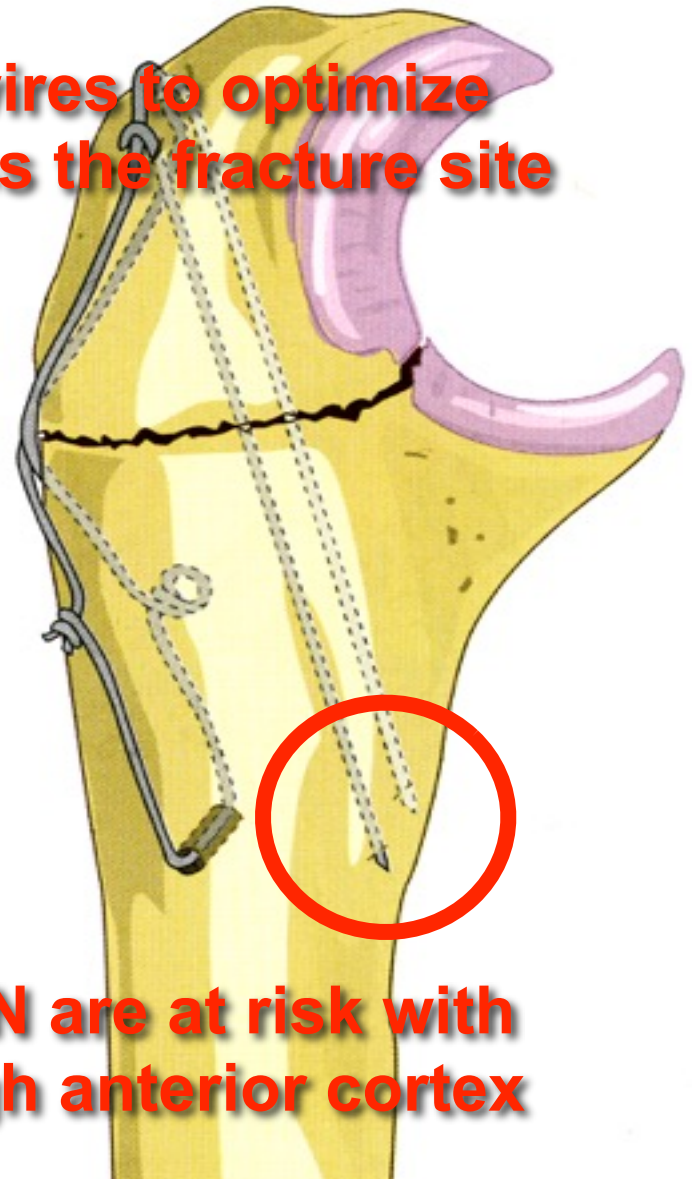
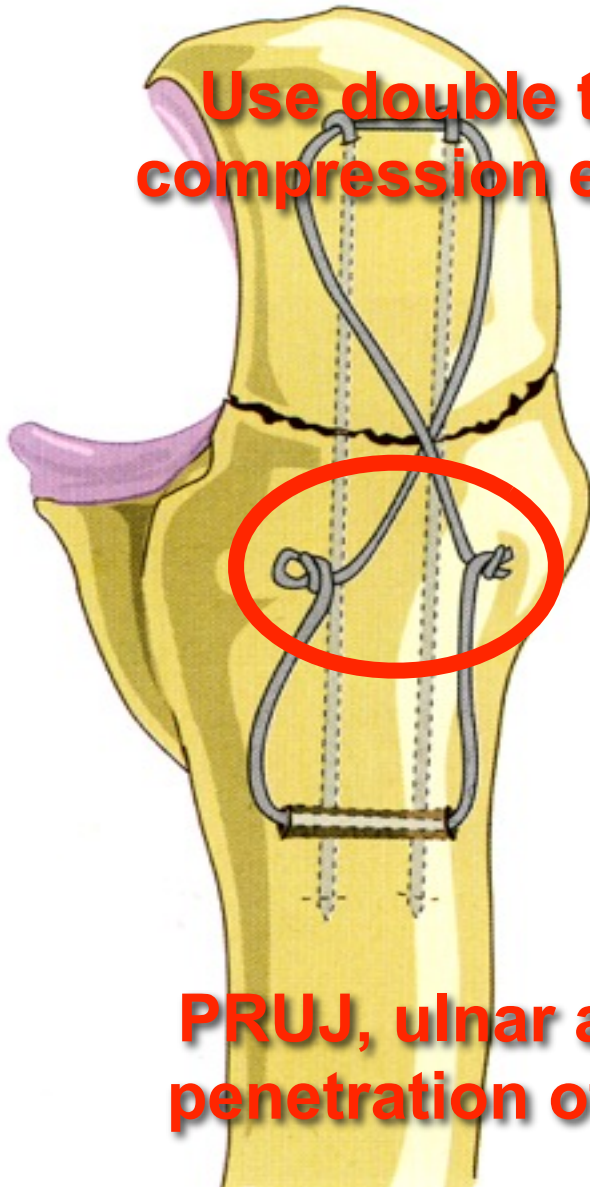




Ulnar nerve

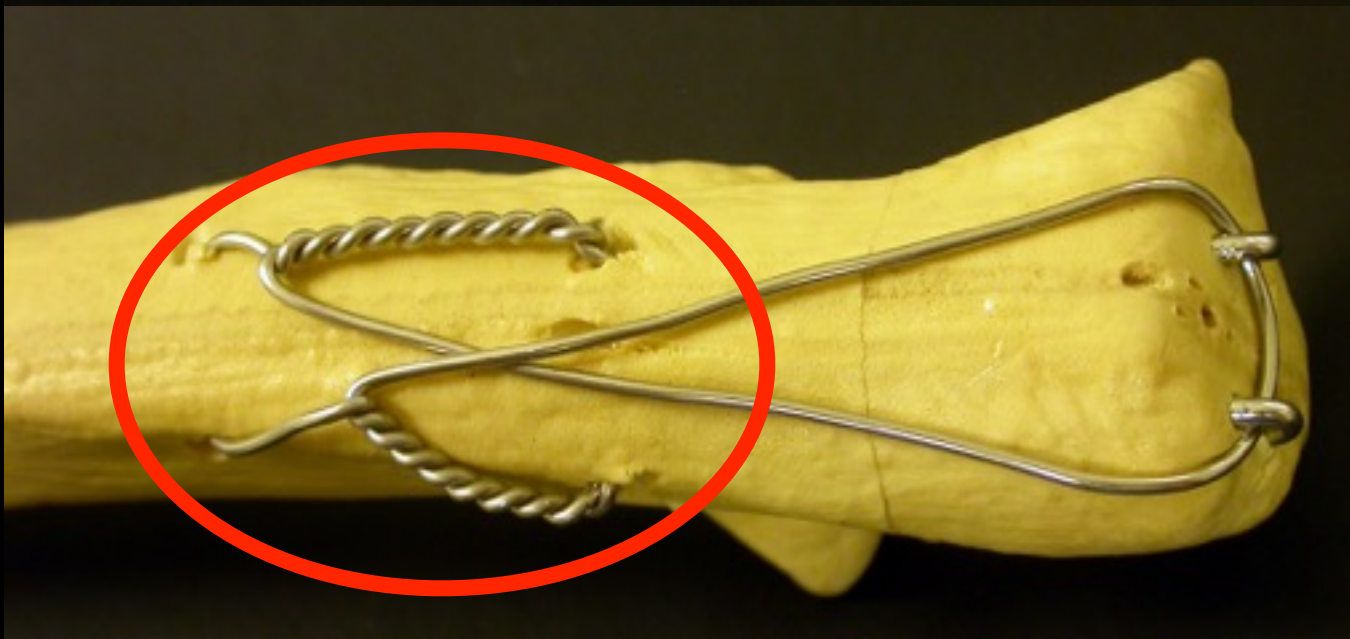
**Medial
Epicondyle**

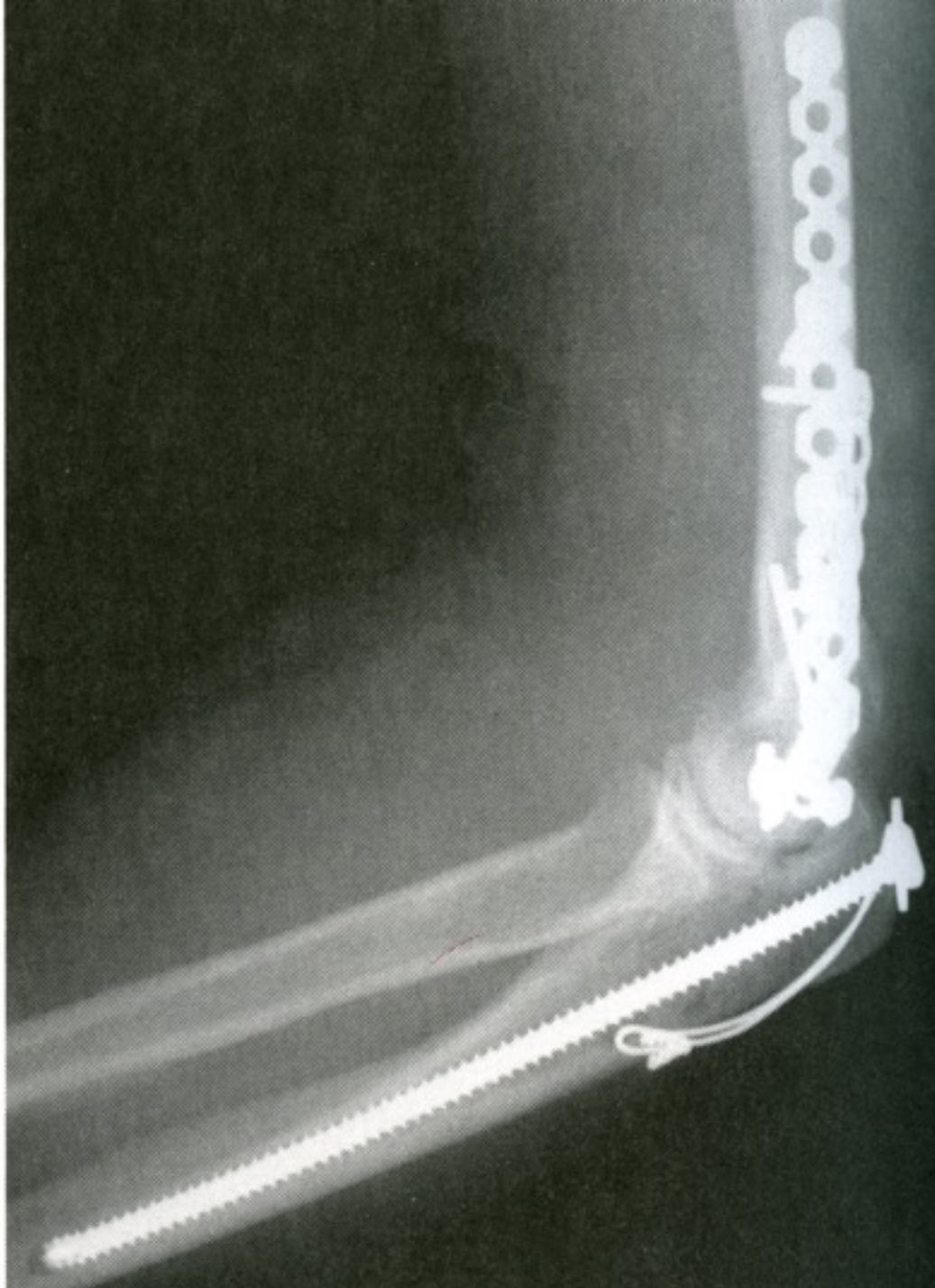
Use double twist of the wires to optimize compression equally across the fracture site

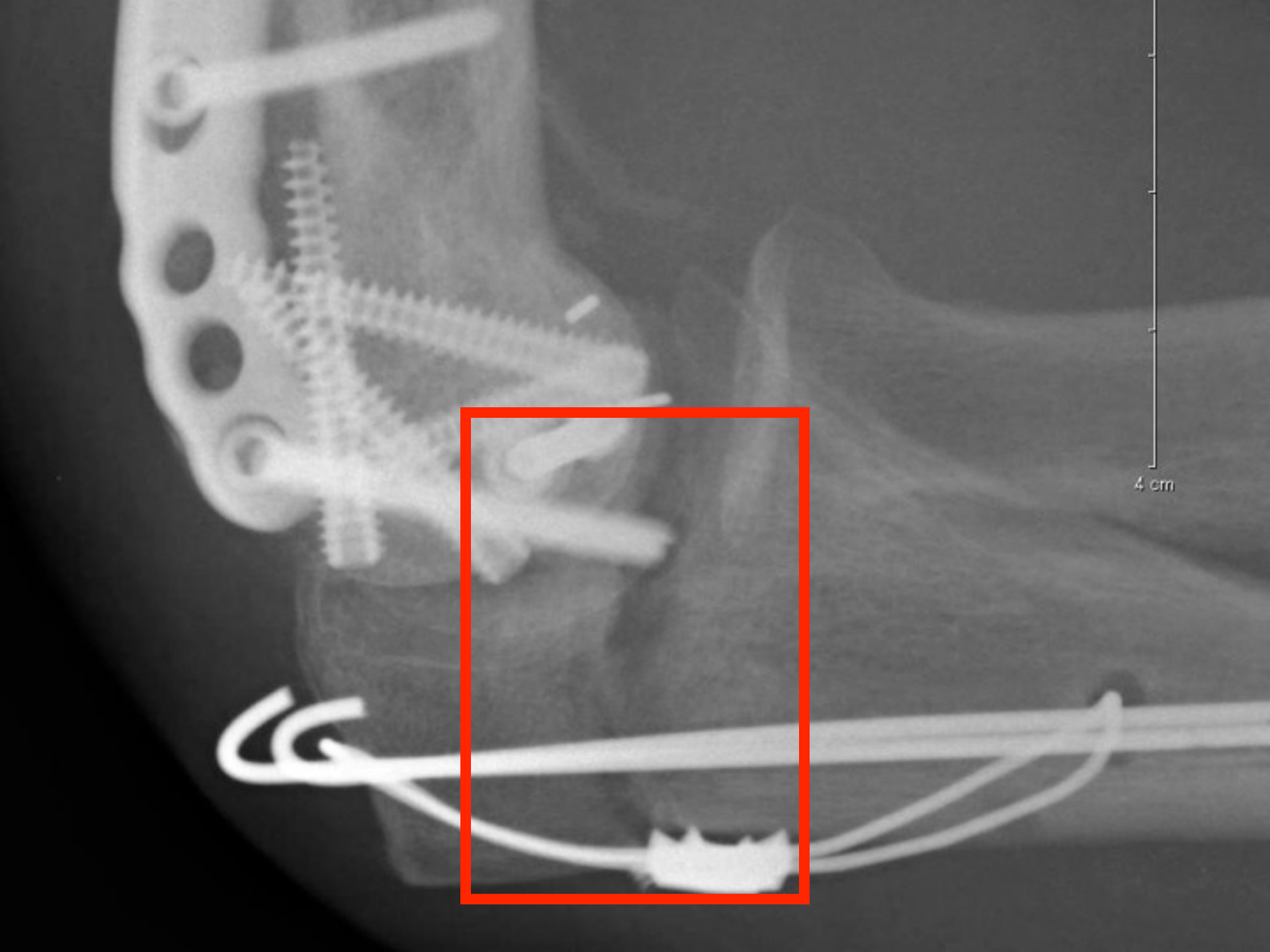


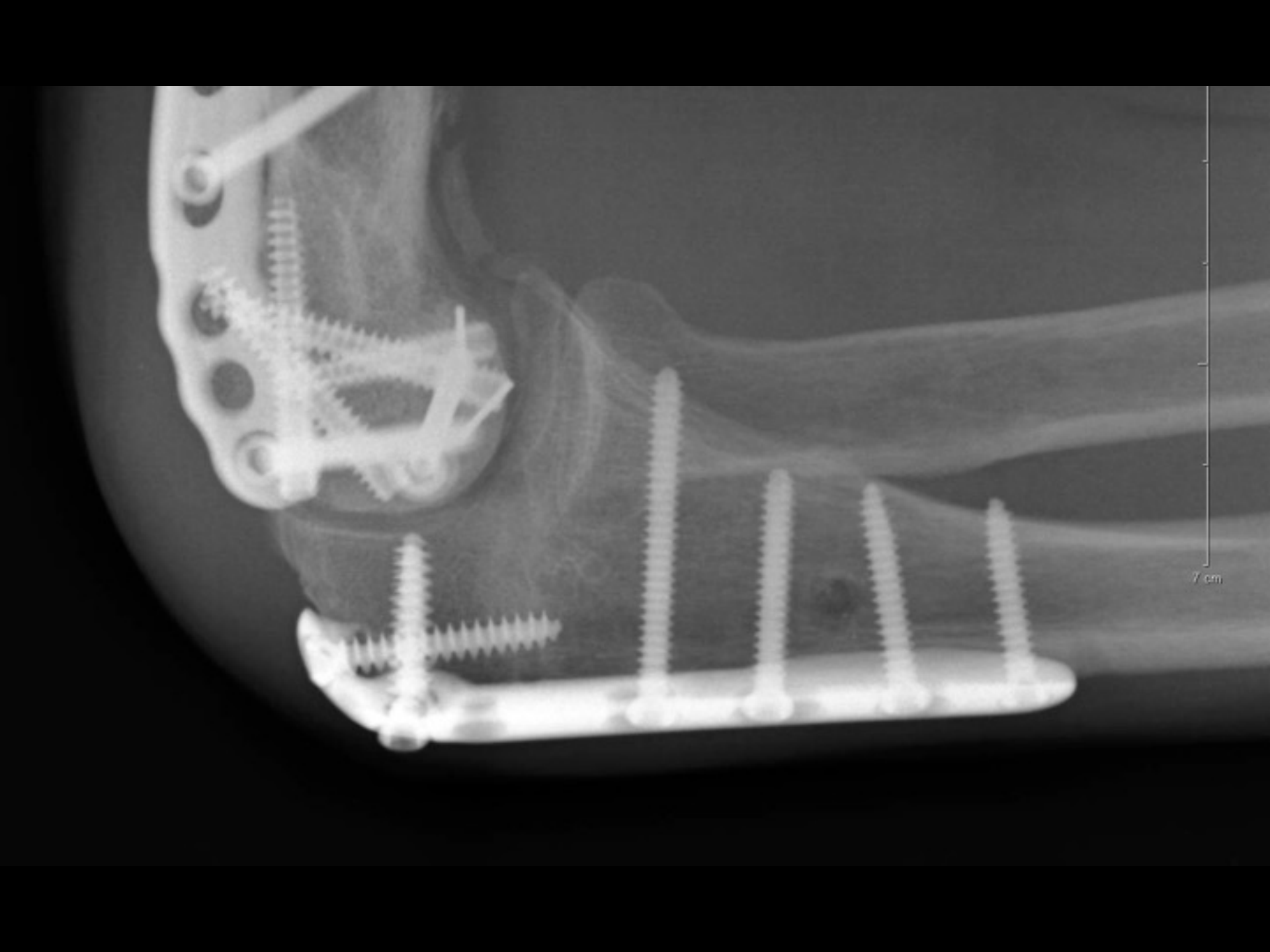
PRUJ, ulnar artery and AIN are at risk with penetration of pins through anterior cortex







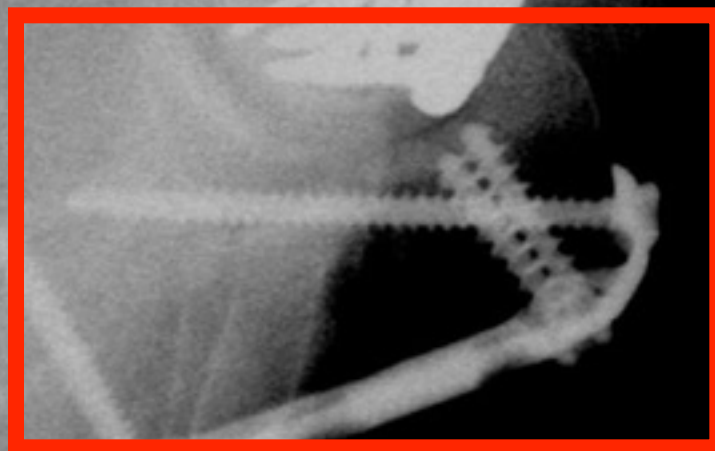




Standard
L 11-14-95

L 11-14-95

**Make certain that “home run”
screw is extra-articular**



TORREZ, RAHONAH
TICQUEL, REGINALD
REGIONAL MED. CTR.
02-25-1997

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INSTABILITY CLASSIFICATION

1. Simple posterior dislocation (no fxs)

- Valgus PLRI, Varus PMRI

2. Posterior dislocation with fracture

- PLRI with radial hd/coronoid tip
- PMRI with anteromedial facet

3. Olecranon fracture/dislocations



INSTABILITY CONSTRAINTS

- **Primary Static**
 - Ulnohumeral
 - Radiocapitellar
- **Secondary Static**
 - Medial Collateral lig
 - Lateral Collateral lig
 - Anterior capsule
- **Dynamic**
 - Flex/Ext origin
 - Triceps
 - Brachialis/Biceps
 - Anconeus



FX/DLC Treatment Principles

1. FX/DLCS should be converted to simple dislocations by repairing or reconstructing the bony stabilizers of the elbow
2. Restoration of motion results from restoration of a congruent stable joint
3. Initial treatment is important because it can be difficult to salvage subacute and chronic elbow subluxation with damage to articular surfaces

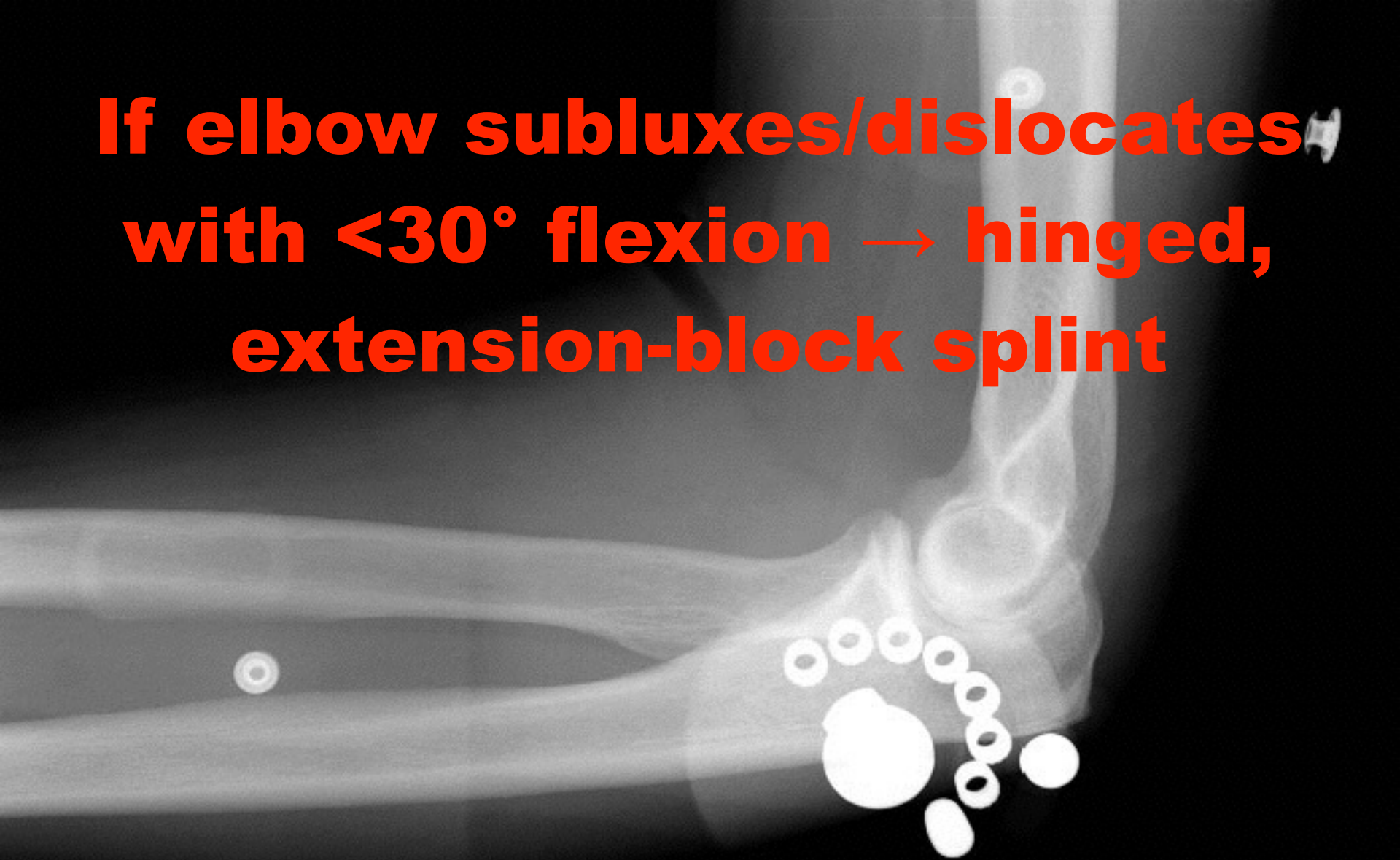


INITIAL ER EVAL

- Assess neurovascular status**
- Correct varus/valgus alignment**
- Reduce posterior dislocation**
- Don't test varus/valgus stability**
- Check posterior instability**



**If elbow subluxes/dislocates
with $<30^\circ$ flexion $\rightarrow$ hinged,
extension-block splint**



Surgery if $>60^\circ$ flexion required!

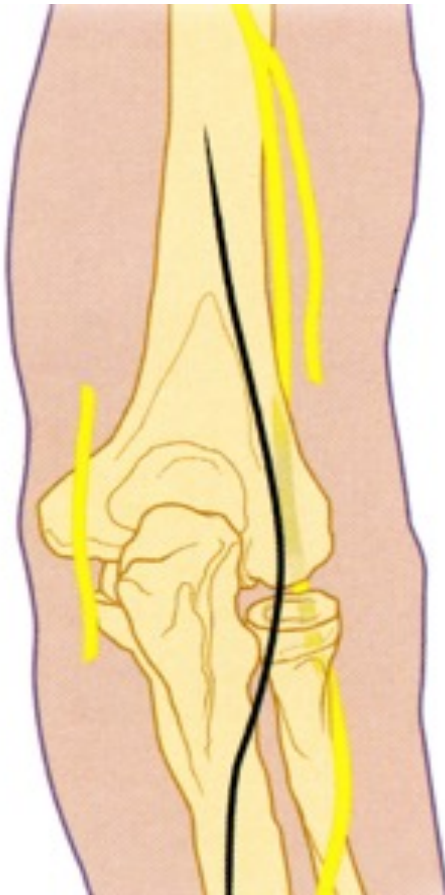
Delayed Instability?

Slight sagging of the joint (drop sign) can often be addressed with active flexion exercises and avoidance of shoulder abduction





POSTERIOR APPROACH

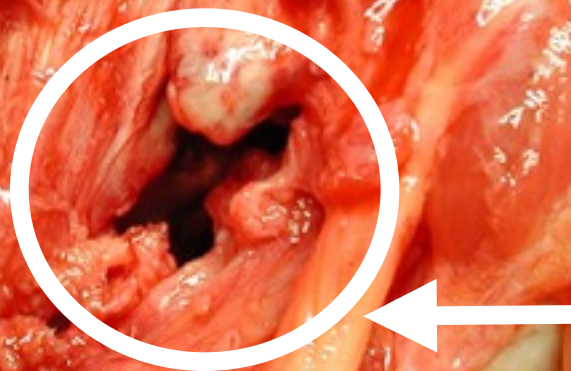


- **Keep incision away from tip of olecranon**
- **Keep scar lateral away from ulnar n**
- **Consider two incisions**



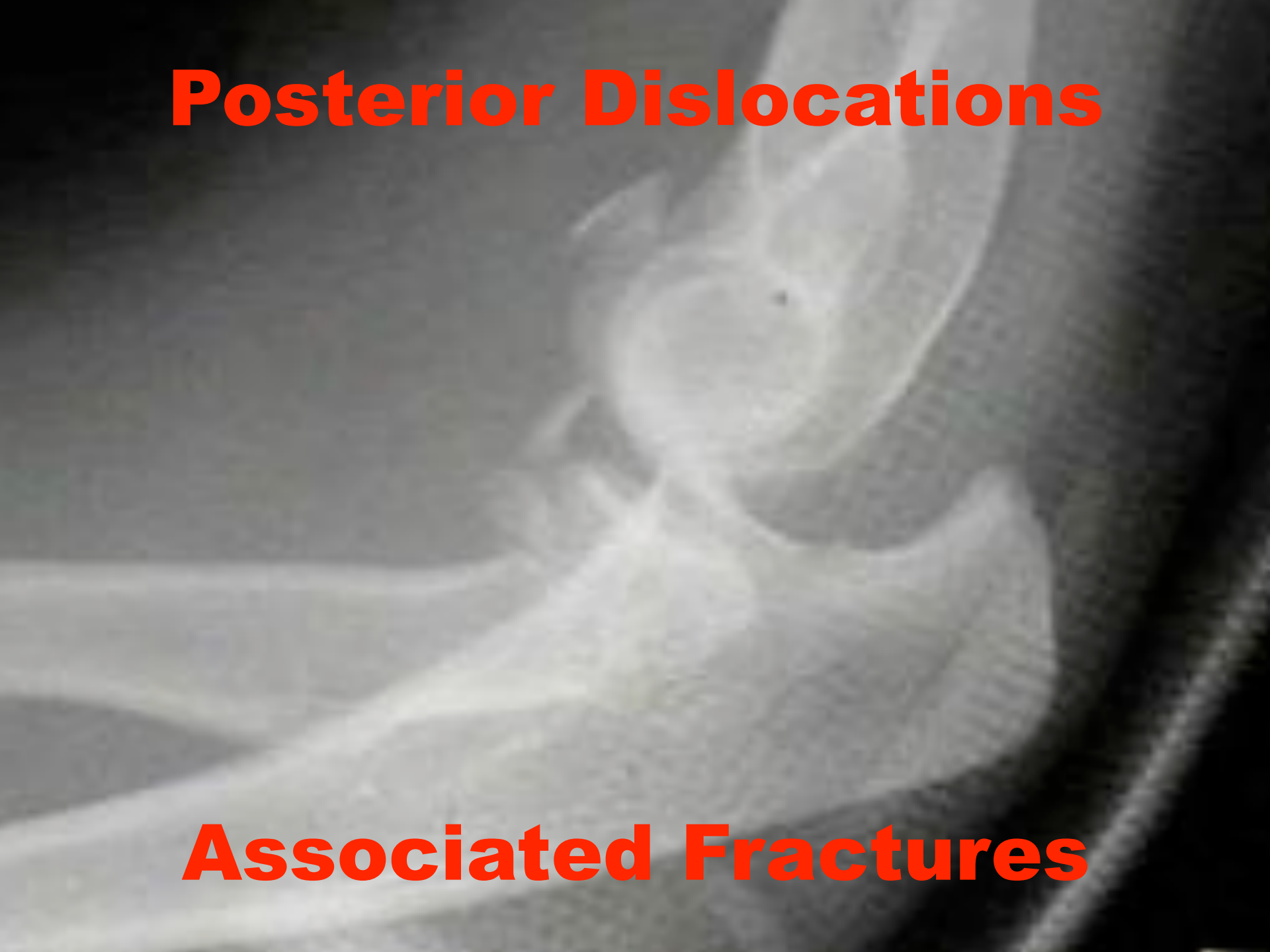
Lateral Ligament Complex

Medial Ligament Complex



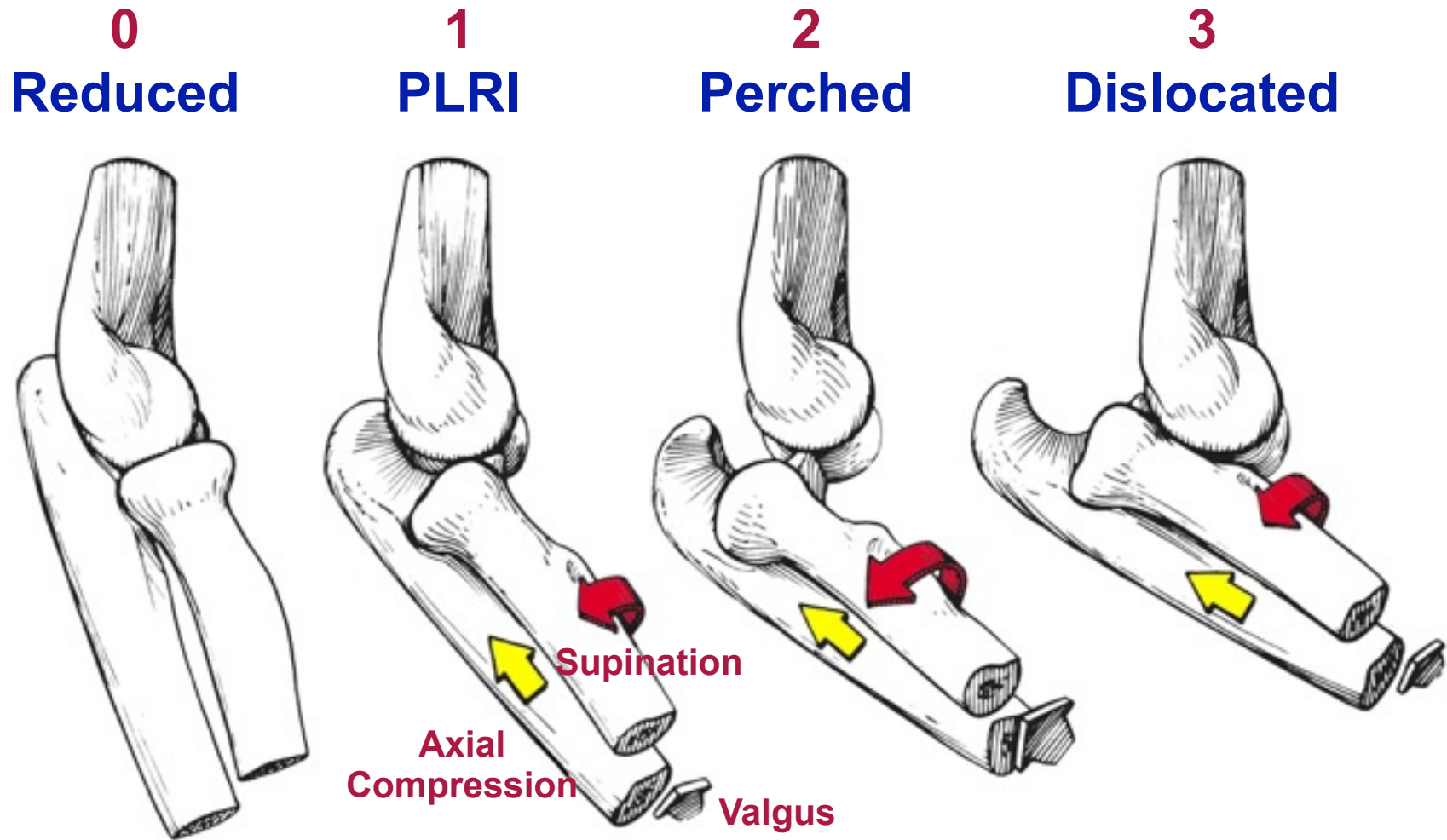
Rarely repair acutely

Posterior Dislocations

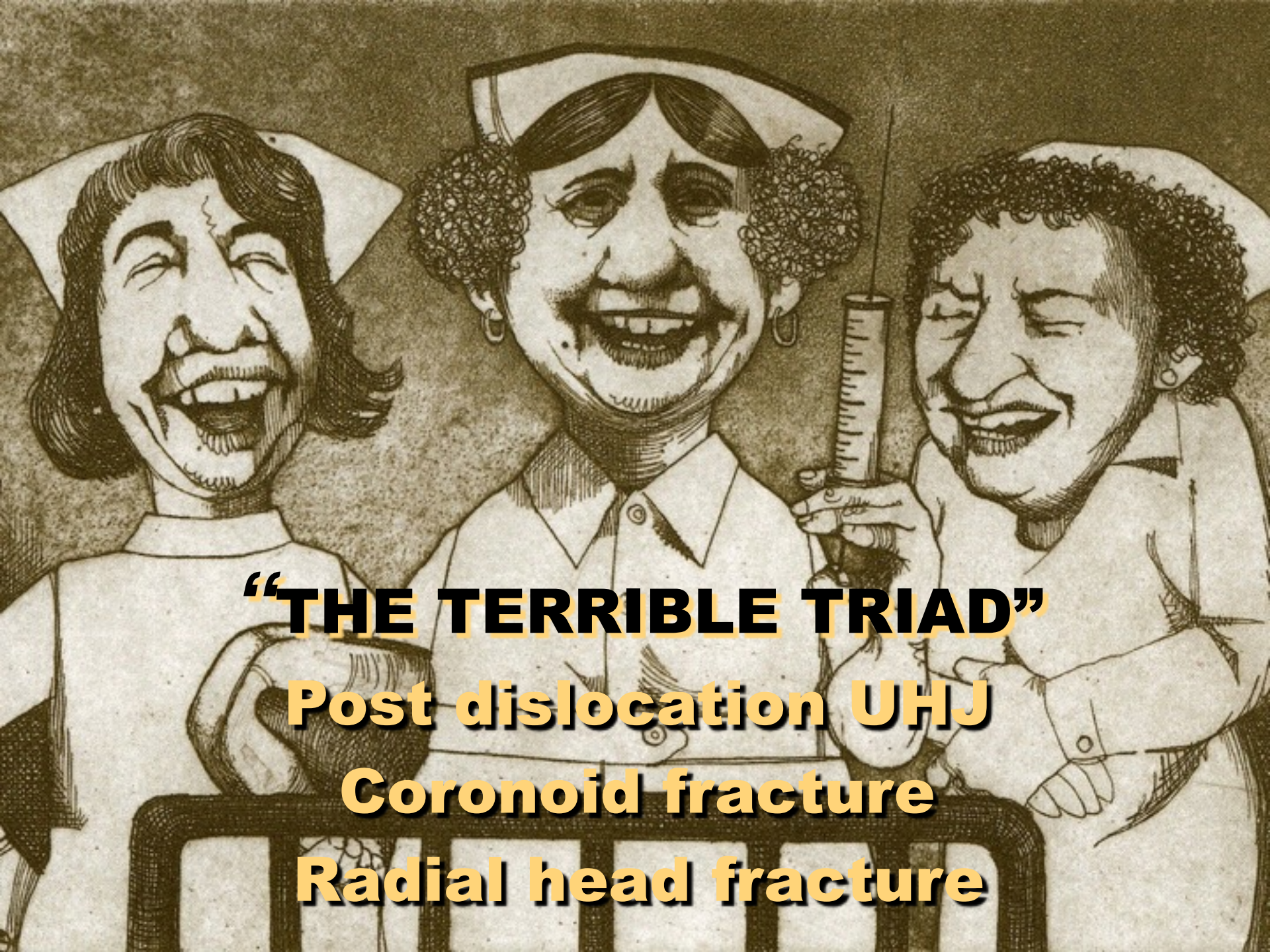


Associated Fractures

Simple Elbow Dislocation



Arrows indicate forces and moments responsible for displacements



“THE TERRIBLE TRIAD”

Post dislocation UHJ

Coronoid fracture

Radial head fracture

VARUS POSTEROMEDIAL INSTABILITY

Recently recognized injury pattern

Suspect if no radial head fracture

Obtain CT scan for confirmation

Anteromedial coronoid facet fracture

Medial to lateral injury less stable

Be aggressive with surgical fixation



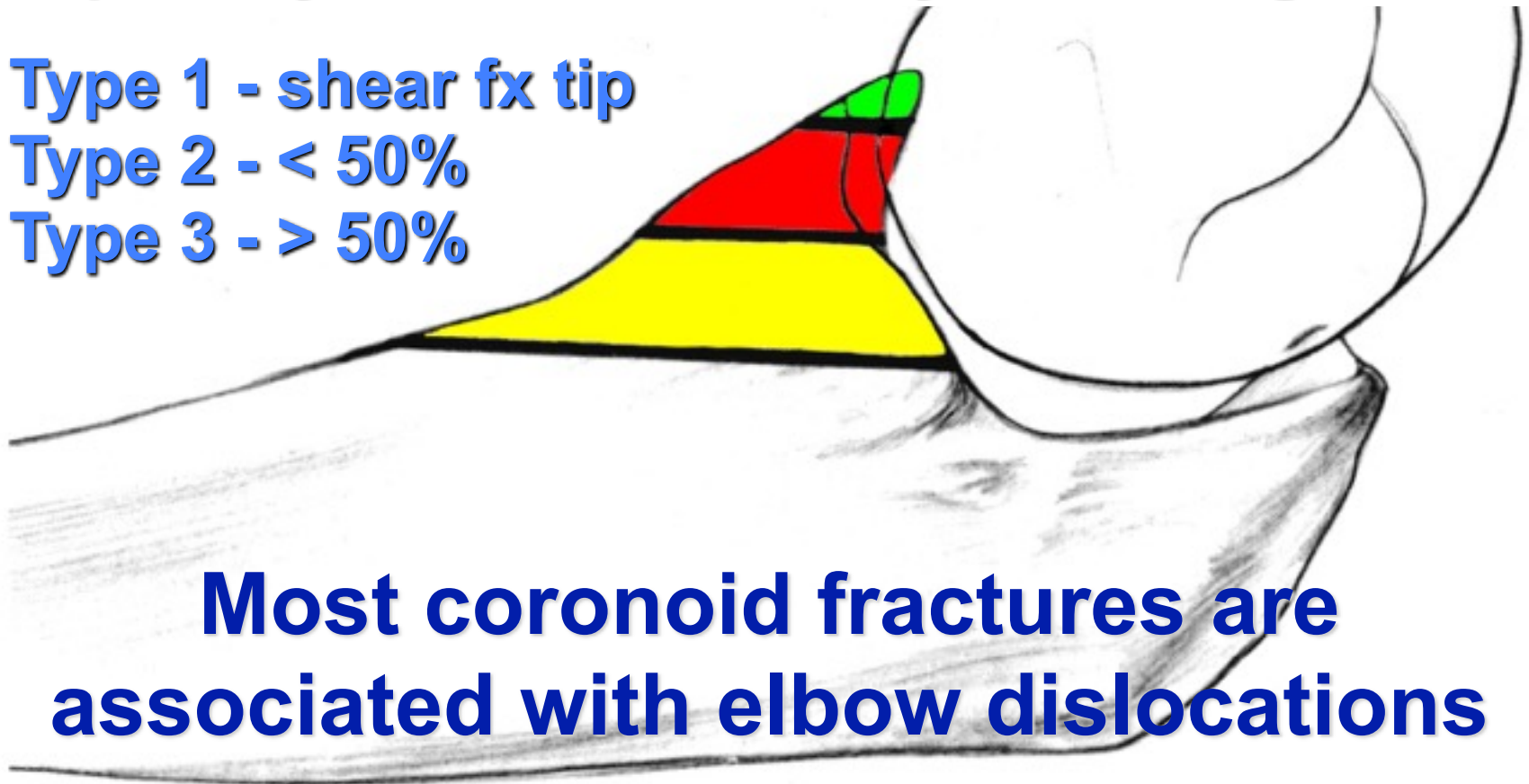
Coronoid acts as an anterior buttress and the anterior band of the MCL attaches to fragment

Elbows with fx < 50% displace more readily especially with extension beyond 60 degrees

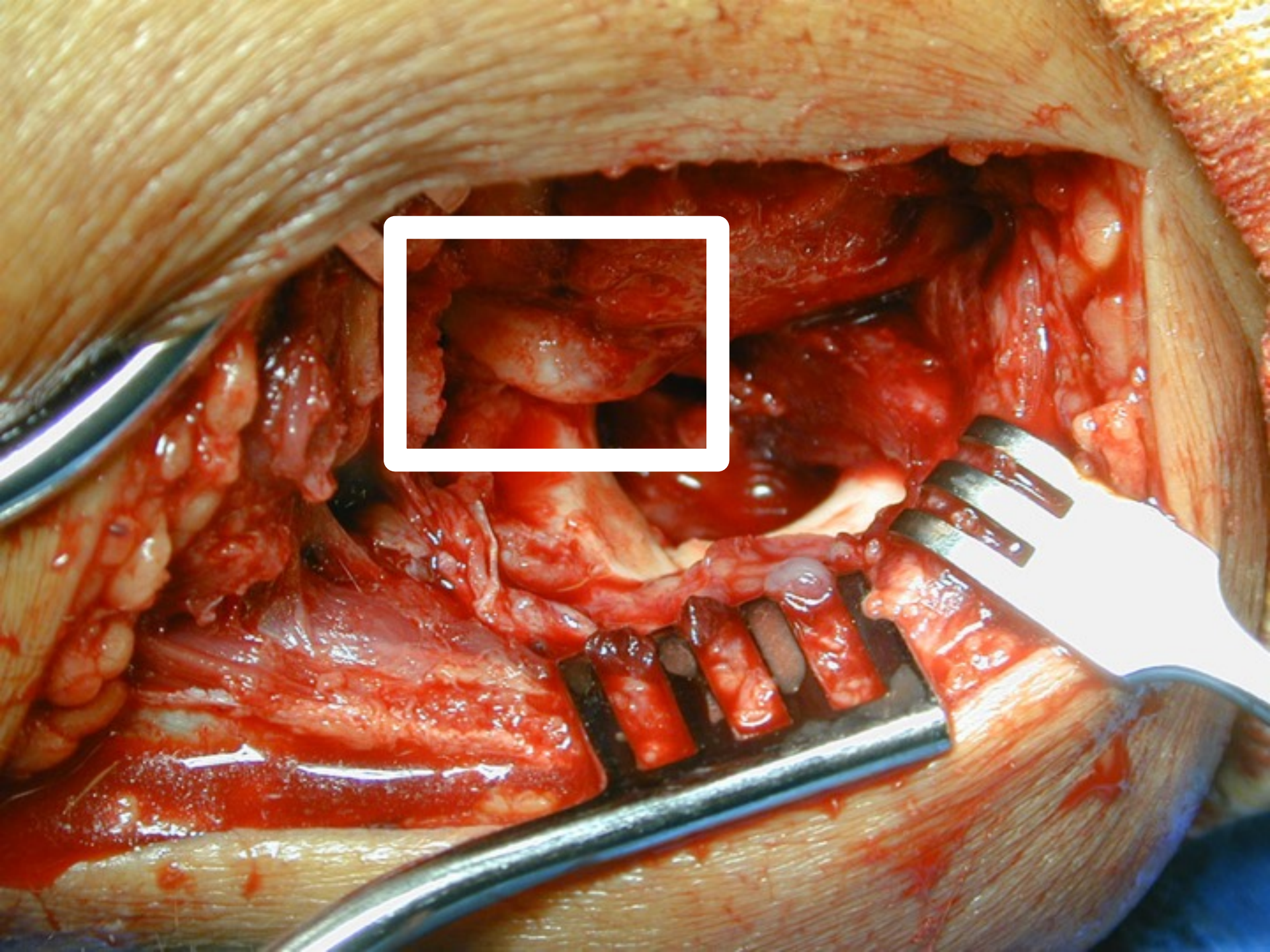
Type 1 - shear fx tip

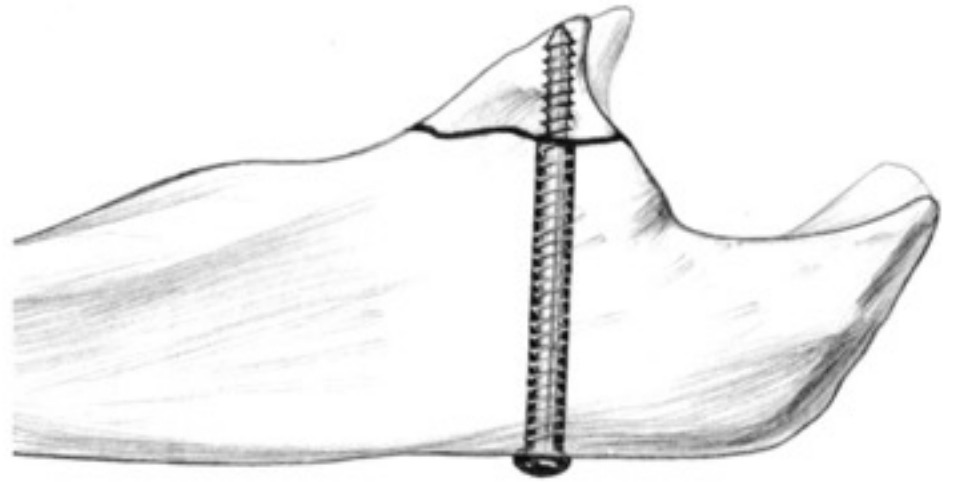
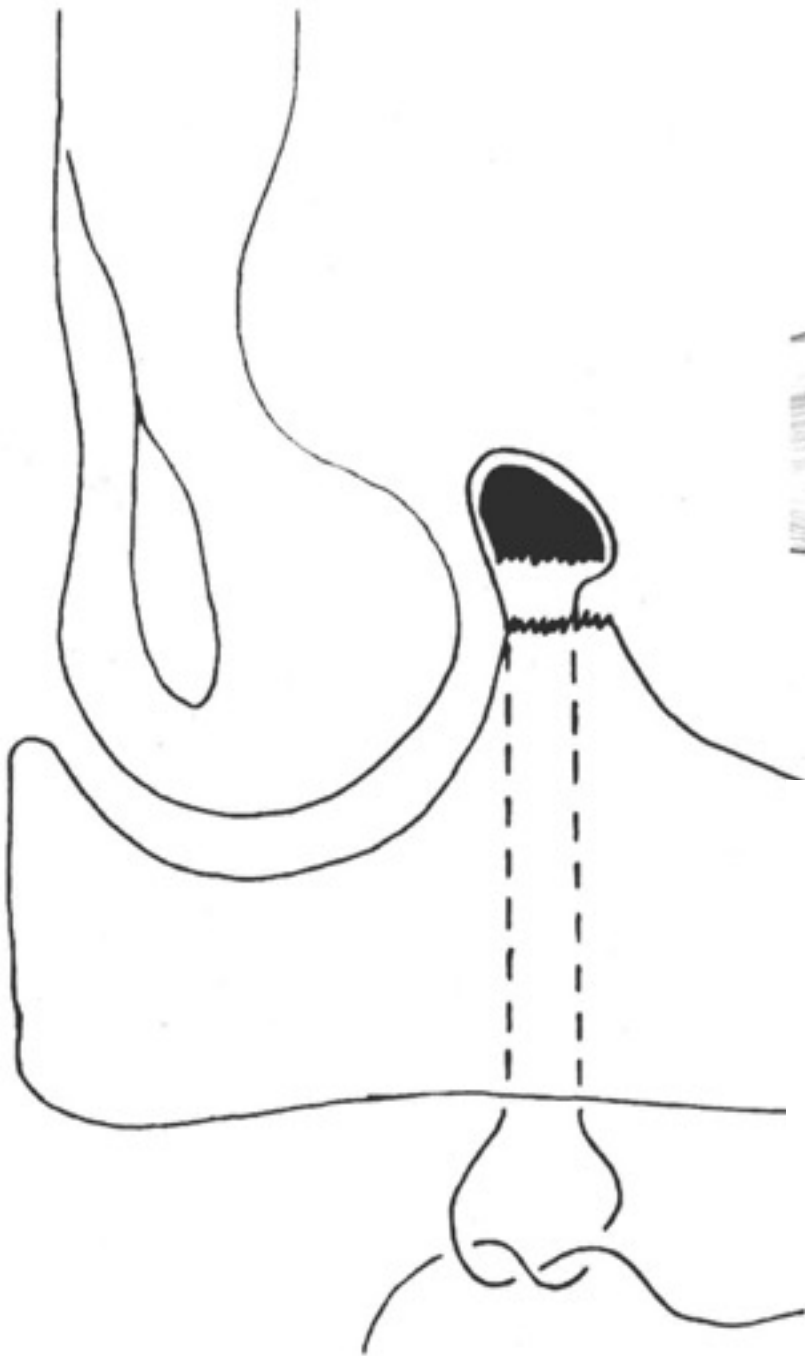
Type 2 - < 50%

Type 3 - > 50%



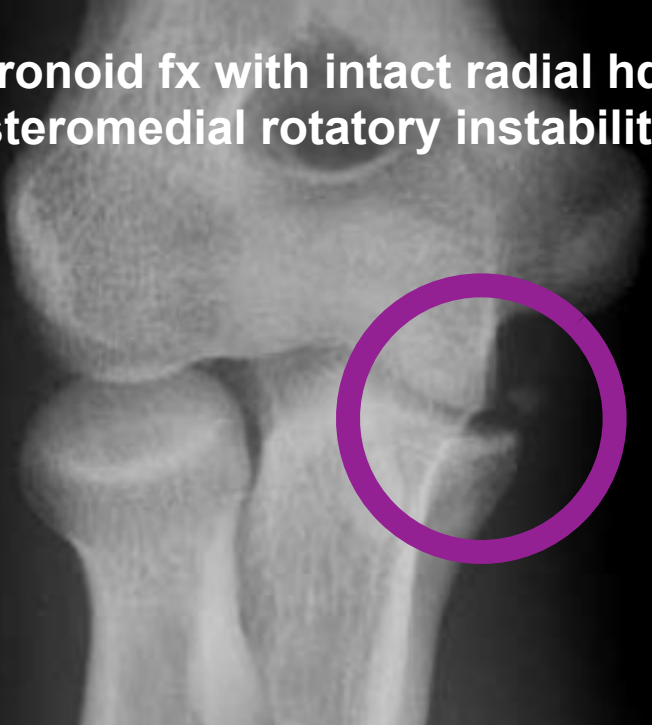
Most coronoid fractures are associated with elbow dislocations

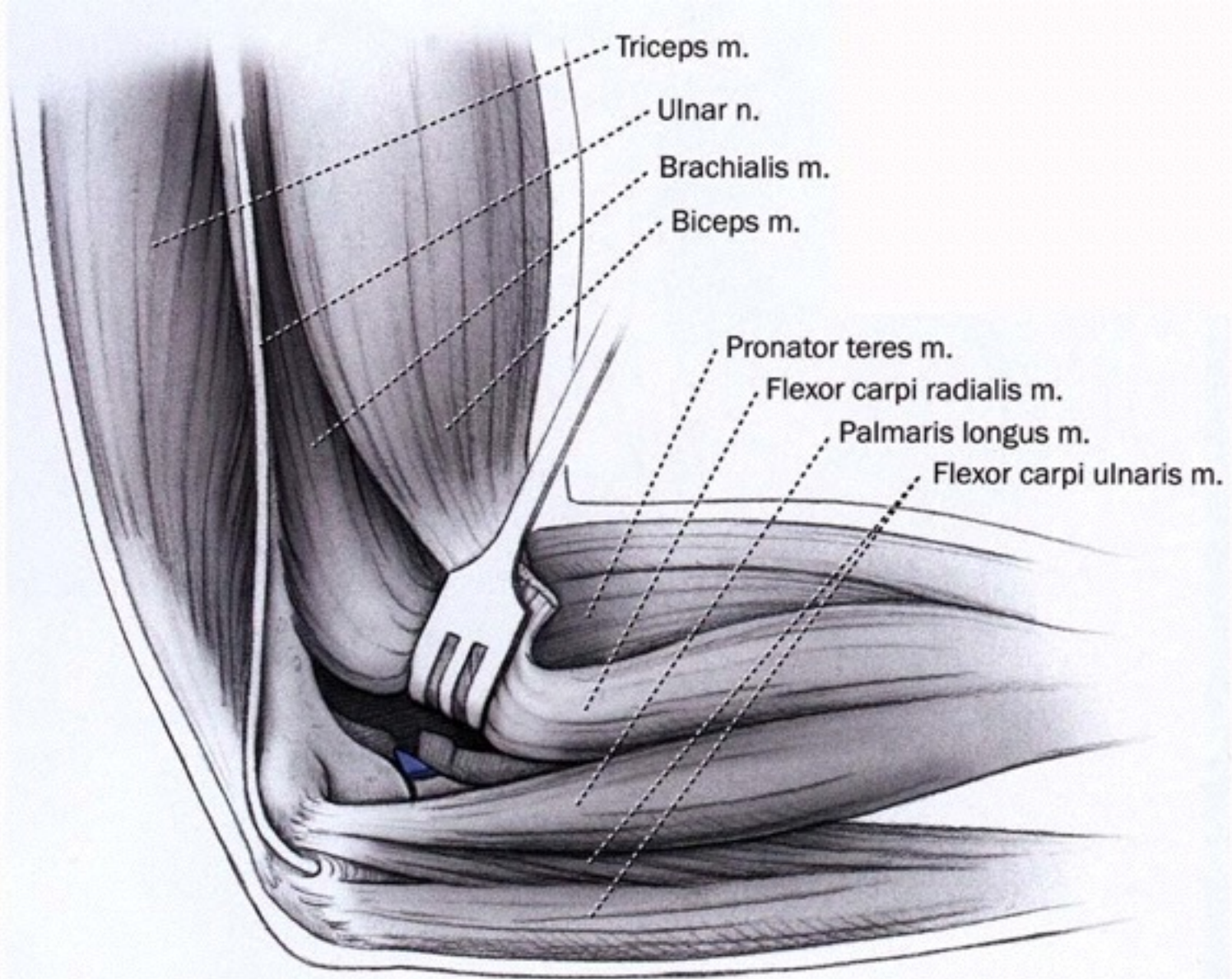




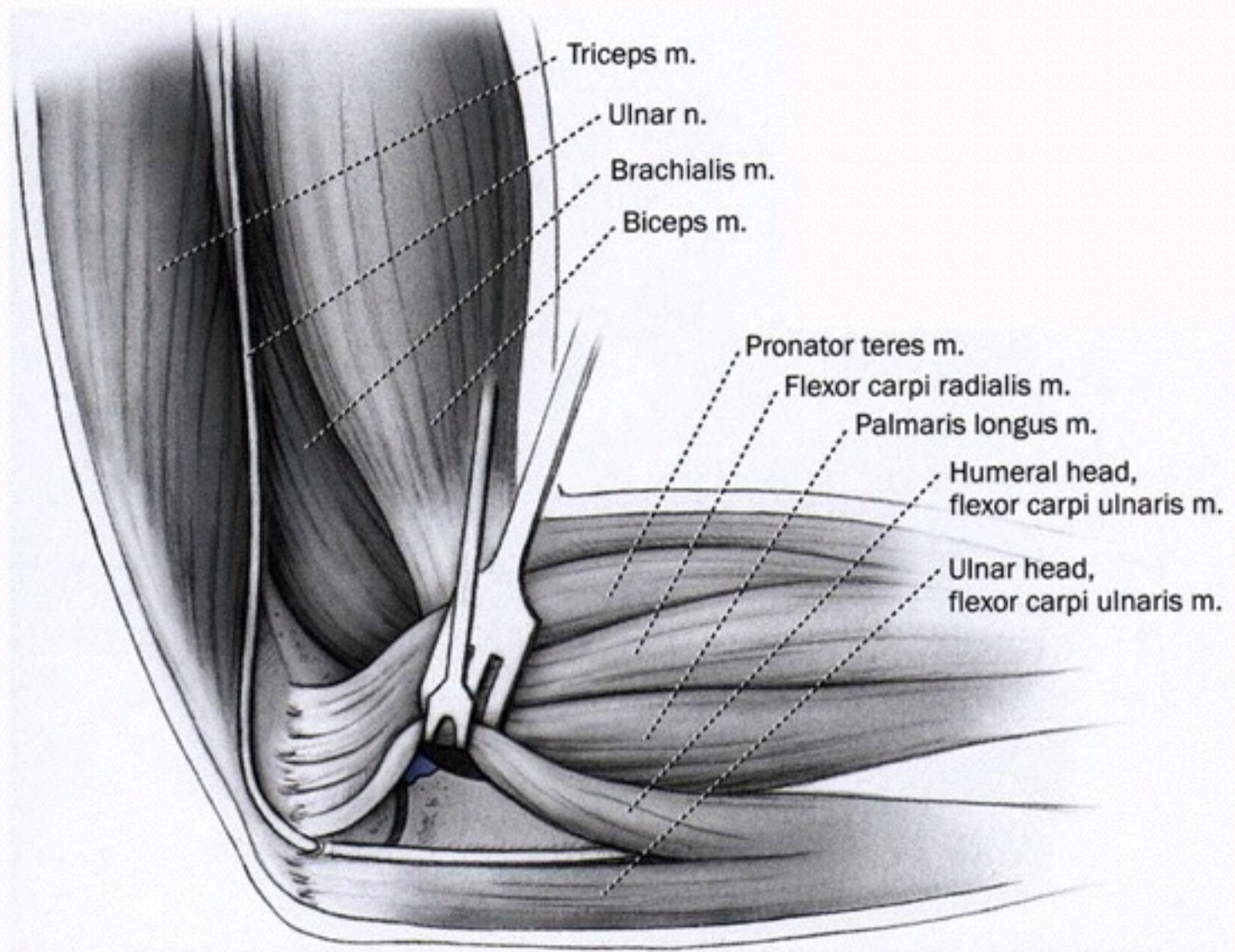
Coronoid ORIF

Coronoid fx with intact radial hd
Posteromedial rotatory instability

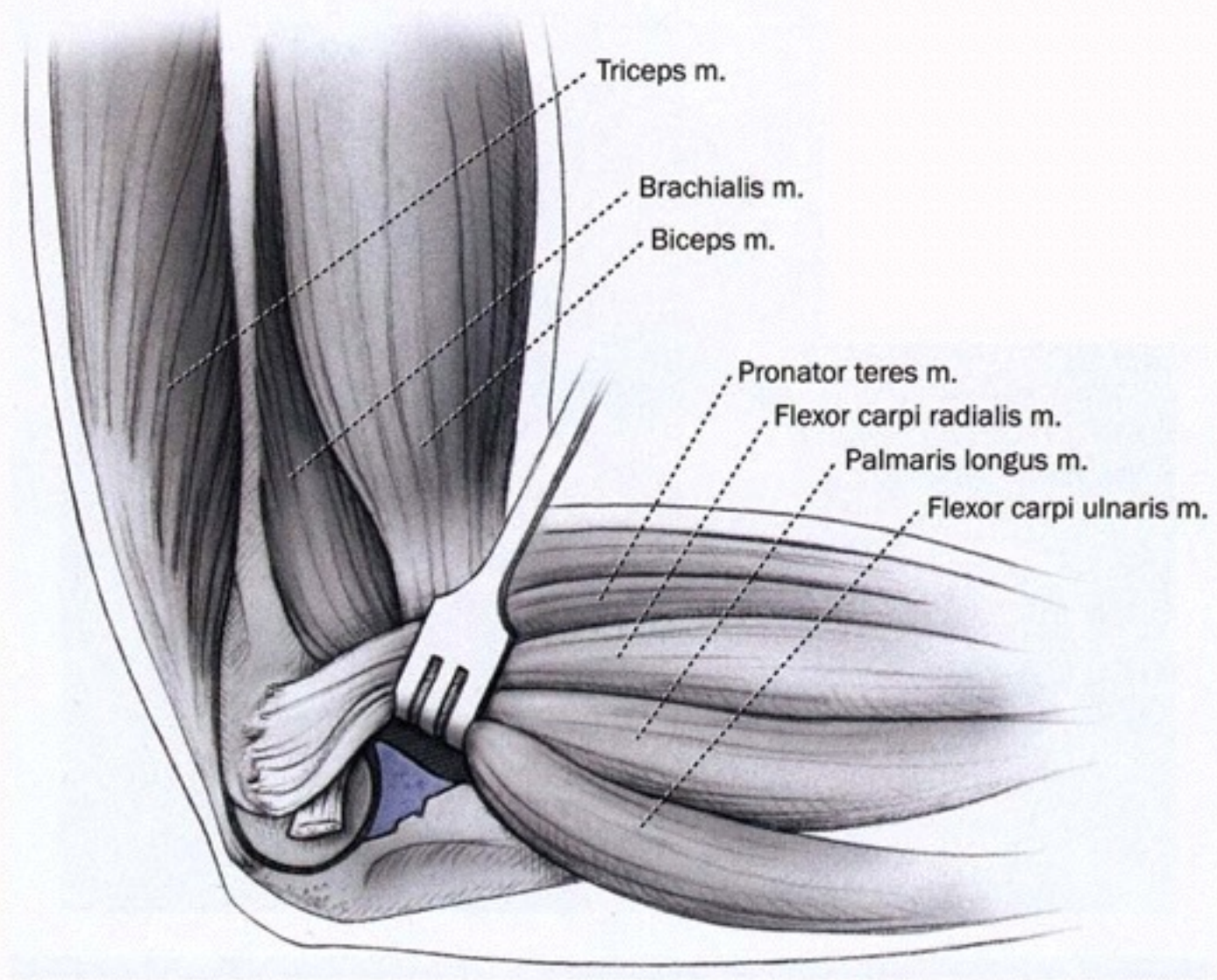




Smaller fractures that remain anterior to the sublime tubercle (the insertion of the anterior band of the medial collateral ligament) are often best accessed through a split in the flexor-pronator mass



Fractures that involve the sublime tubercle, but are still relatively small (the most common type of fracture) are best exposed by developing the natural split between the two heads of the FCU



Large fractures that extend to the base, particularly when associated with an olecranon fracture, can be exposed by elevating the entire flexor-pronator mass, from the dorsal to the volar aspects



Radial Head Fracture

Acute valgus instability

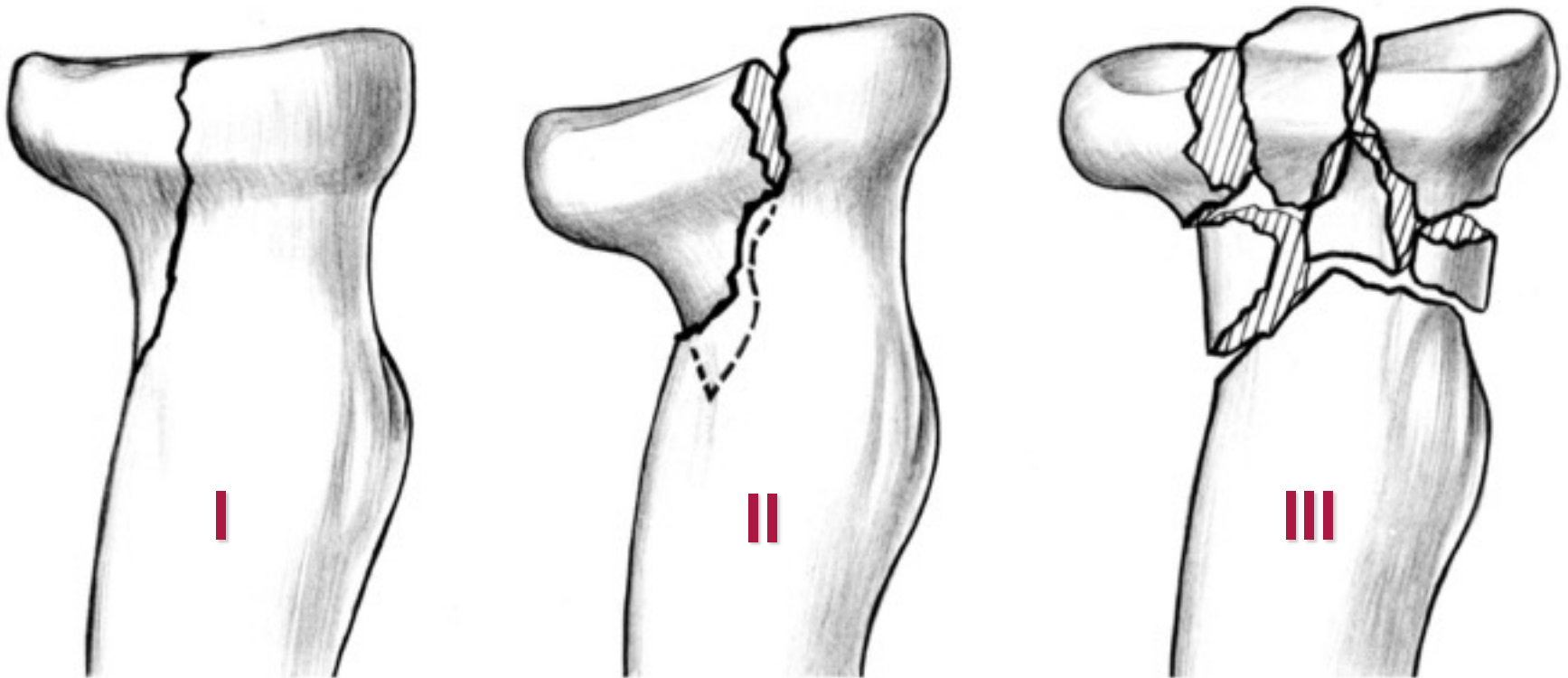
Fracture of radial head

Rupture of the LCL

Rupture of the MCL

Instability if hd excised

MODIFIED MASON CLASSIFICATION



Severely comminuted distal radius fracture
 Judged to be unstable by X-ray and CT
 Usually requires excision and replacement

**Intra-articular injection
of lidocaine in the
triangular soft spot to
permit exam**



Goal is to start mobilization ASAP





If motion is near full, begin aggressive forearm rotation with elbow at 90 degrees of flexion

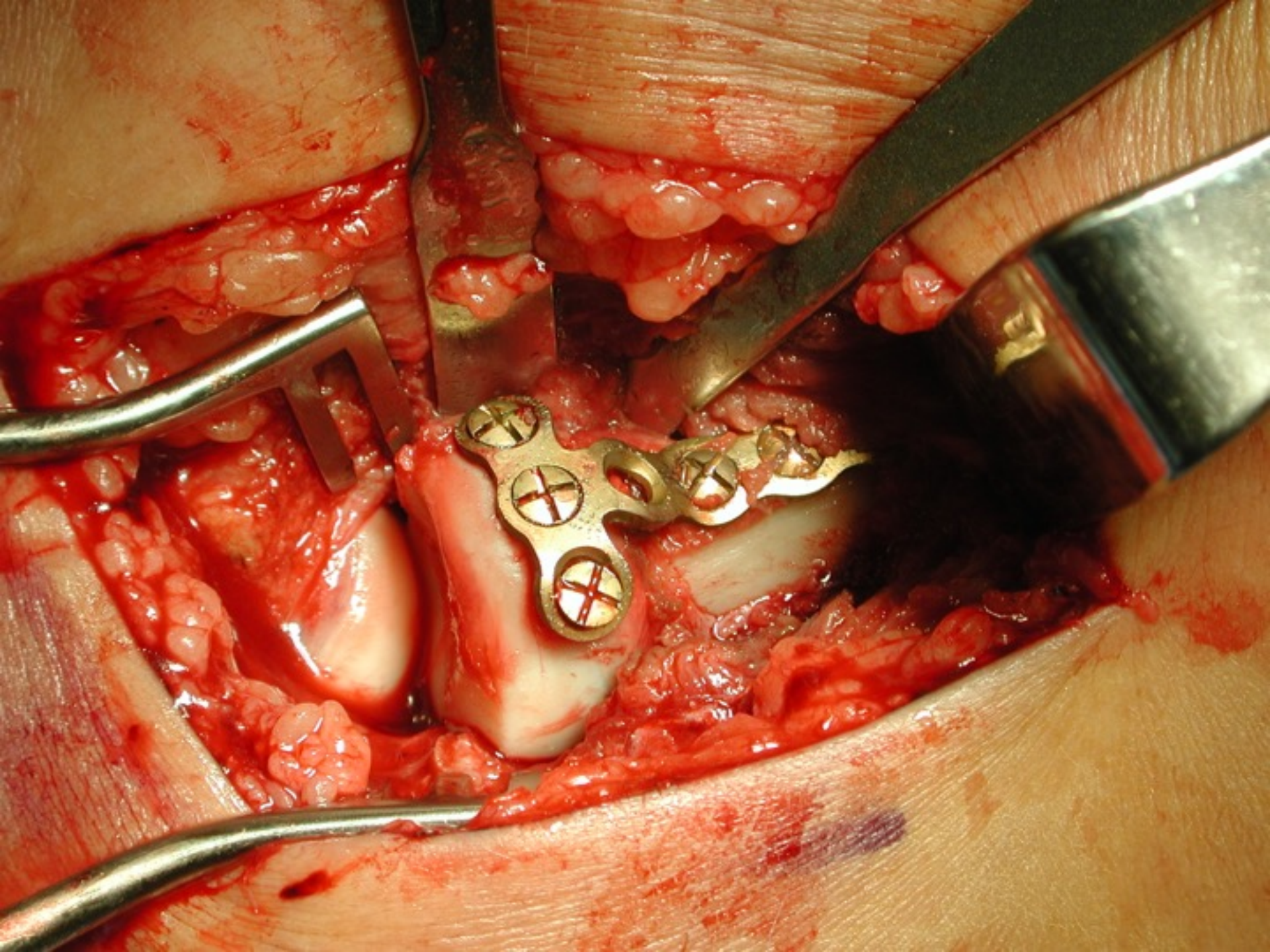


**Never excise the radial head
in the presence of instability**

Essex-Lopresti Longitudinal Forearm Instability





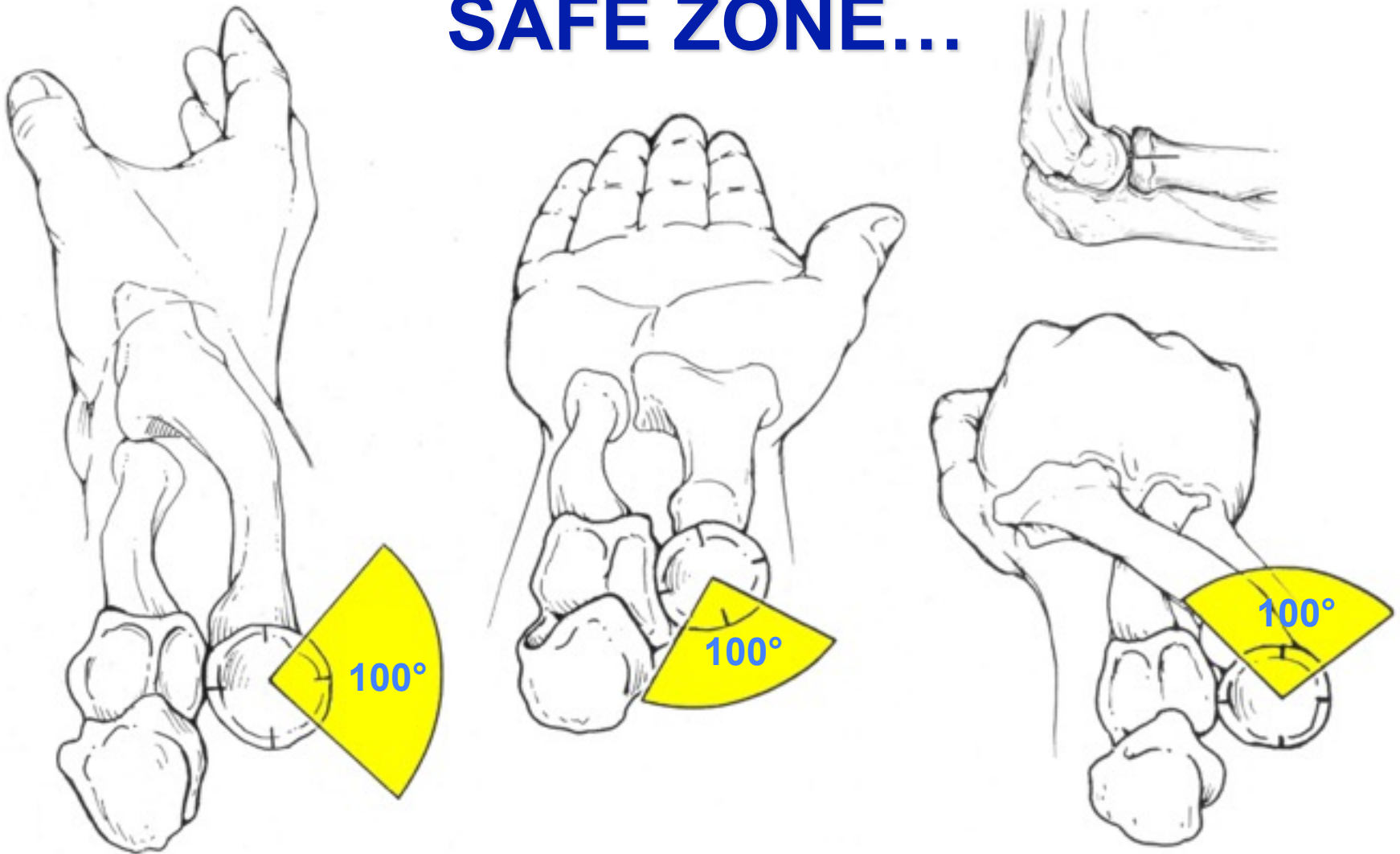




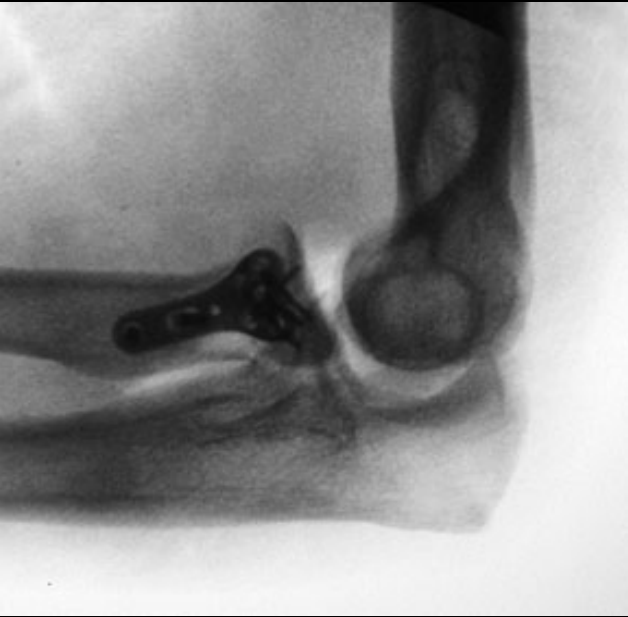
Speciality Locking Plates



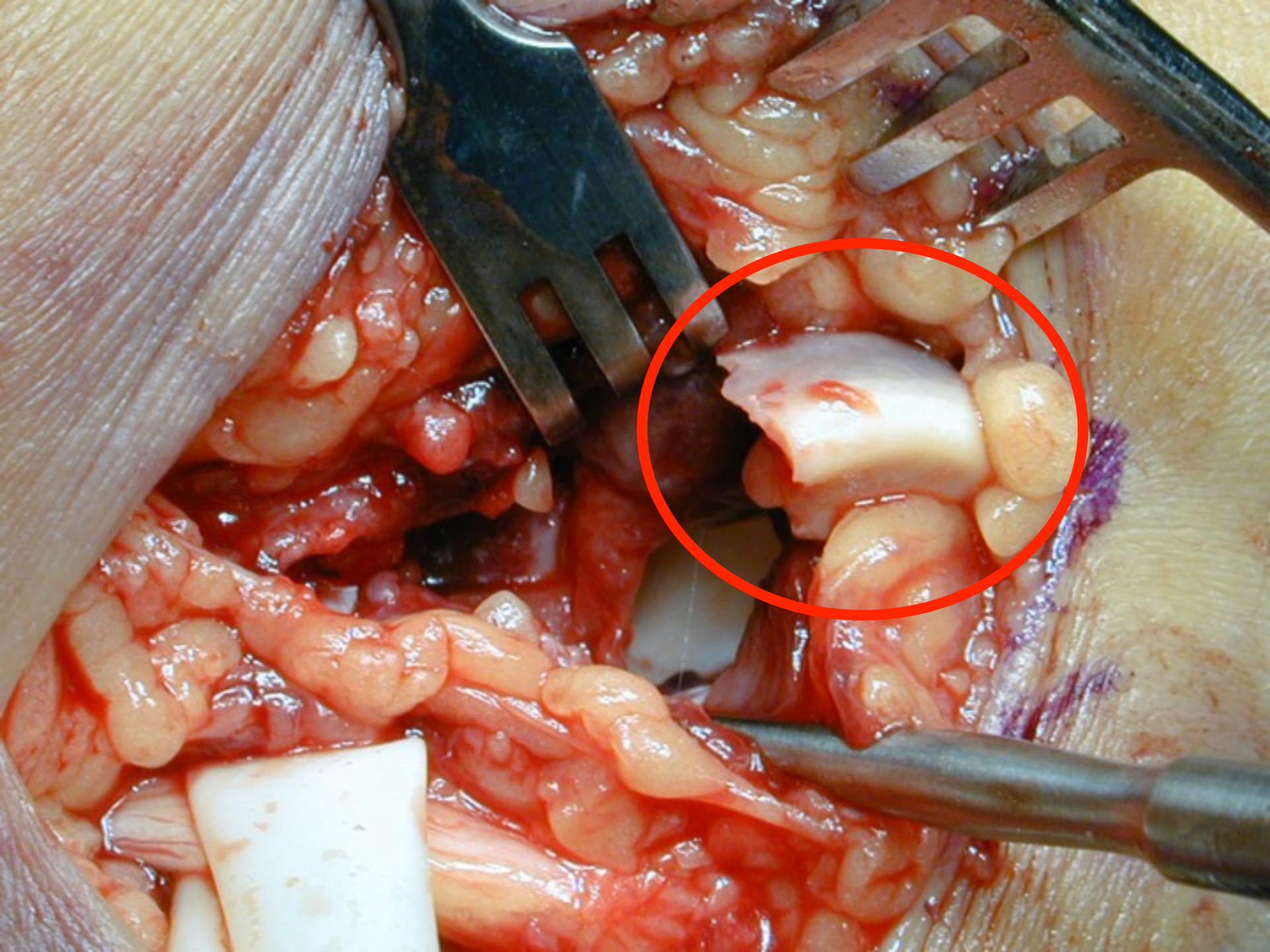
SAFE ZONE...



**for hardware placement is centered
on the equator in neutral position**

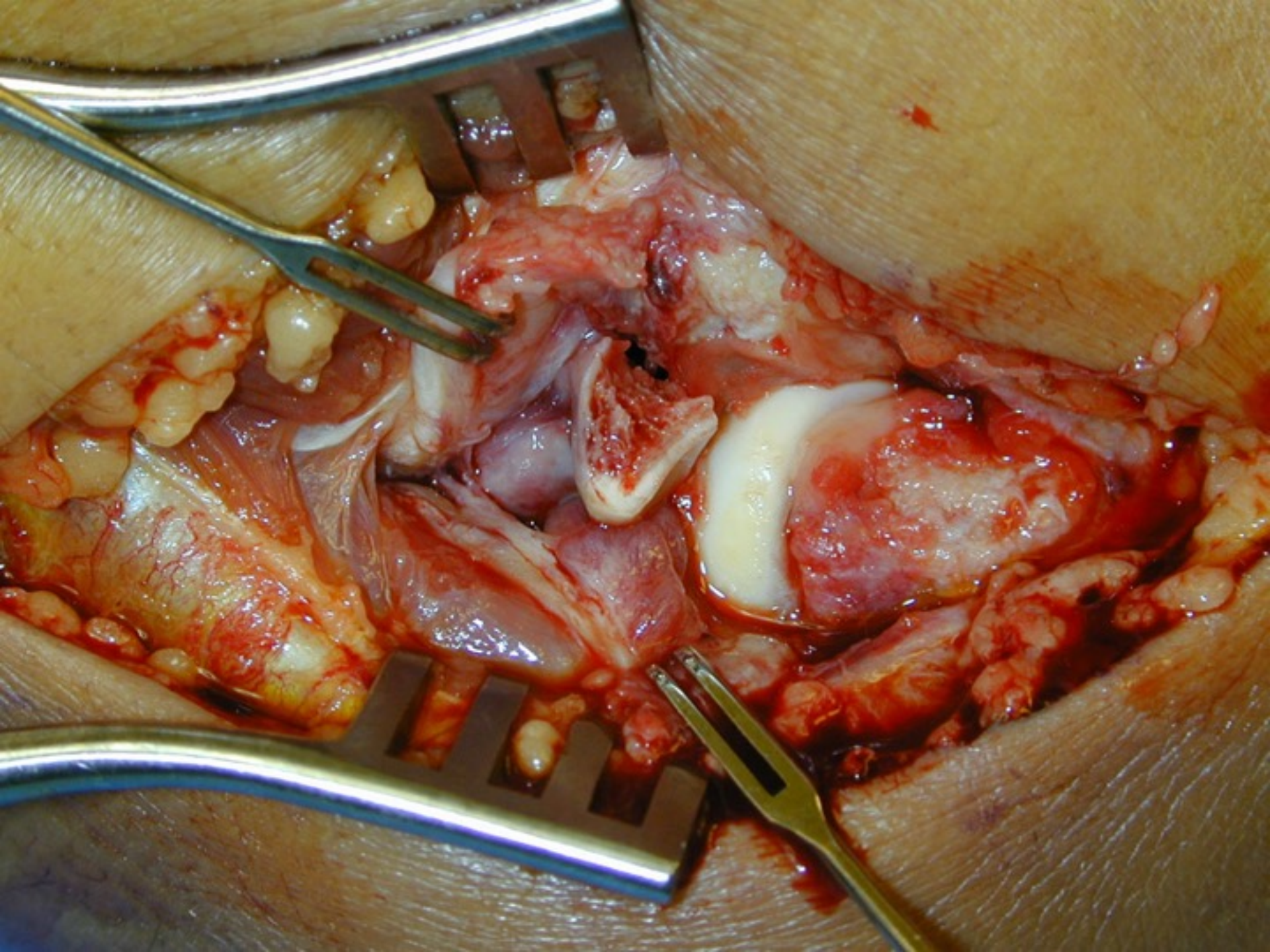


Check forearm rotation with Fluoroscopy



**Check under fluoro to make sure
all fragments have been excised**





EVOLVE™ O.R. TABLE ASSEMBLY FIXTURE



**28MM
HEAD**

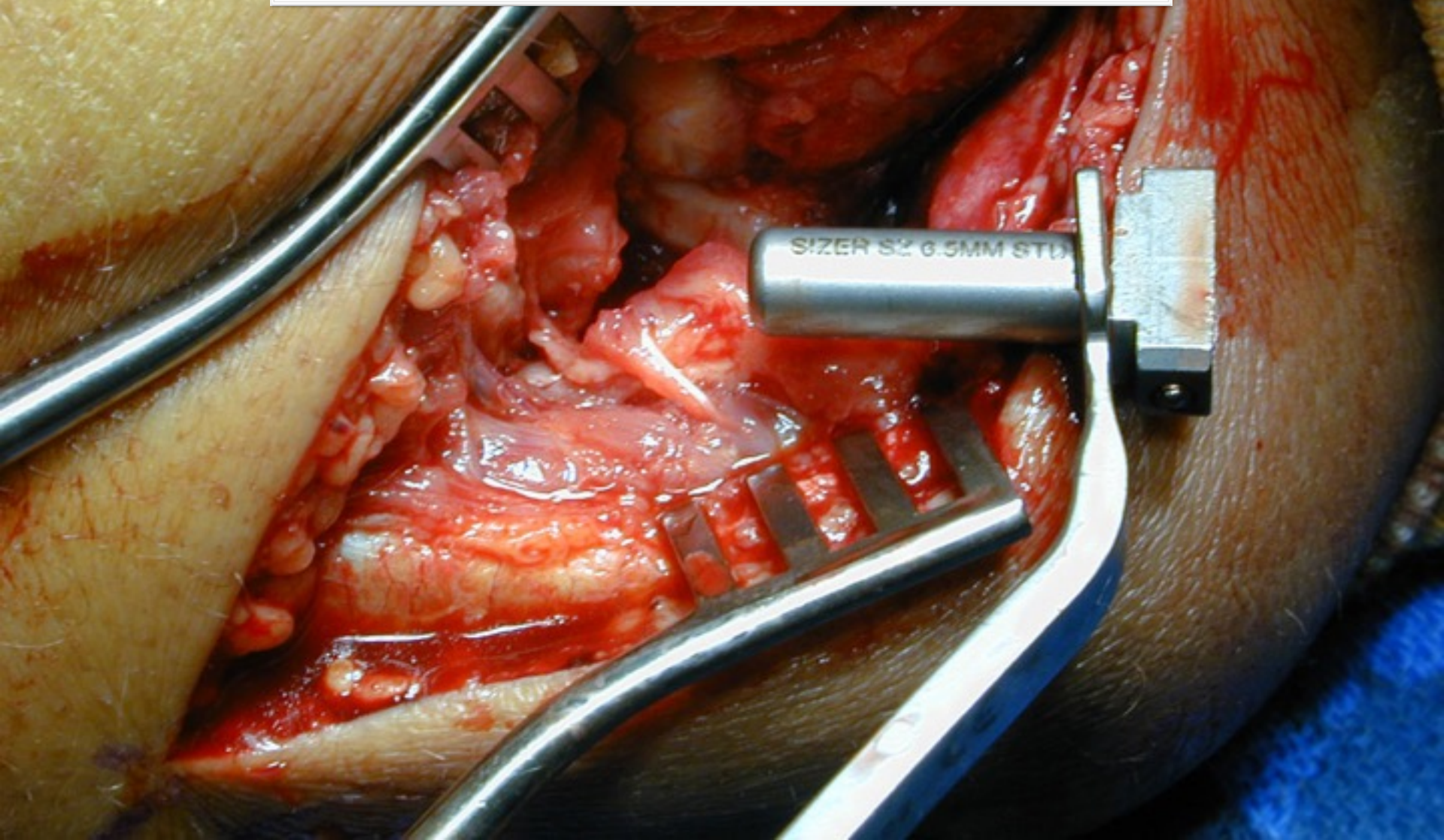
**22MM
HEAD**

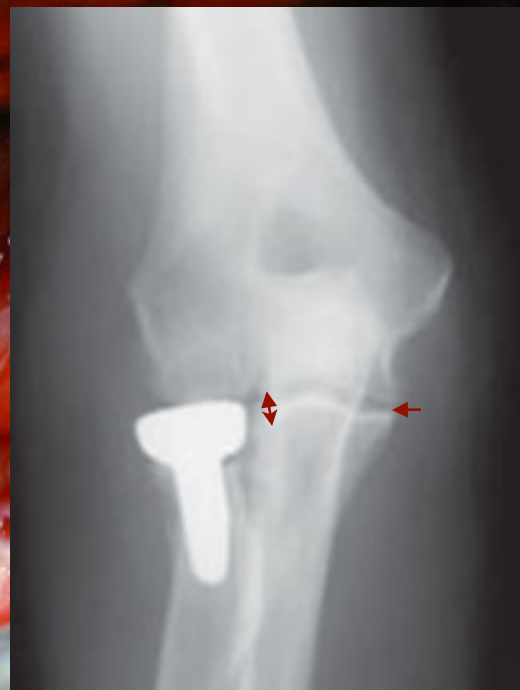
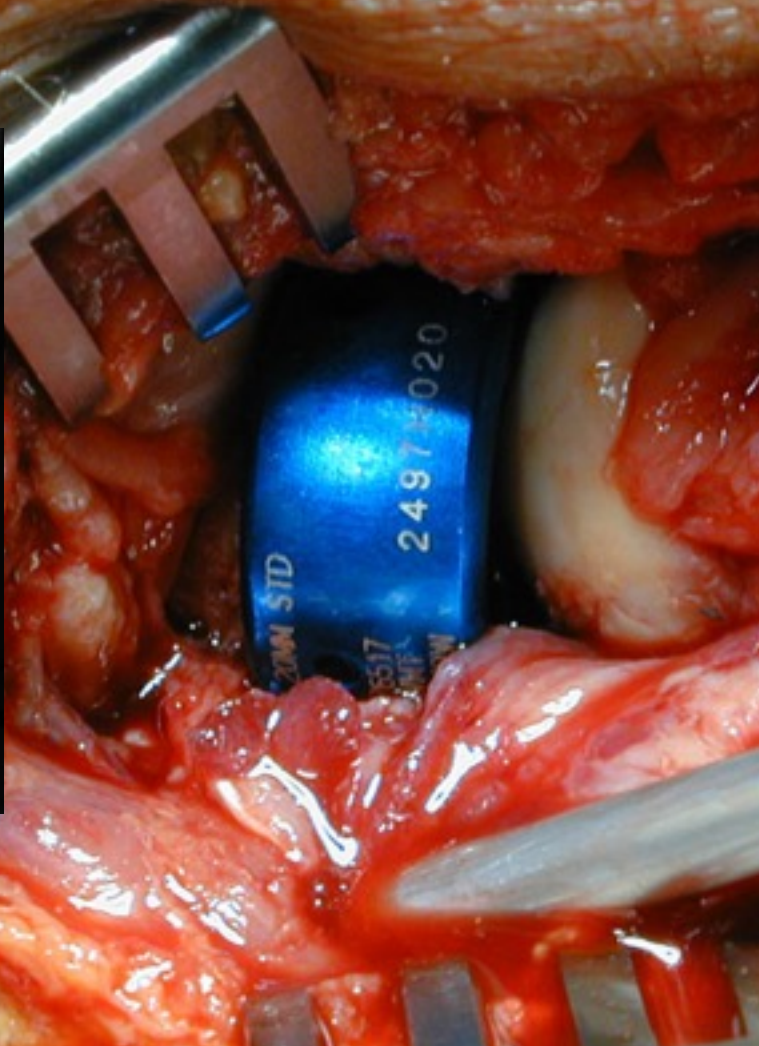
**PLACE
FIXTURE
ON STABLE
SURFACE**



Ream without fracturing radial shaft

Resect as little shaft as possible
Square off proximal end prn





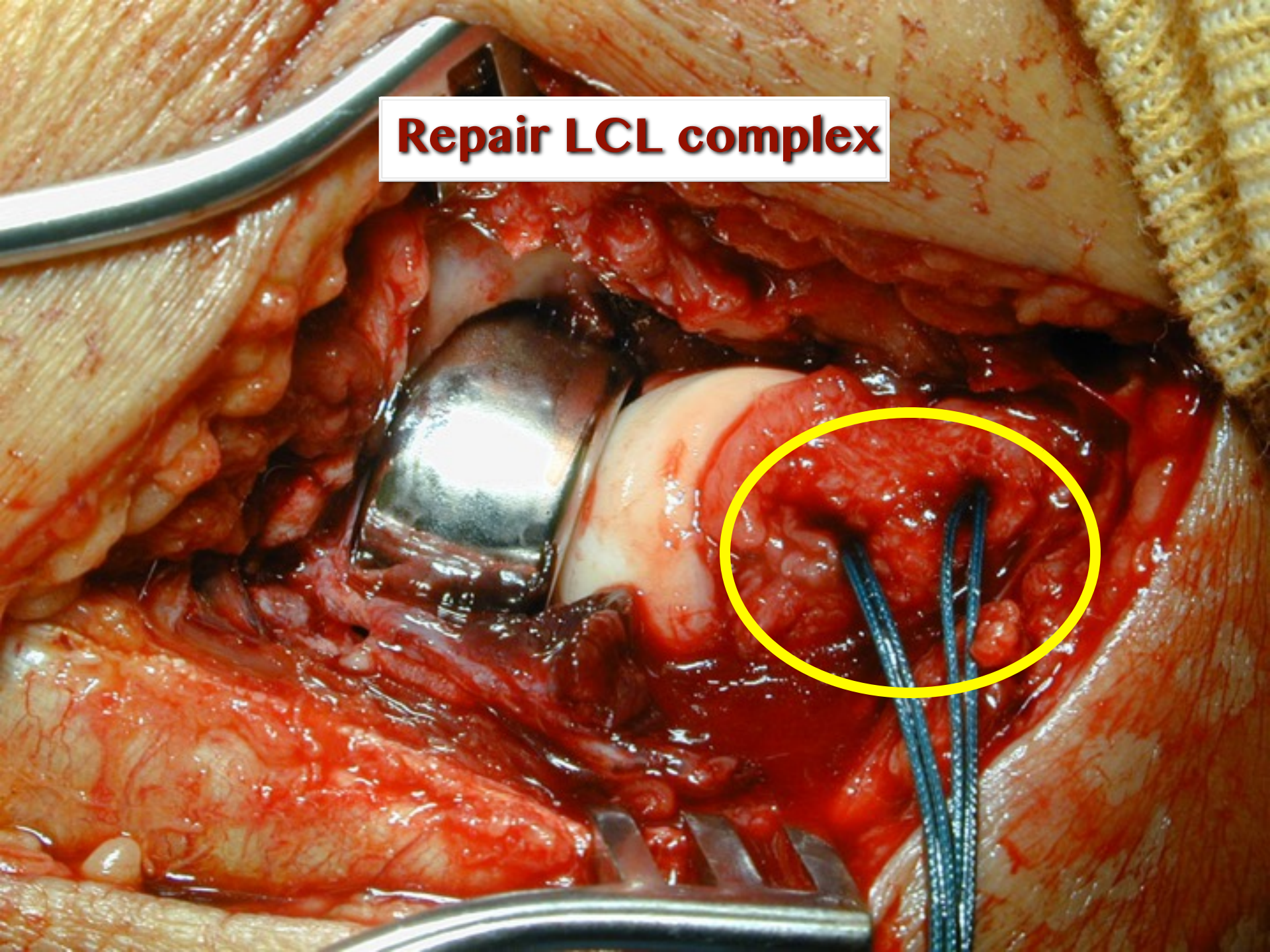
Always downsize if faced with a choice

Avoid Overstuffing





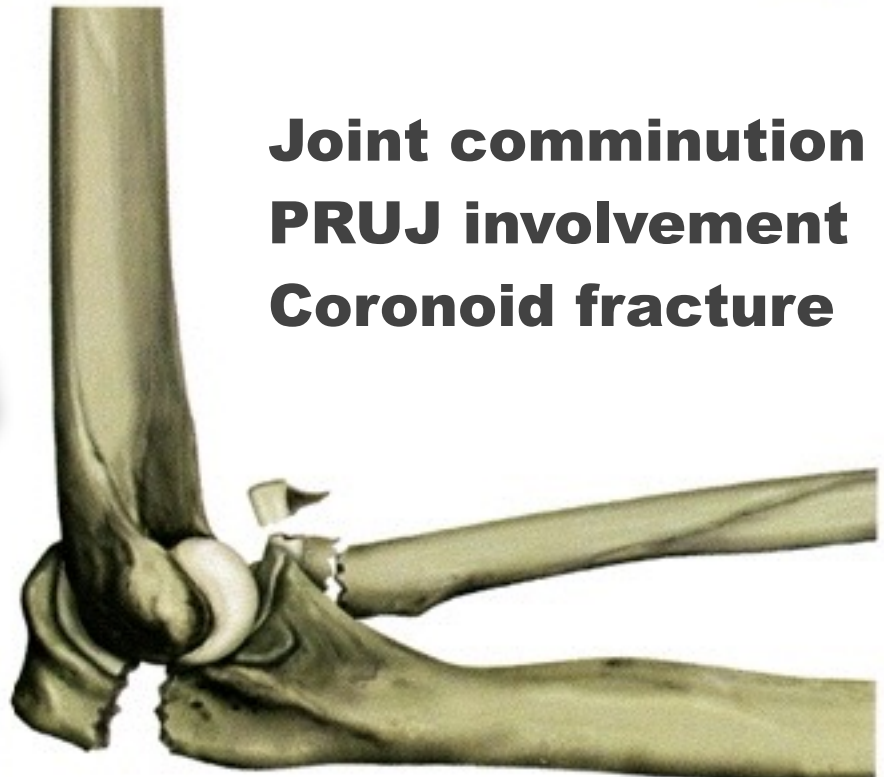
Repair LCL complex





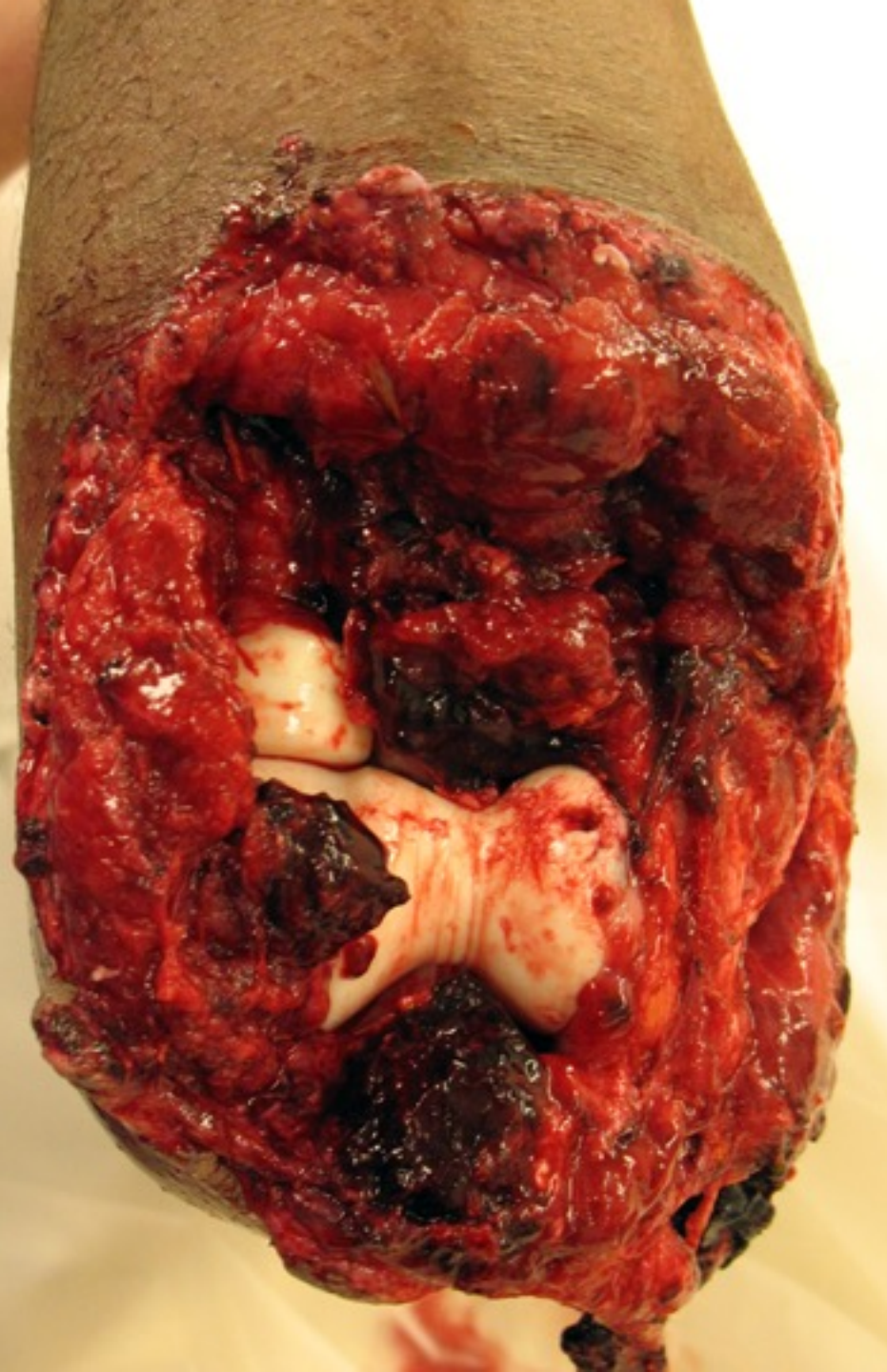
OLECRANON FRACTURE DISLOCATIONS

**Joint comminution
PRUJ involvement
Coronoid fracture**











External fixator excellent “belt and suspenders” bailout option



Course of the Radial Nerve in Relation to the Center of Rotation of the Elbow—The Need for a Rational Safe Zone for Lateral Pin Placement

Kilian Wegmann, MD, Sebastian Lappen, Doreen B. Pfau, MD,
Wolfram F. Neiss, MD, PhD, Lars P. Müller, MD, PhD, Klaus J. Burkhart, MD, PhD

Clinical relevance Based on this cadaveric study, it is not possible to define a rational safe zone. The safest method of pin application for dynamic external fixation of the elbow is to perform a mini-open dissection with direct visualization. (*J Hand Surg Am.* 2014;39(6):1136–1140. Copyright © 2014 by the American Society for Surgery of the Hand. All rights reserved.)

Key words Radial nerve, center of rotation, dynamic fixator, iatrogenic injury, elbow.

Results The measured positions of 3 landmarks of the radial nerve in the lateral aspect of the humerus ranged from 19% to 43% of the length of the humerus and were located, on average, 6.0, 9.7, and 13.5 cm from the lateral center of rotation.

Conclusions These data help predict the humeral course of the radial nerve and define a safe zone for pin implantation. However, because of variability in the course of the radial nerve, a safe zone cannot fully ensure prevention of iatrogenic injury to the nerve. The safest method of pin application remains mini-open dissection and visual implantation.

Clinical relevance Based on this cadaveric study, it is not possible to define a rational safe zone. The safest method of pin application for dynamic external fixation of the elbow is to perform a mini-open dissection with direct visualization. (*J Hand Surg Am.* 2014;39(6):1136–1140. Copyright © 2014 by the American Society for Surgery of the Hand. All rights reserved.)

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