A Team Approach to Upper Extremity Trauma

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The Bone and Joint Institute of Tennessee

Definition of Team

A group of individuals working together to achieve a common goal.

Our Goal = MAXIMIZE PATIENT OUTCOME

Types of Trauma

- Fractures
- Lacerations
  - Tendon
  - Nerve
  - Vascular
  - Ligament
  - Skin
- Dislocations
- Tendon Ruptures
- Ligament Ruptures

Treatment Goals

- Expeditious return to activities
  - Occupation
  - Athletics
  - ADLs
- Recognizing and managing complications
- Maximizing Outcomes

Treatment Challenges

- We rely on our upper extremities to perform the vast majority of ADL's.
- Mild dysfunction can result in significant morbidity.
- 'Morbidity' includes:
  - Loss of function
  - Loss of income
  - Psychological distress (depression/anxiety)

Steps for Maximizing Outcomes

- Thorough initial exam
  - Physical exam
  - Radiographic exam
- Preoperative patient education / expectations
- Appropriate surgical management
- Prompt postoperative rehabilitation
- Communication between providers
  - Multiple eyes on the patient will recognize issues only if the treating physician is aware.

Surgical Treatment Algorithm

- Obtain stable fixation when required.
- Insure adequate blood flow.
- Repair tendons / ligaments / joint capsule.
- Manage the integument and obtain stable soft tissue coverage.
  - Laceration closure
  - Flap coverage
  - Skin graft
  - Synthetic wound coverage dressings

Rehabilitation of Upper Extremity Trauma

What is a Certified Hand Therapist?

- Occupational or Physical Therapist with advanced clinical specialty in treatment of conditions affecting the hand and upper extremity
- Advanced study and experience required
- Three years of practice experience, 4000 hours of practice in upper extremity rehabilitation, certification exam that demonstrates all areas of hand therapy/upper extremity rehabilitation
- Renew through continued education and participation in hand therapy practice

What Does A Hand Therapist Do?

- Evaluate and treat any problem related to the upper extremity (includes shoulder to the fingertip)
- Treat and rehabilitate patient through post operative rehabilitation, preventative, non-operative or conservative treatment
- Work closely with physician and patient to provide continuum of care
- In our practice focus on working closely with physician and PA to provide comprehensive care to achieve best outcomes and return patient to optimal function
- Often first to see patients after trauma post-operatively (3-7 days post surgery is typical)

Evaluating A Patient Through the Lens of OT/CHT

- Posture
- Affect / Disposition / Emotional Status
- Pain: quality, intensity, location, behavior, interference with function
- Response to movement and touch
- Color: capillary refill, vasomotor changes
- Edema: what type?
- Sensation: 2 pt discrimination
- ROM: Are they moving free parts of extremity or guarding?
- Compartments: Changes in blood supply, nerve response, muscle function
- Function: How is the patient impacted in daily life, basic ADLs, work, household tasks, recreational tasks
- How is disruption affecting disposition?
- Motivation
- Support system / Living situation

Teamwork as Key to Maximizing Outcomes

- Importance of open communication and trust between therapist/surgeon in knowing surgical repair/fixation techniques are based on evidence-based practices to drive rehab for maximum outcomes.
- Identifying and monitoring early complications and risk factors with collaboration in management, involves PA.
- Patient-centered coordinated care
- Fracture stability, limitations of ROM based on stability
- Mechanism of injury, date of injury, structures injured and repaired, technical specifics of repair of tendon (i.e. suture technique, suture type)

Managing Complications Post UE Trauma: Chronic Regional Pain Syndrome (CRPS)

- Early recognition and communication between team members to manage is key to long term success
- Often requires multidisciplinary approach between hand surgeon, hand therapist, internist and psychologist (zhongyu et al, 2005)
- Combination of therapy for motion and symptom management and pharmacologic agents is key
- Therapist often able to recognize early symptoms after trauma as we see the patient first and more frequently

CRPS I and II Defined

- CRPS I: pain, autonomic dysfunction, trophic changes, and functional impairment without an identifiable nerve injury
- CRPS II: identical to above with a nerve injury (Zhongyu, et al. 2005)
- Early diagnosis and intervention is most important in outcome of CRPS
- Important to initiate early therapy before structural changes occur to affected limb (Walsh,)
- Delay in treatment often leads to recurrence 53% of time
- Previous traumatic incident with CRPS also can lead to more likely recurrence

Recognizing Signs and Risk Factors

- Posture: neglect of limb or guarding of limb (does patient carry the extremity with unaffected side, “Robot / Barbie hand”
- Patient often states “my limb doesn’t feel like my own, it feels detached from my body”
- Reports of feeling “claustrophobic” in post operative splint
- Pain reported as burning (allodynia), hyperalgesia (significant hypersensitivity to touch: the air hitting my arm makes it hurt)
- Patient c/o tightness of cast or dressing, burning in cast or dressing
- Restricted unaffected joint motion while in cast or splint
- Communication immediately and early with MD/PA when these are present

Signs and Risk Factors (cont)

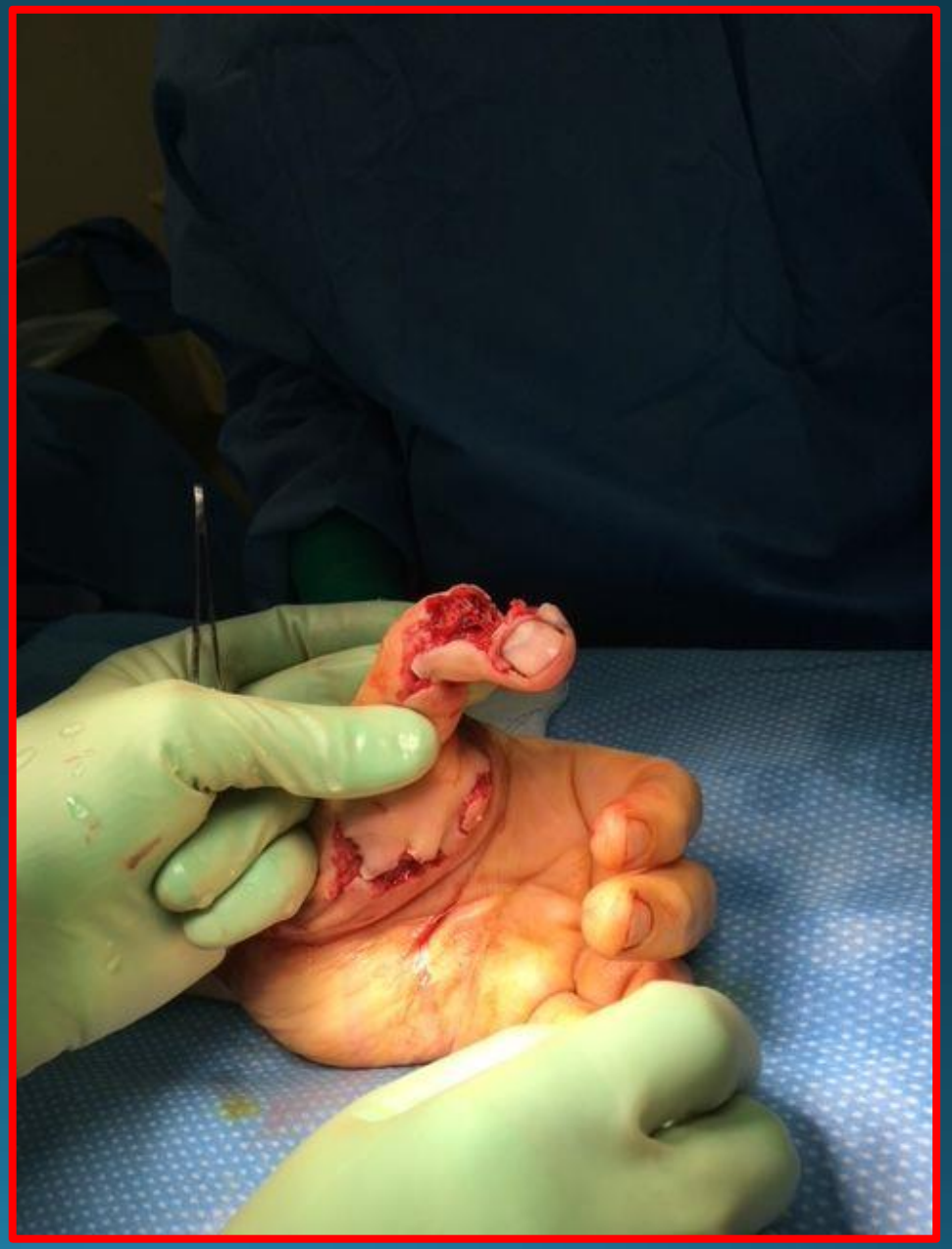
- Vasomotor changes: extremity turning red (vasodilation) or blue (vasoconstriction), often exacerbated with attempts to use extremity, asymmetry from opposite side
- Pseudomotor edema: edema, hyperhidrosis asymmetry
- Motor/trophic changes: decreased ROM, inability to use extremity, neglect, dystonia, dyskinesia

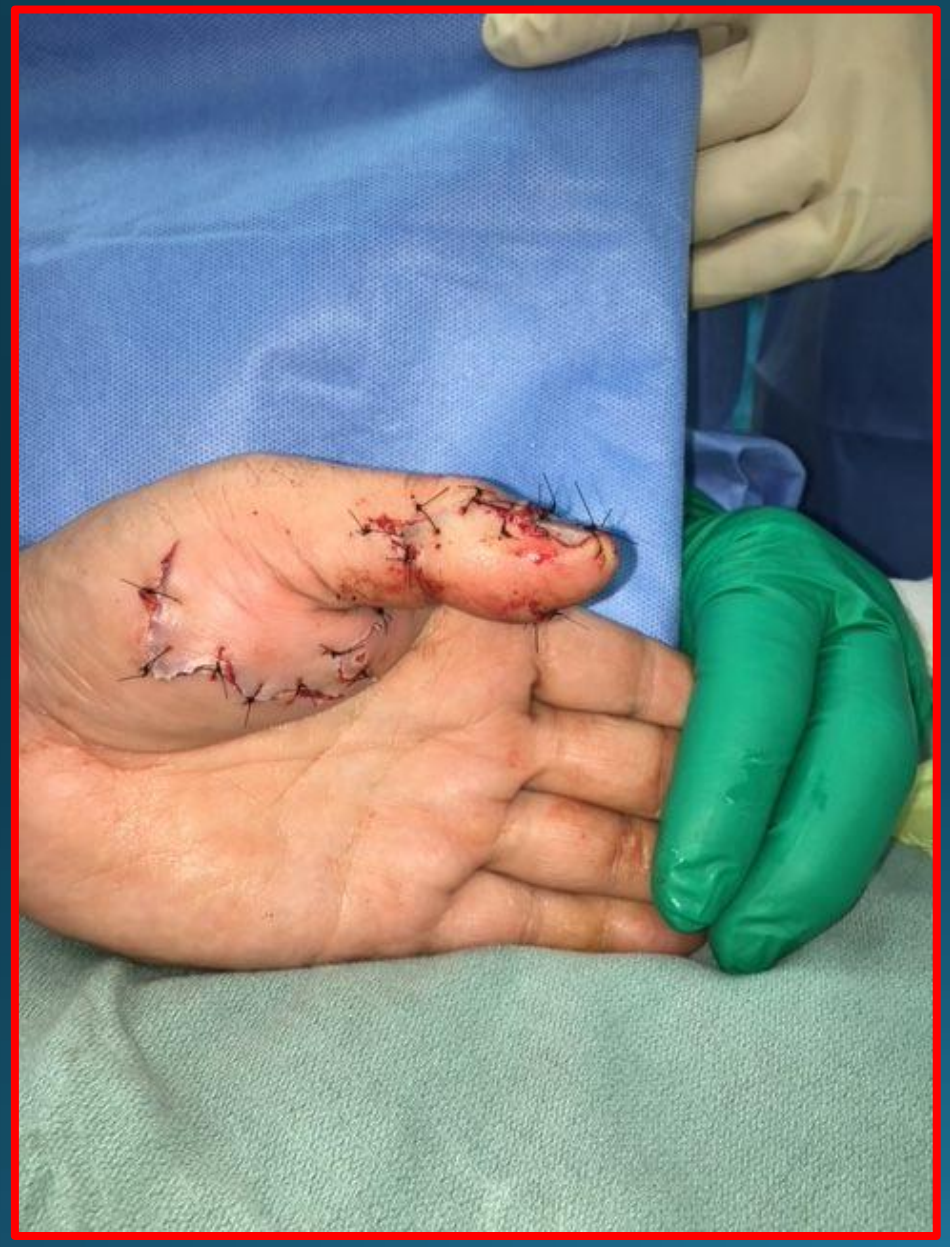
What Do We Now?

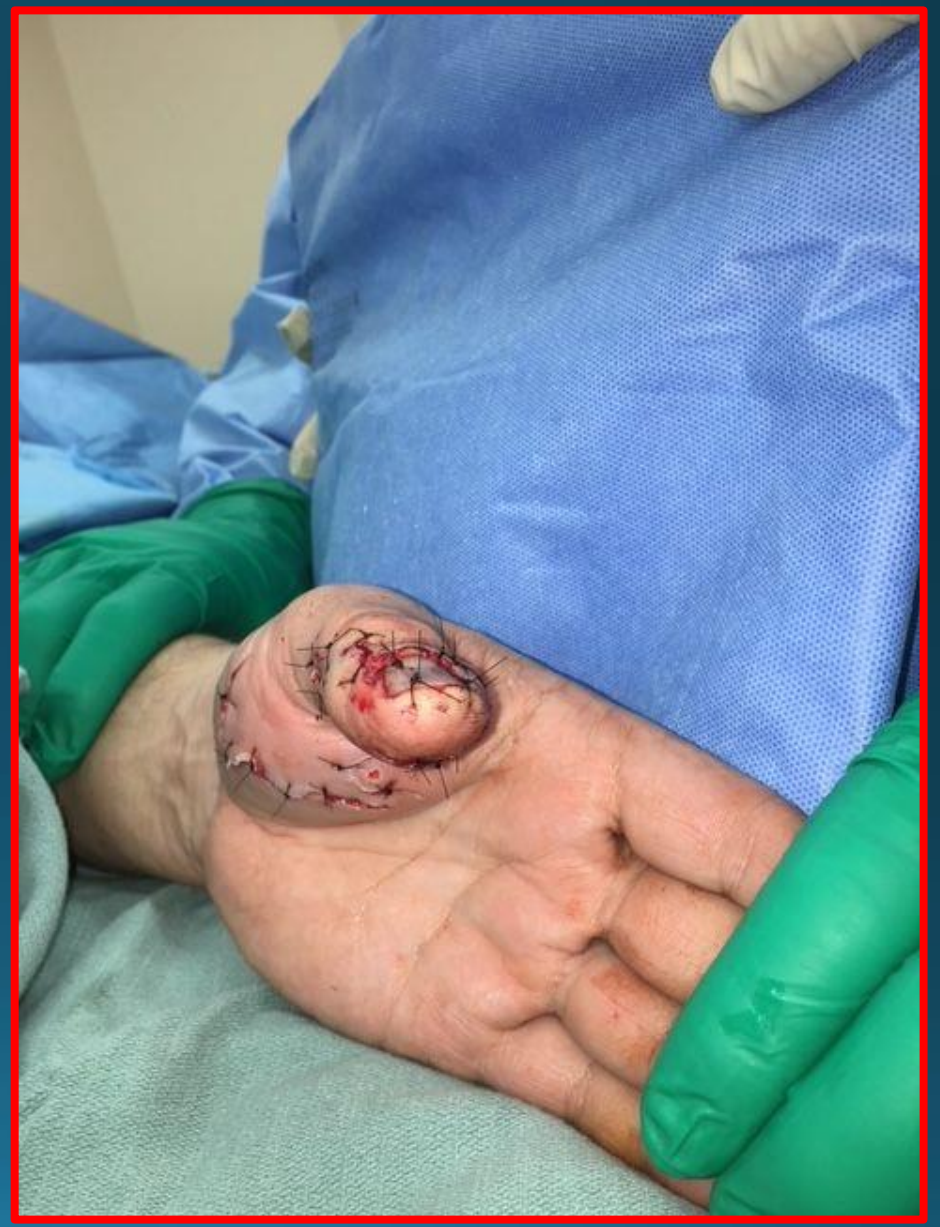
- Communication with MD/PA regarding pharmacologic treatment options, team approach
- Movement based therapy that does not provoke pain
- Functional tasks in therapy and bilateral activities
- Preservation of joint ROM
- Education to avoid unhelpful beliefs
- Edema control
- Pain management
- Stress loading
- Visual feedback – mirror therapy
- Recognition of biopsychosocial aspects, involving psych education on importance of anxiety / depression management
- Desensitization
- Neural mobilization
- Peripheral nerve exam

Clinical Cases

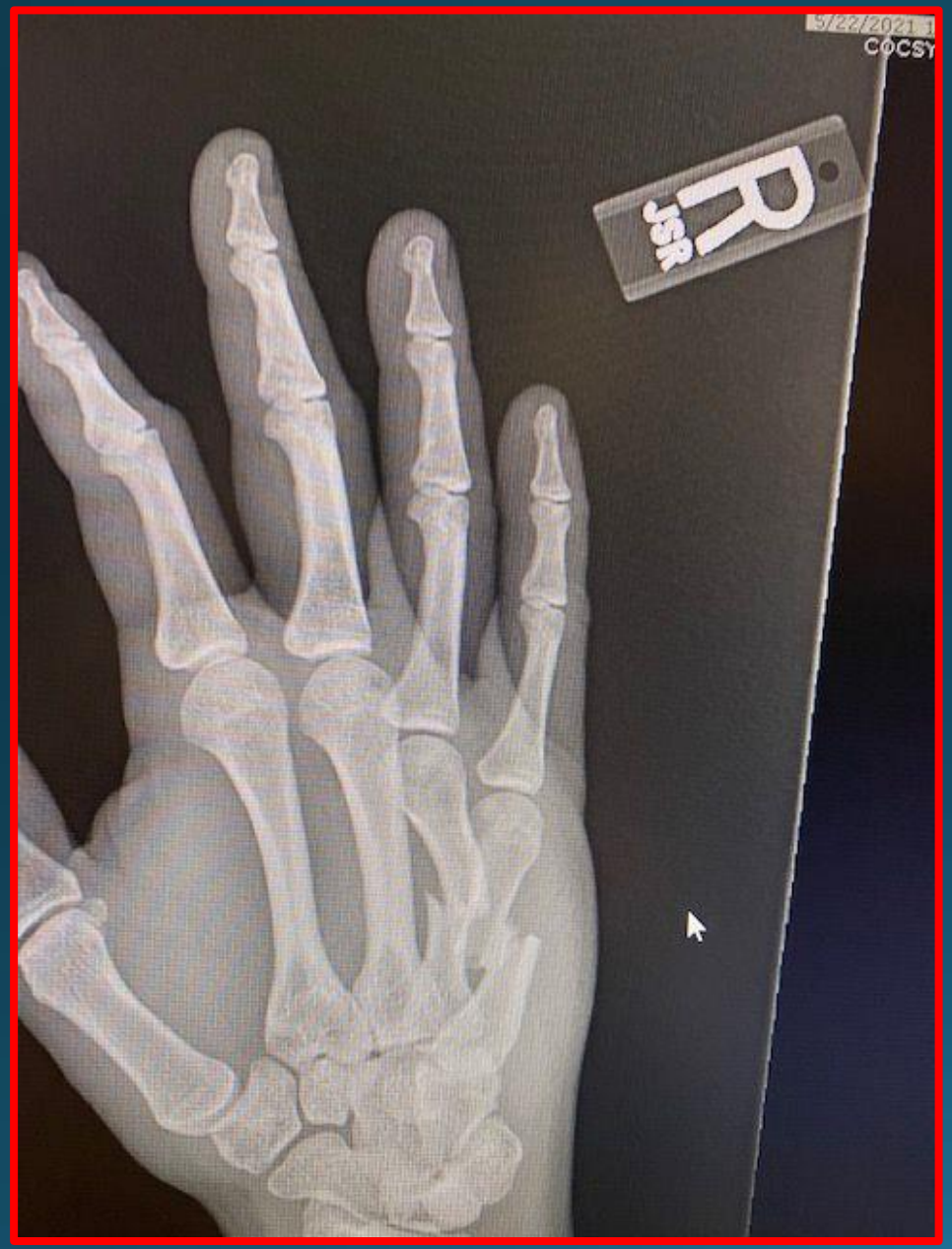
- 42 YO Male
- Dominant Extremity
- Dogbite Injury
- Works in banking industry







- 22 YO Male
- Dominant Extremity
- Punched a piece of wood
- Works in sales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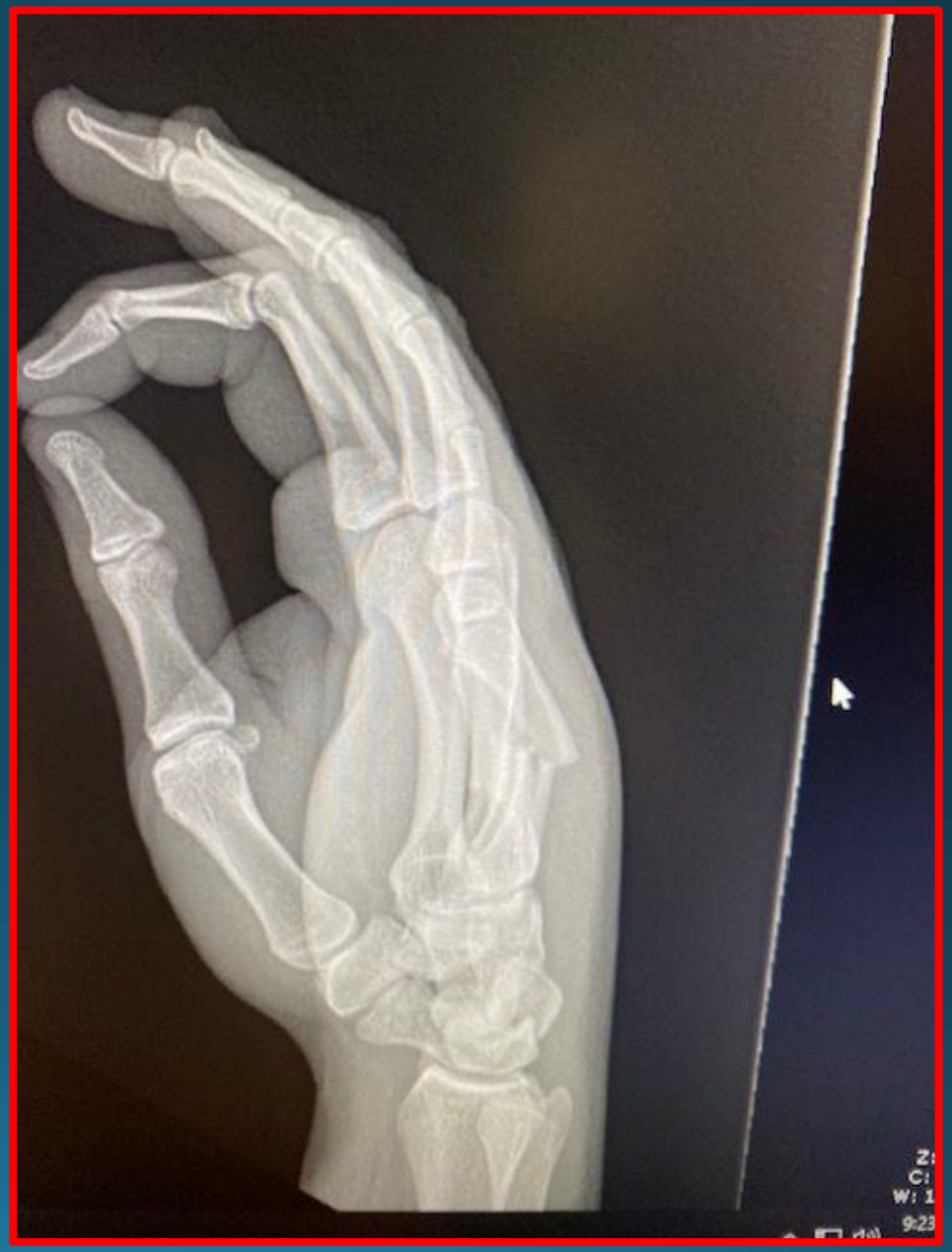
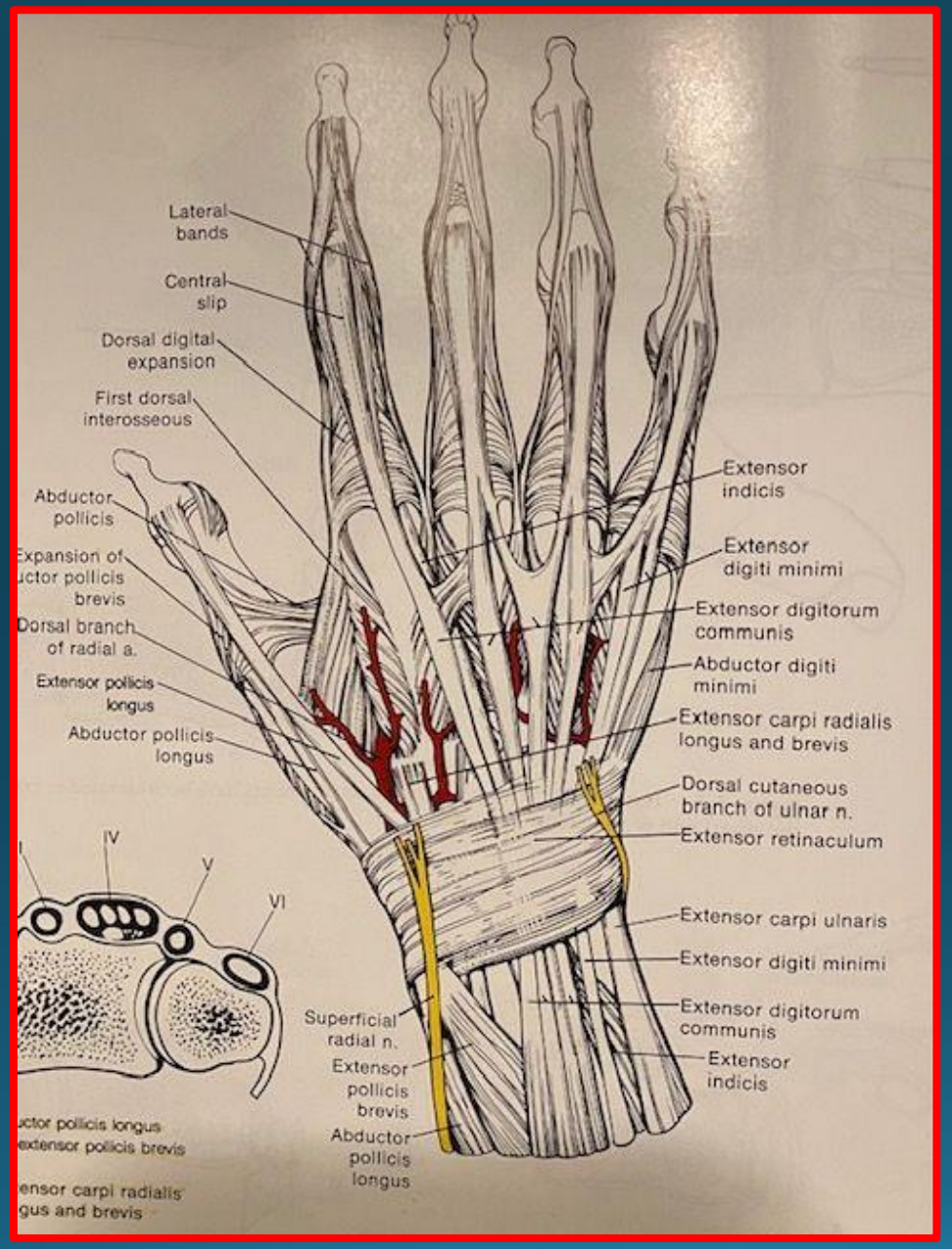
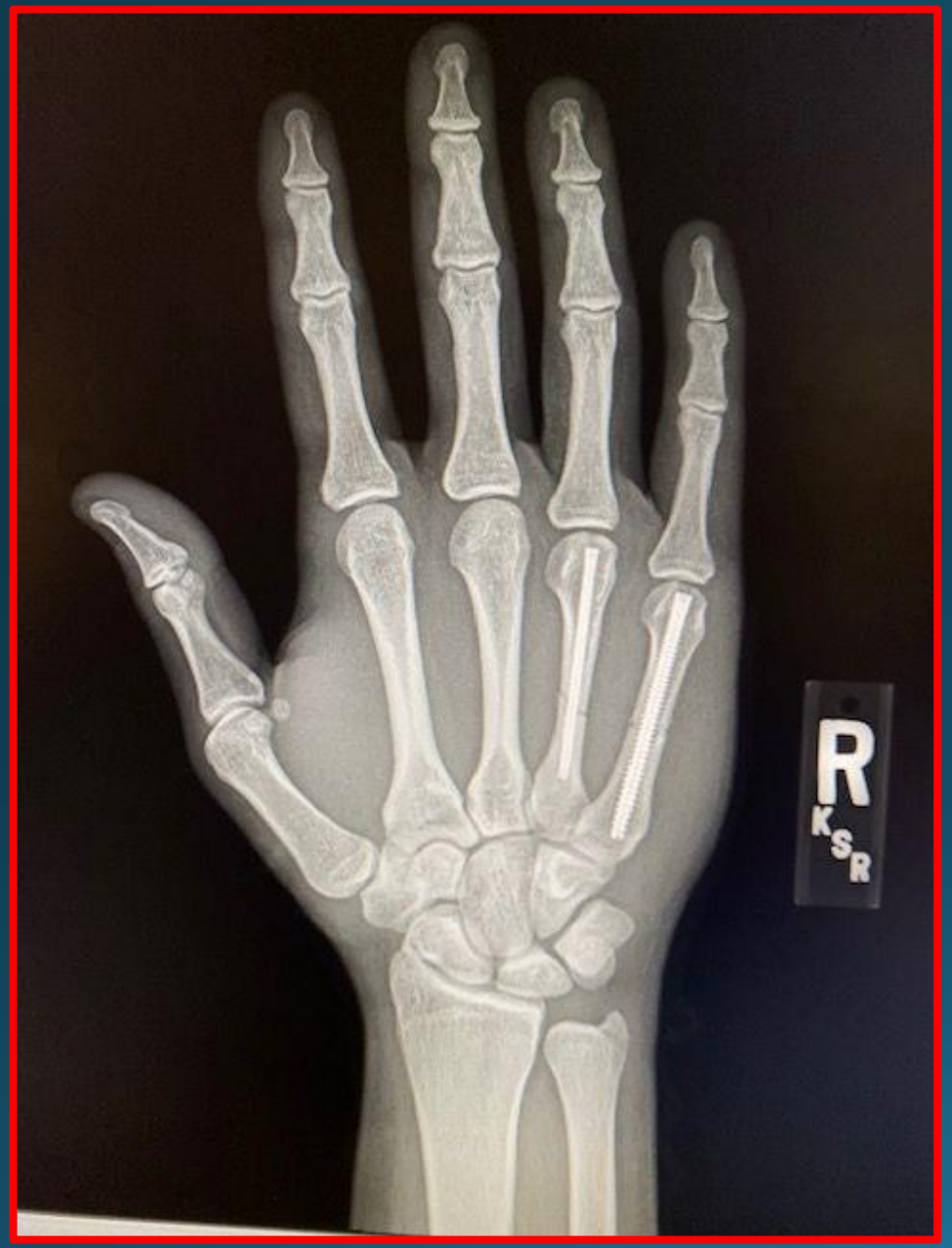



Lateral bands
Central slip
Dorsal digital expansion
First dorsal interosseous
Abductor pollicis
Expansion of ...uctor pollicis brevis
Dorsal branch of radial a.
Extensor pollicis longus
Abductor pollicis longus
IV
V
VI
...uctor pollicis longus
...extensor pollicis brevis
...ensor carpi radialis ...gus and brevis
Extensor indicis
Extensor digiti minimi
Extensor digitorum communis
Abductor digiti minimi
Extensor carpi radialis longus and brevis
Dorsal cutaneous branch of ulnar n.
Extensor retinaculum
Extensor carpi ulnaris
Extensor digiti minimi
Extensor digitorum communis
Extensor indicis
Superficial radial n.
Extensor pollicis brevis
Abductor pollicis longus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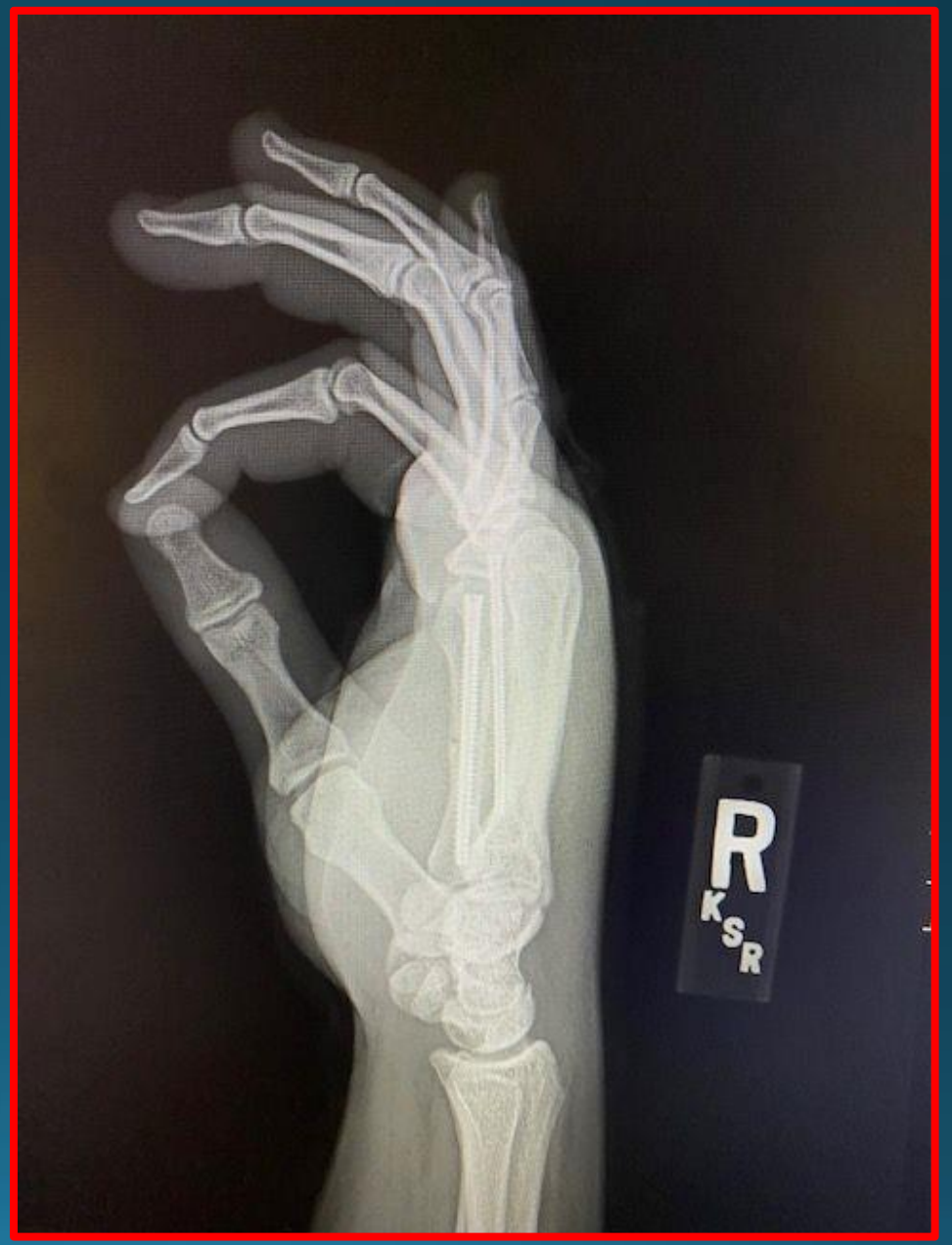
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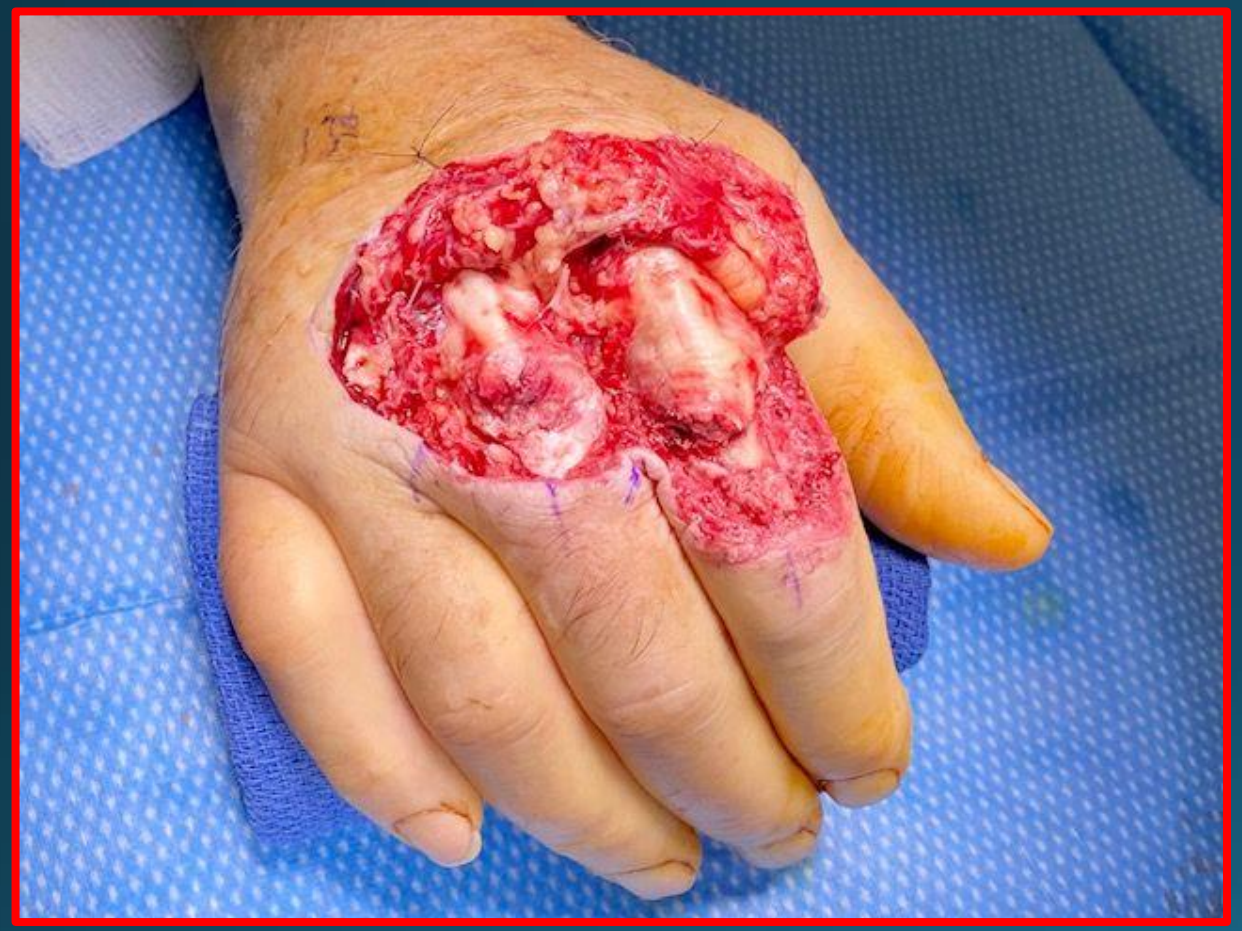
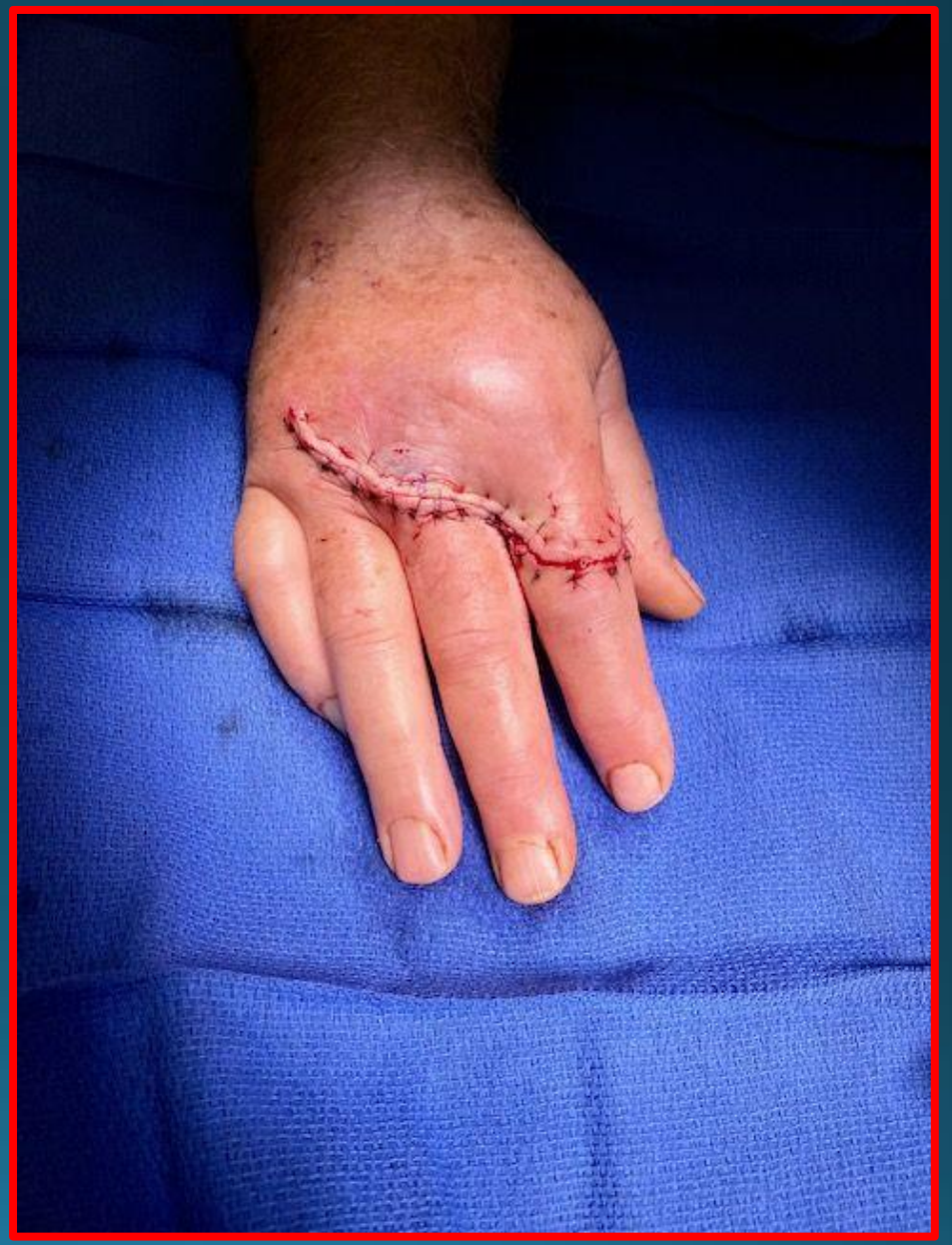
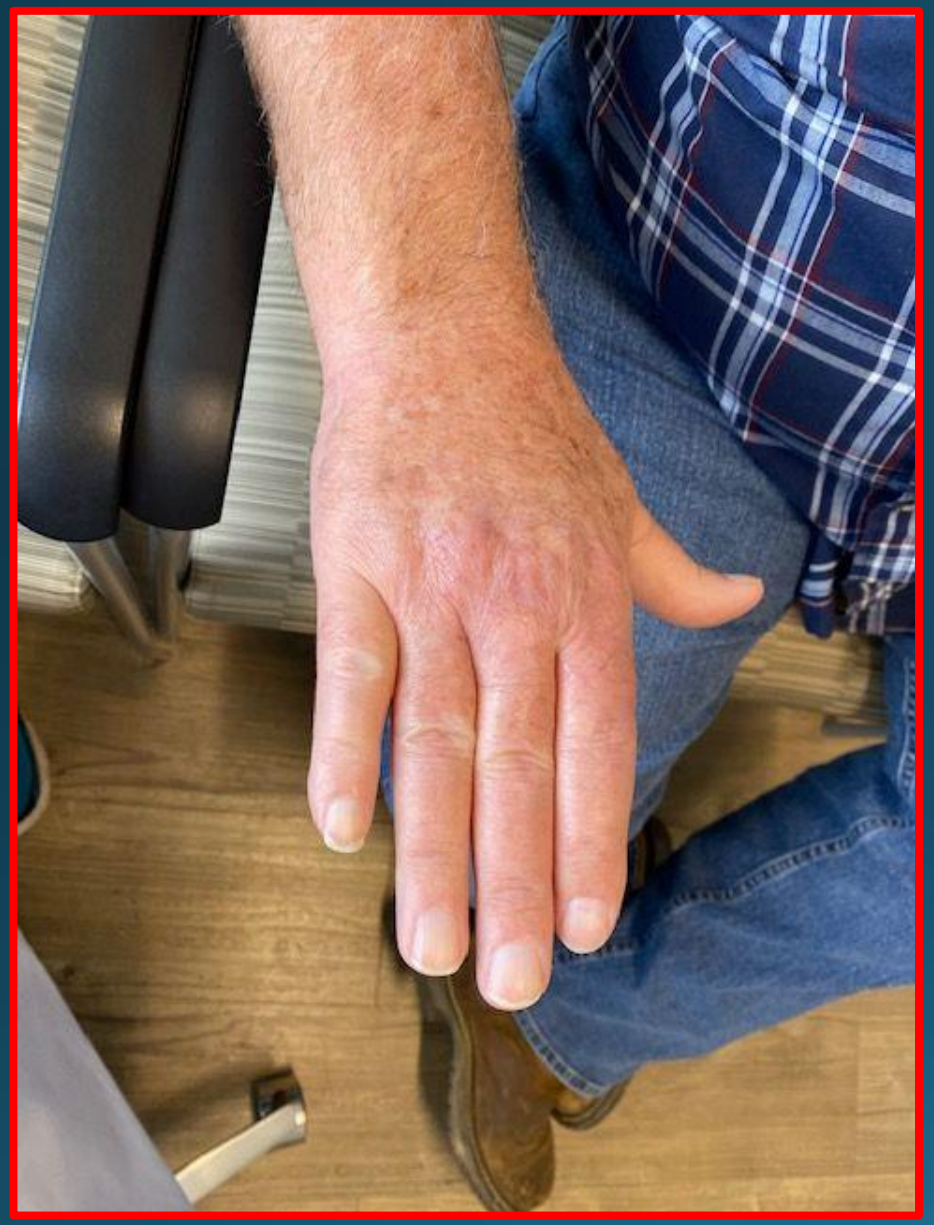
KSR

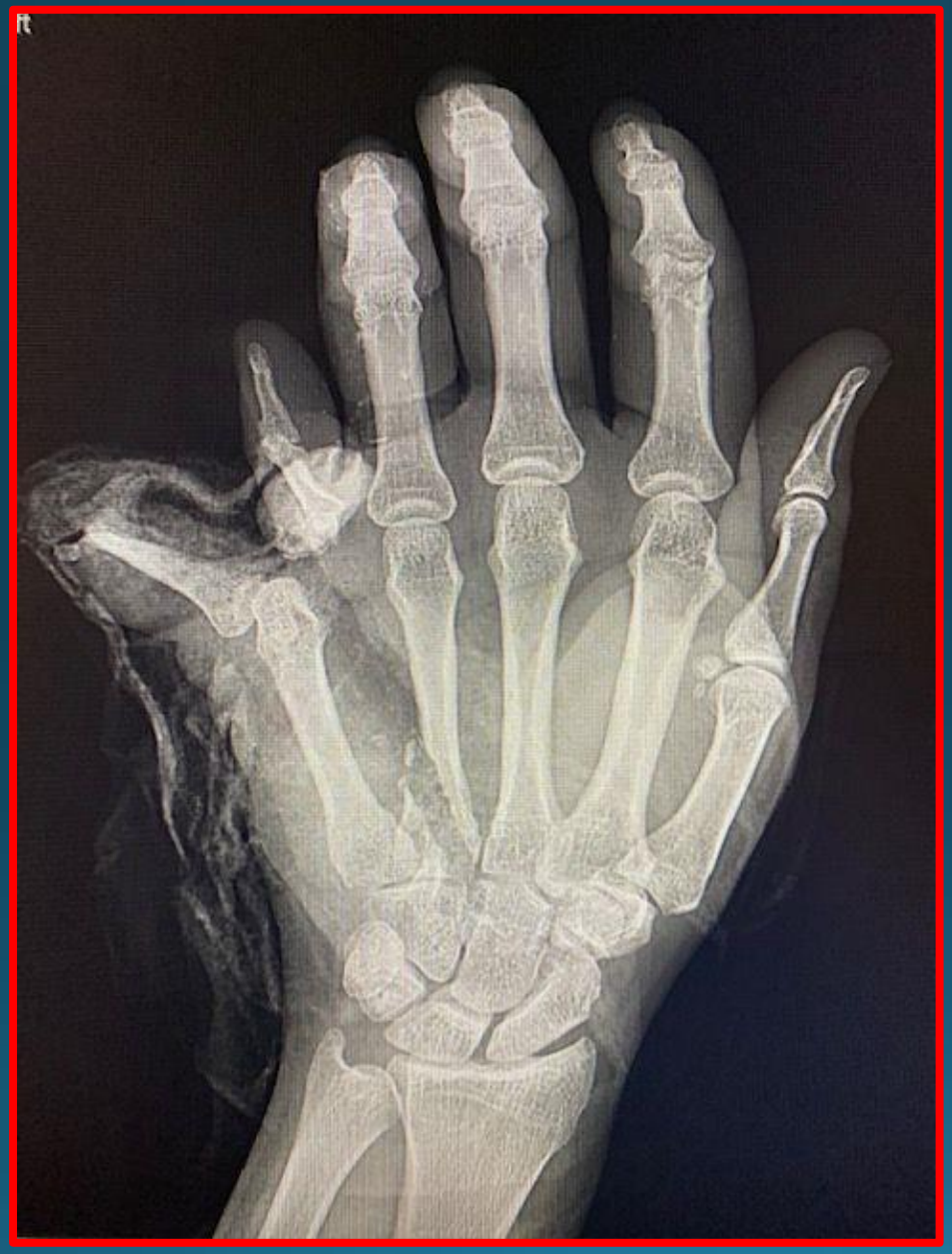
- 62 YO Male
- Nondominant Extremity
- Circular Saw Injury
- Farmer

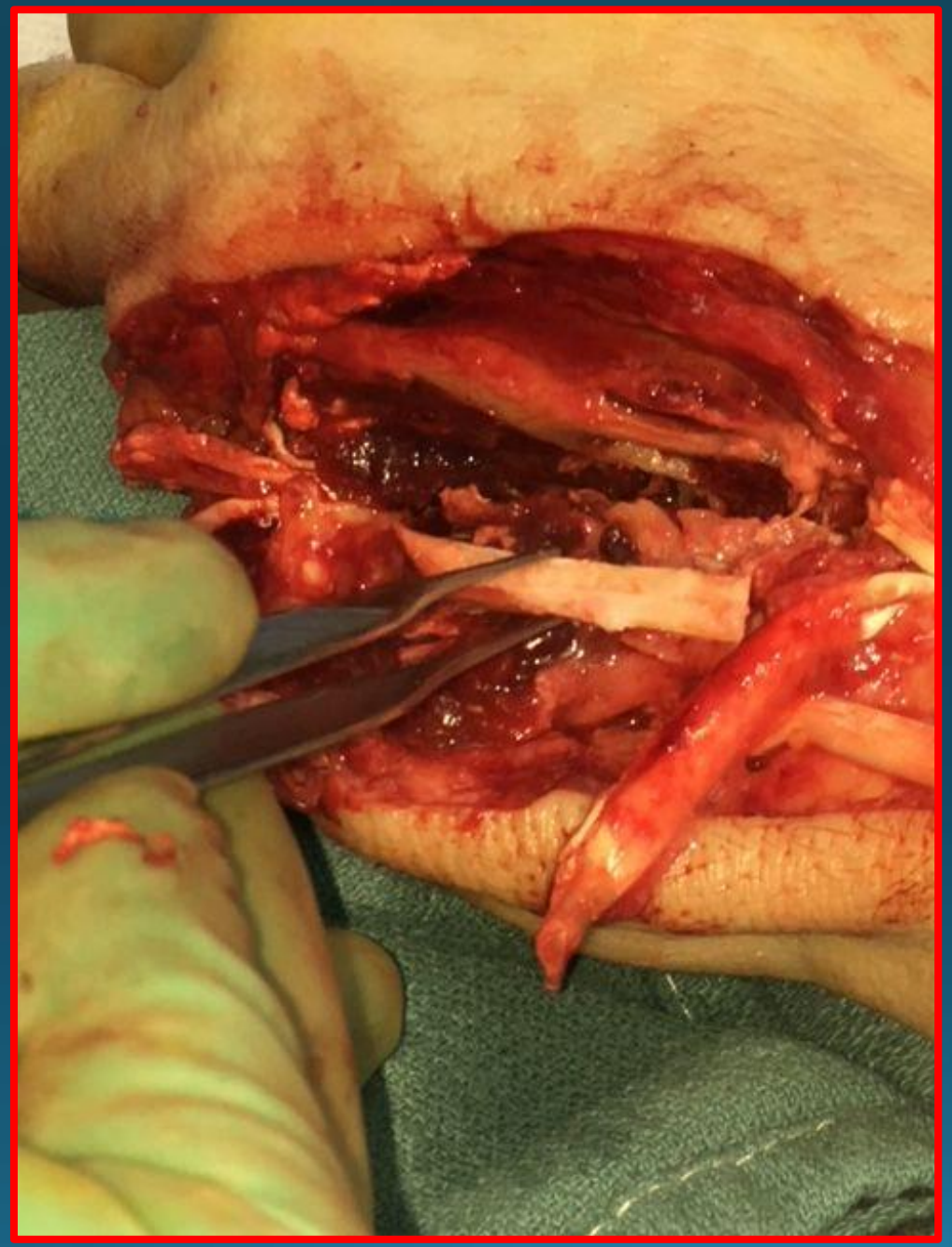


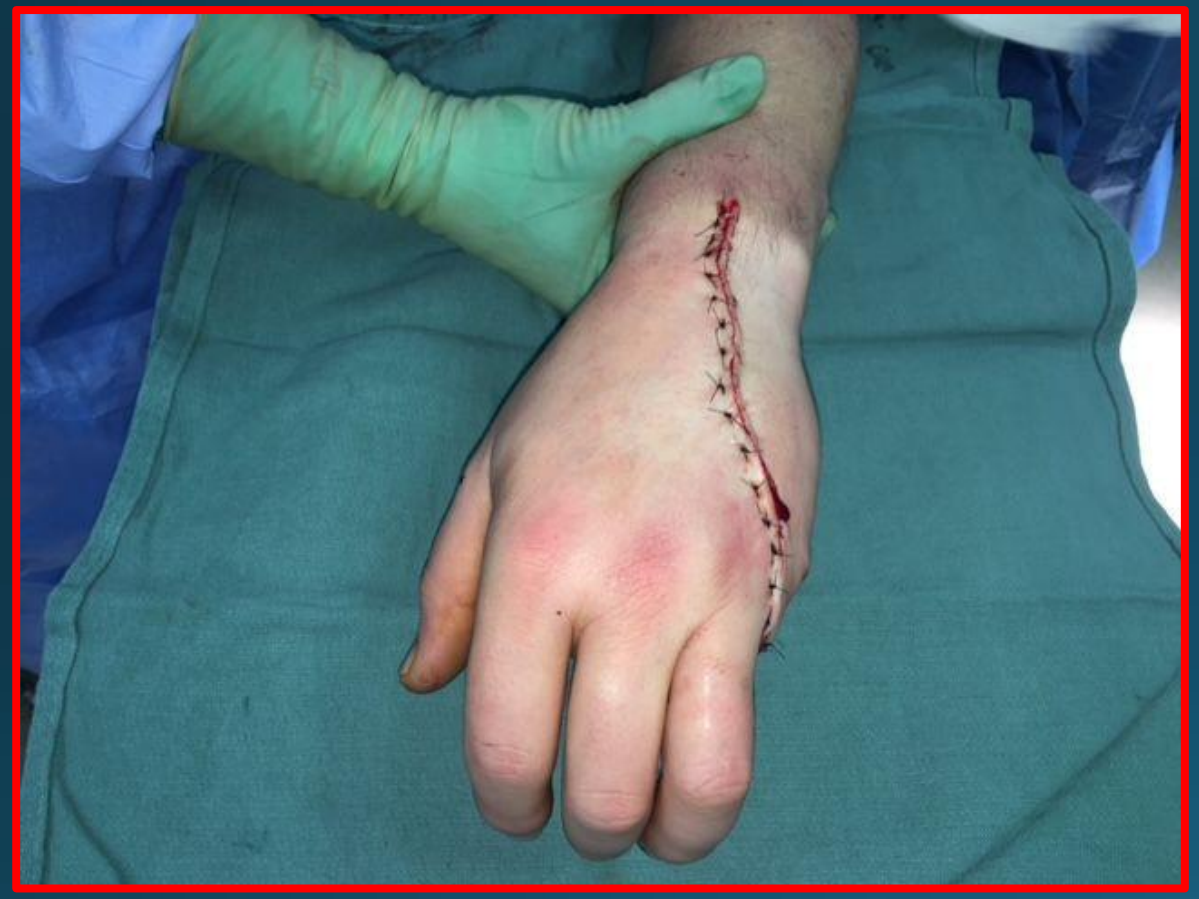


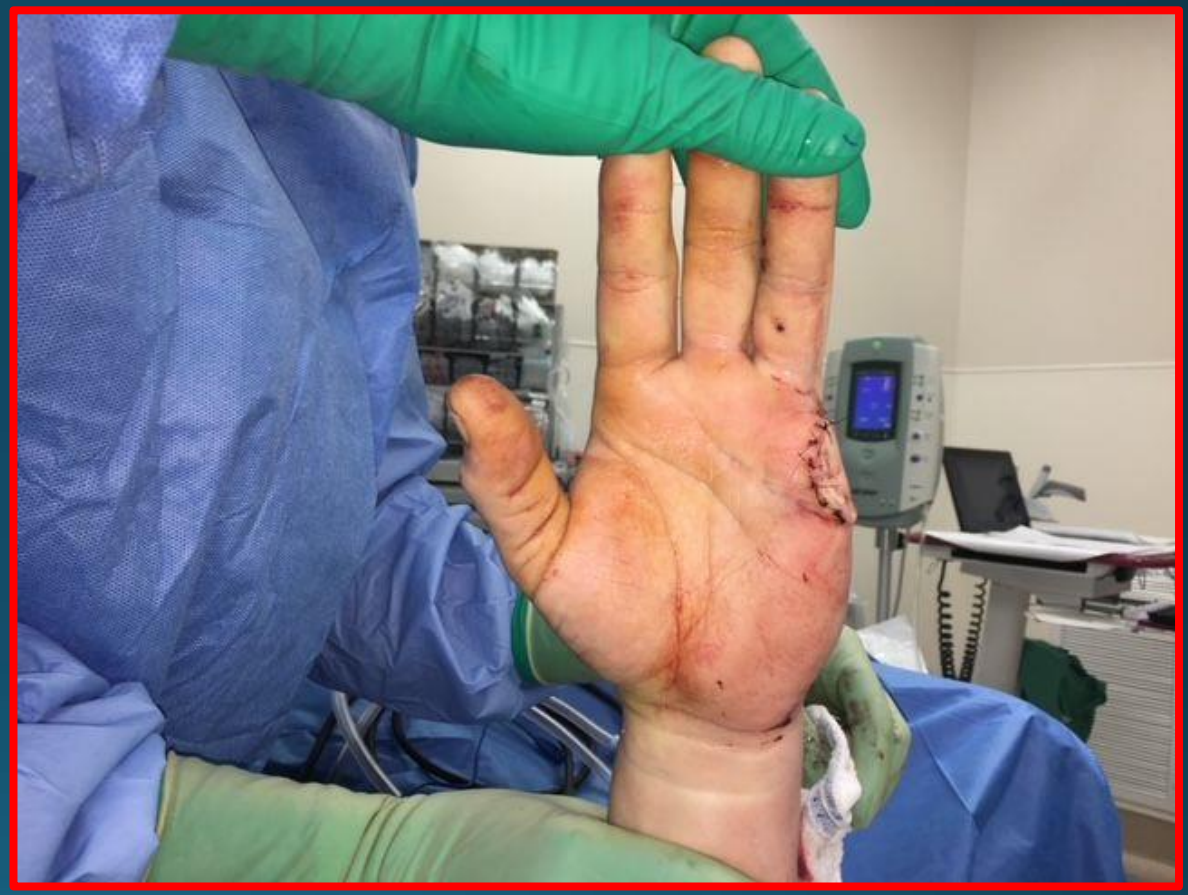


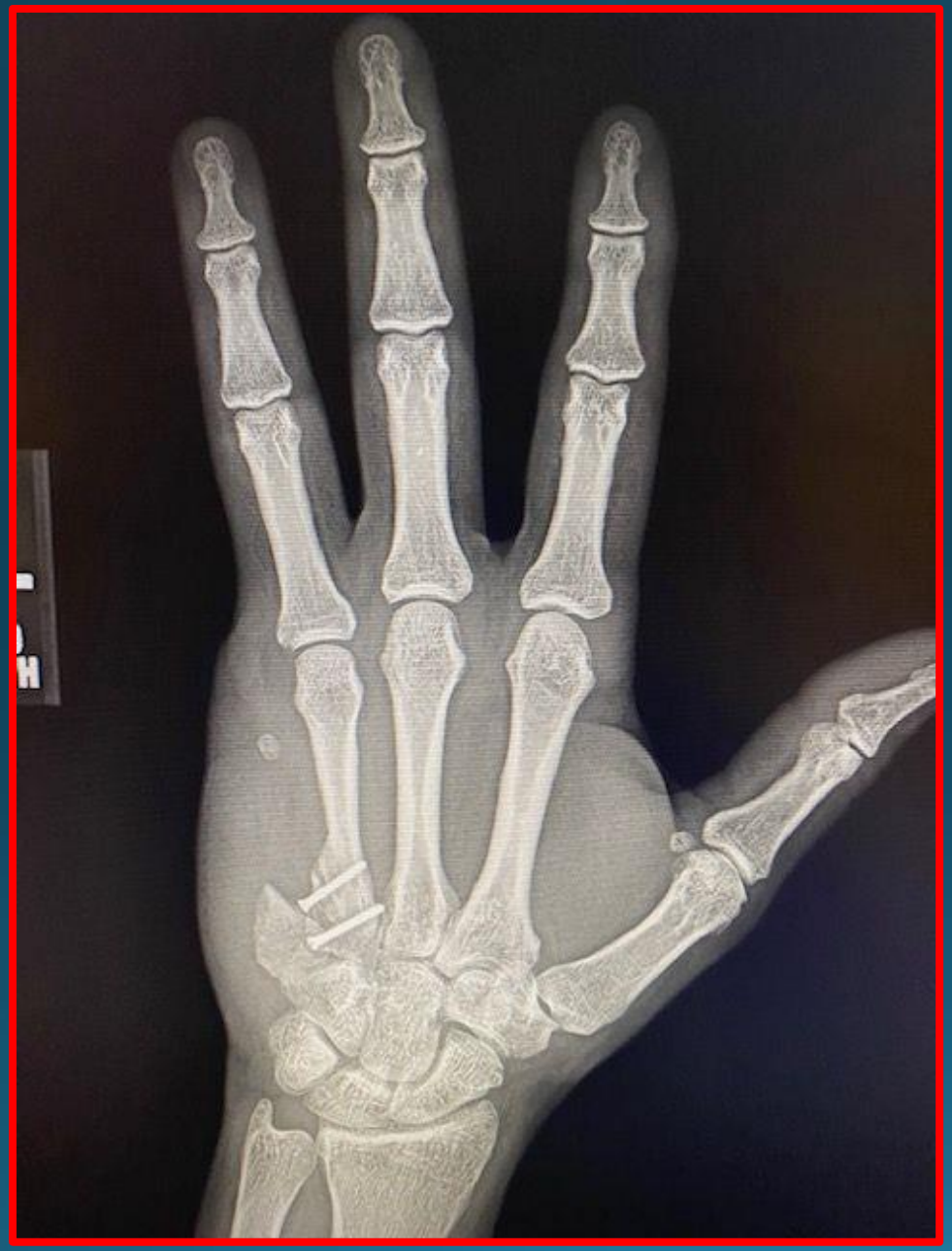
- 45 YO Male
- Nondominant Extremity
- Miter Saw Injury
- Works in construction industry



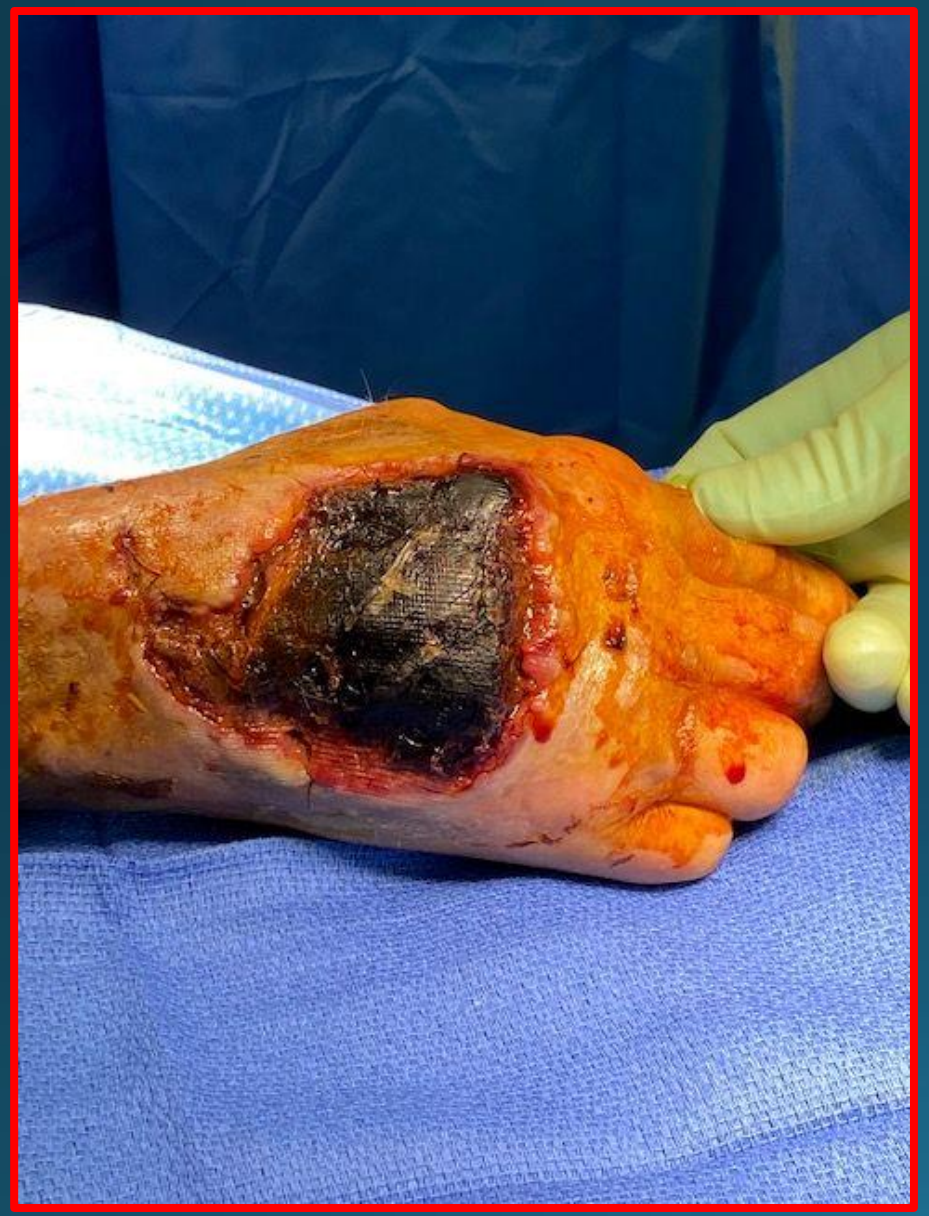


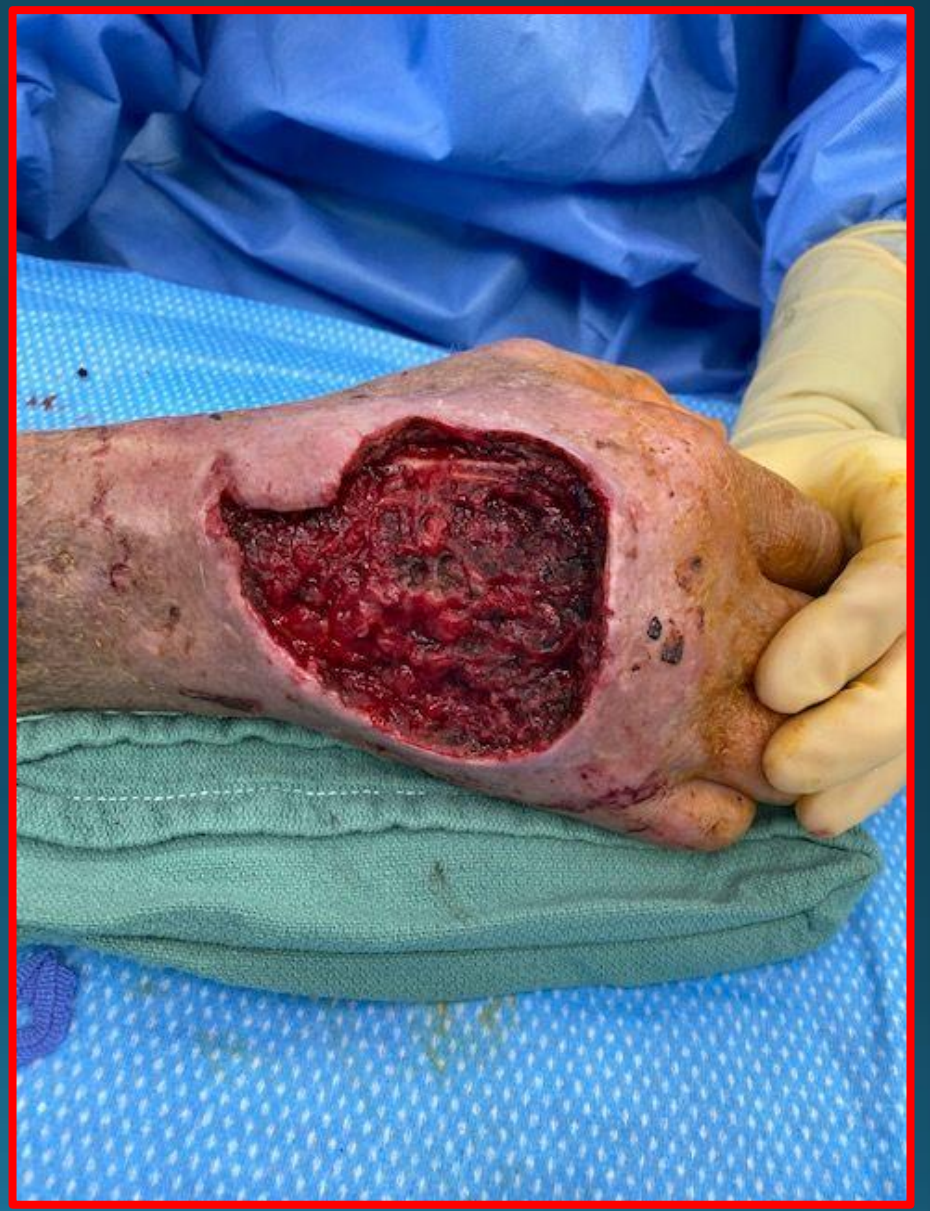


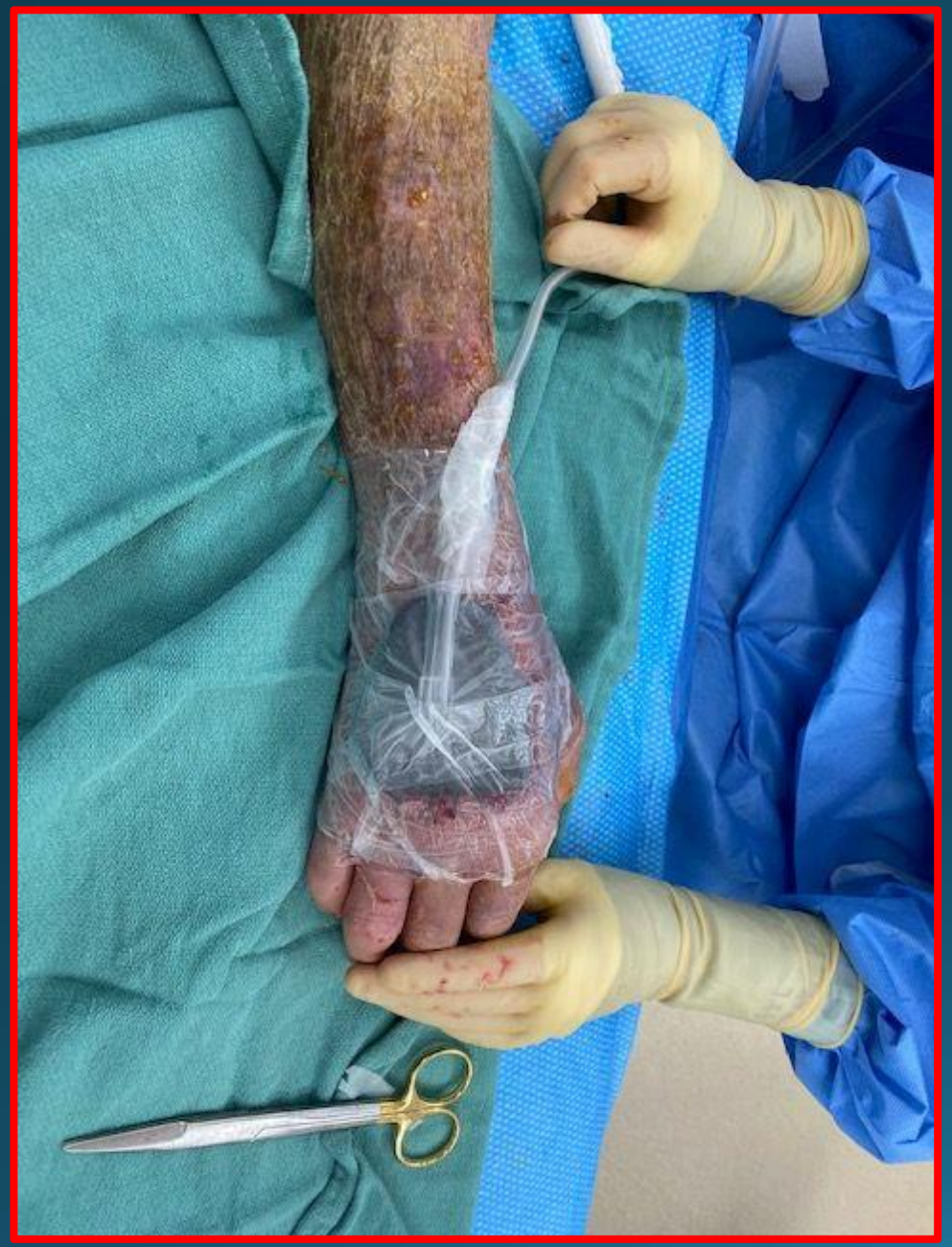


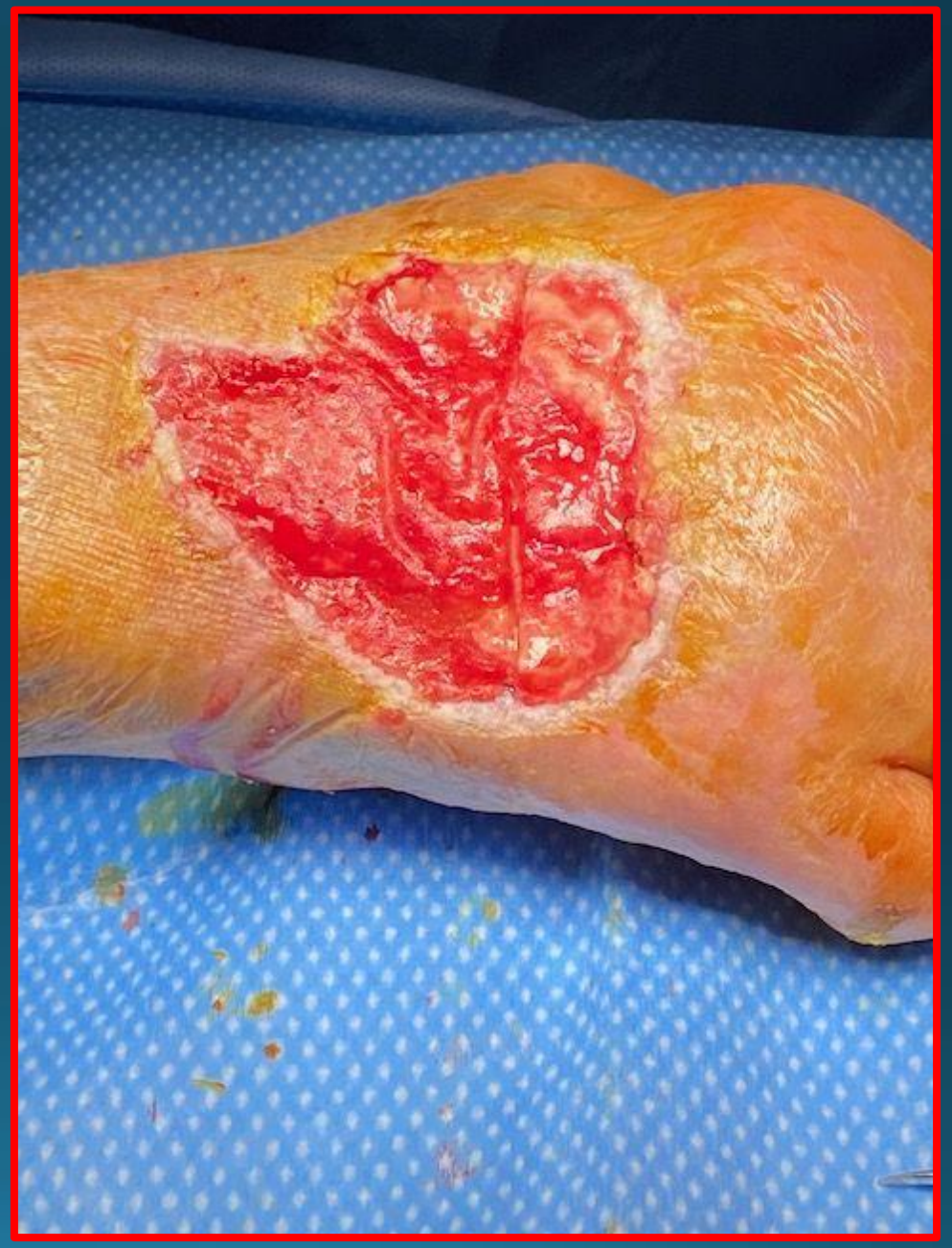


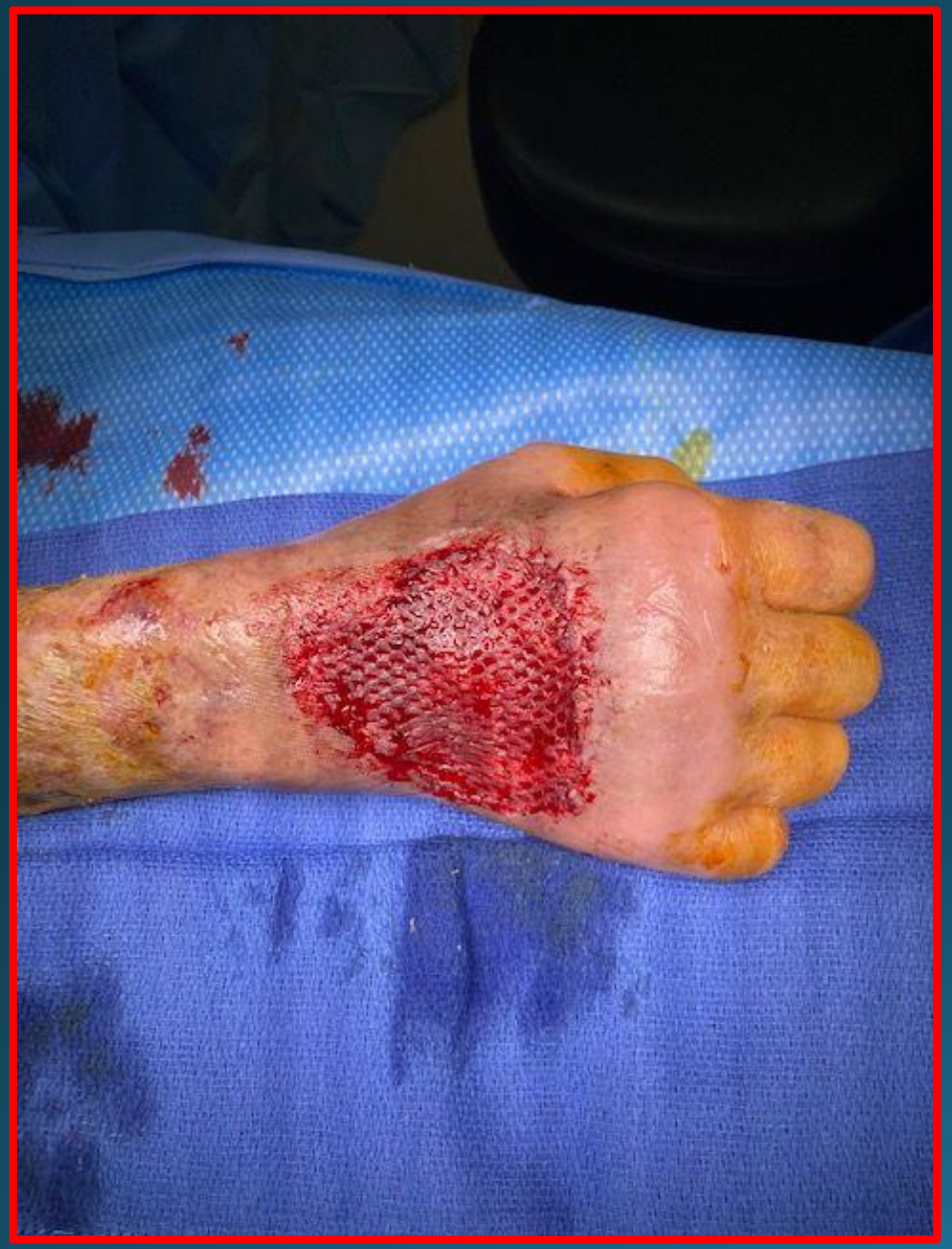
- 82 YO Male with mild dementia
- Dominant Extremity
- Chronic anticoagulation treatment due to valve replacement
- Referred to clinic by PCP with 4 week h/o dorsal hand swelling, pain, ‘infection’
- Reports symptoms began after trimming bushes
- Treated with several rounds of oral antibiotics
- Exam c/w dorsal hand extensor tenosynovitis with transient response to oral steroids
- Developed open wound with persistent drainage 2 weeks later
- Daughter is wound care nurse, son-in-law is neurosurgeon



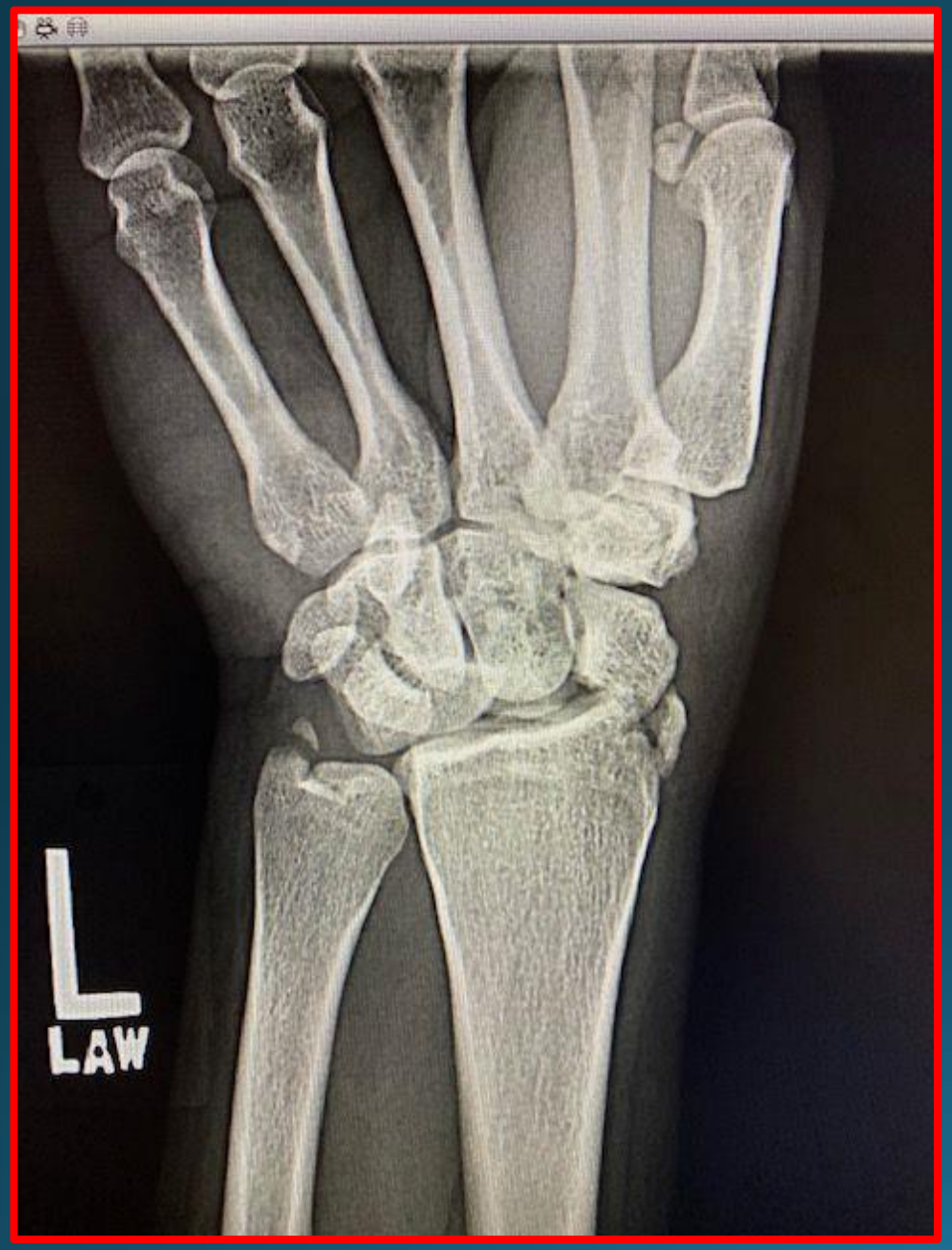








- 39 YO Male
- Nondominant extremity
- 20 ft drop while riding ATV at work
- No 2 pt in median nerve distribution in ER
- Works in landscaping industry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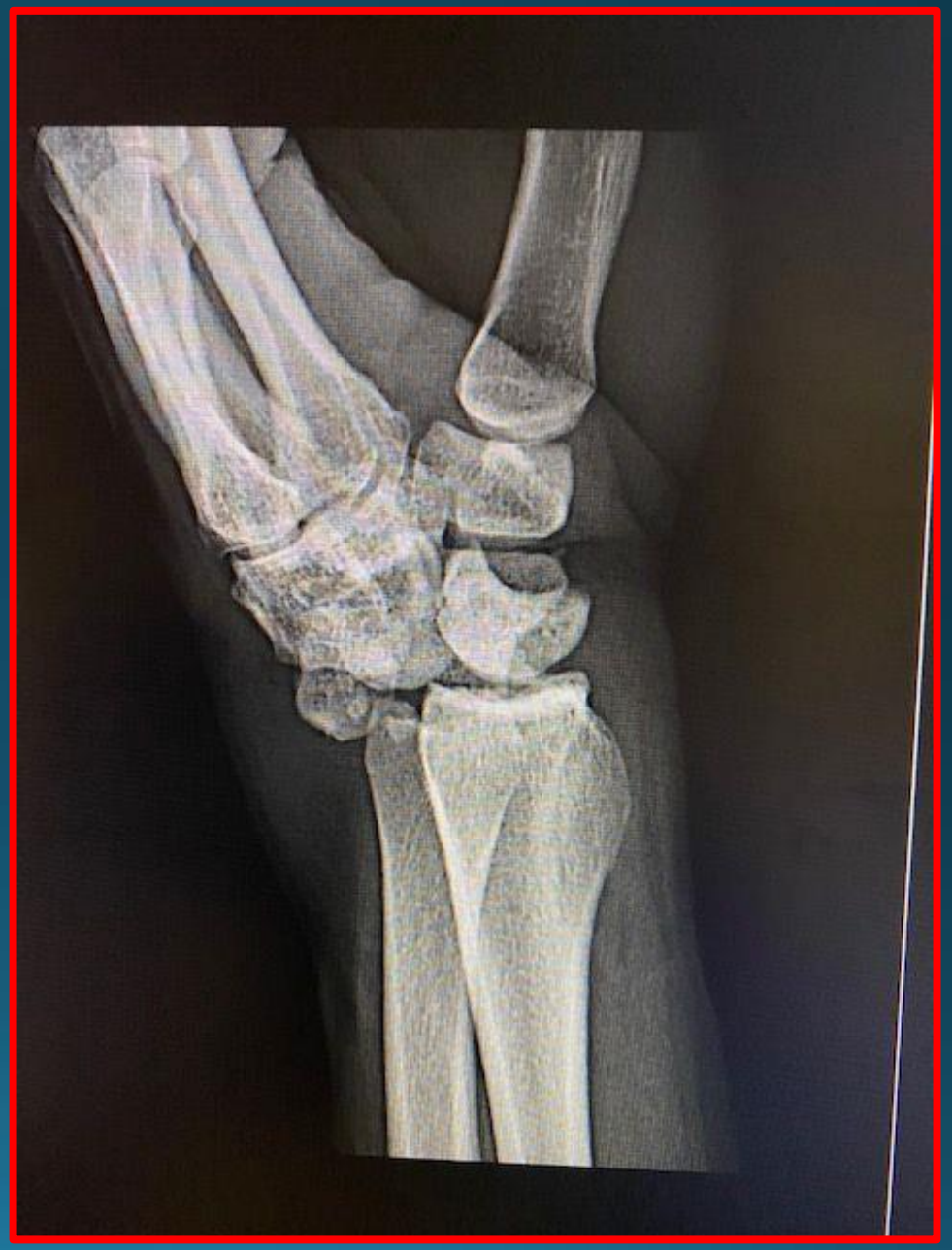

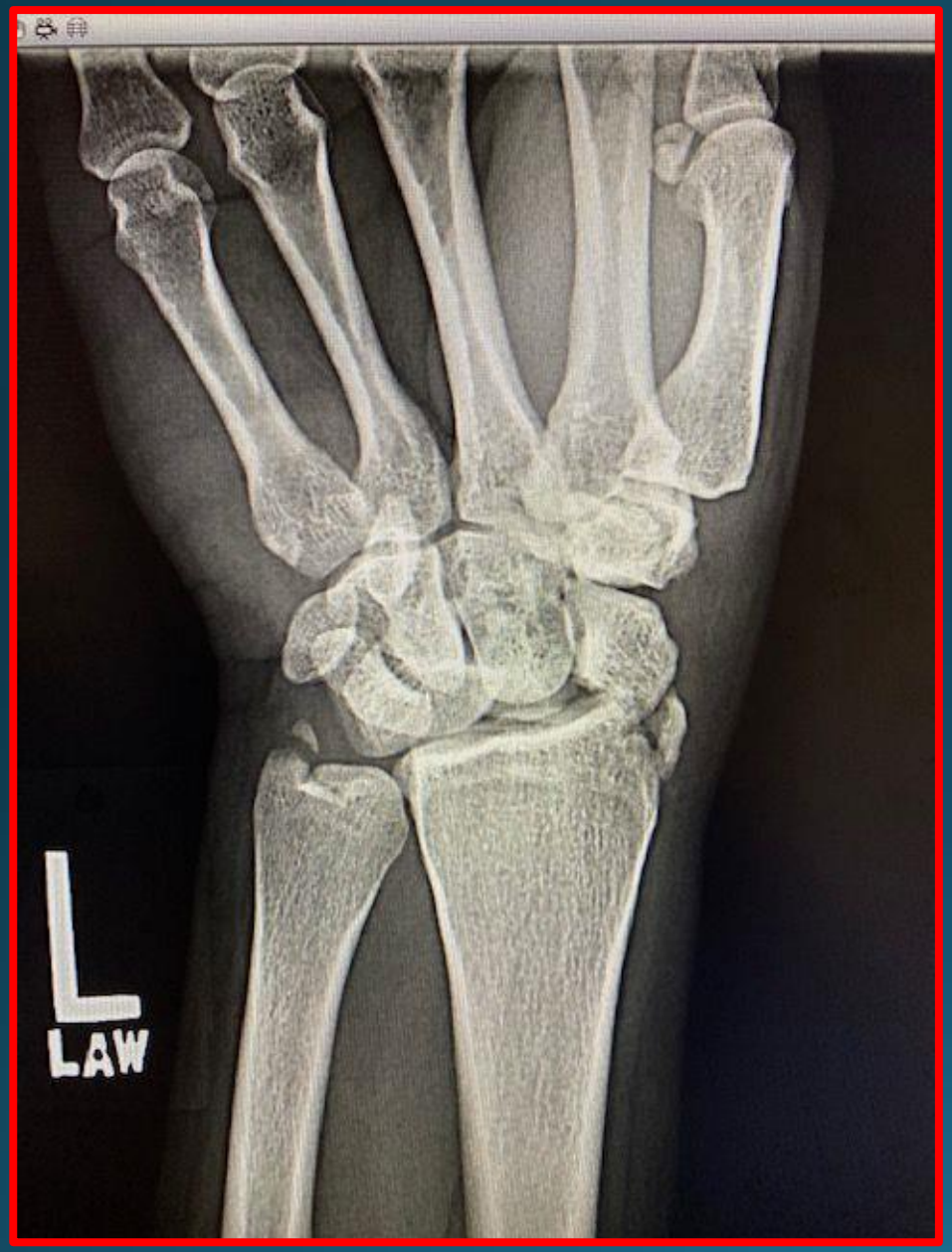
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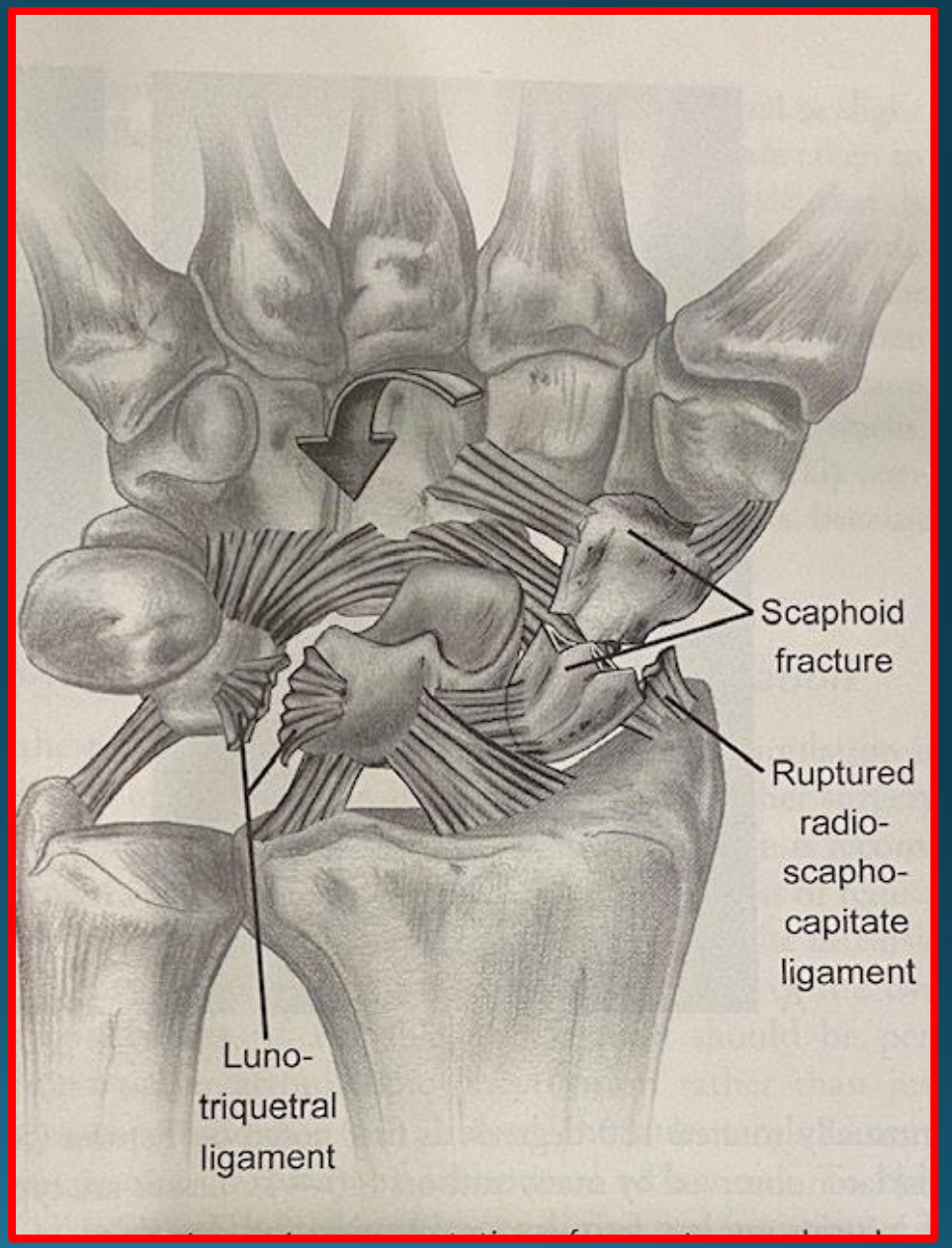
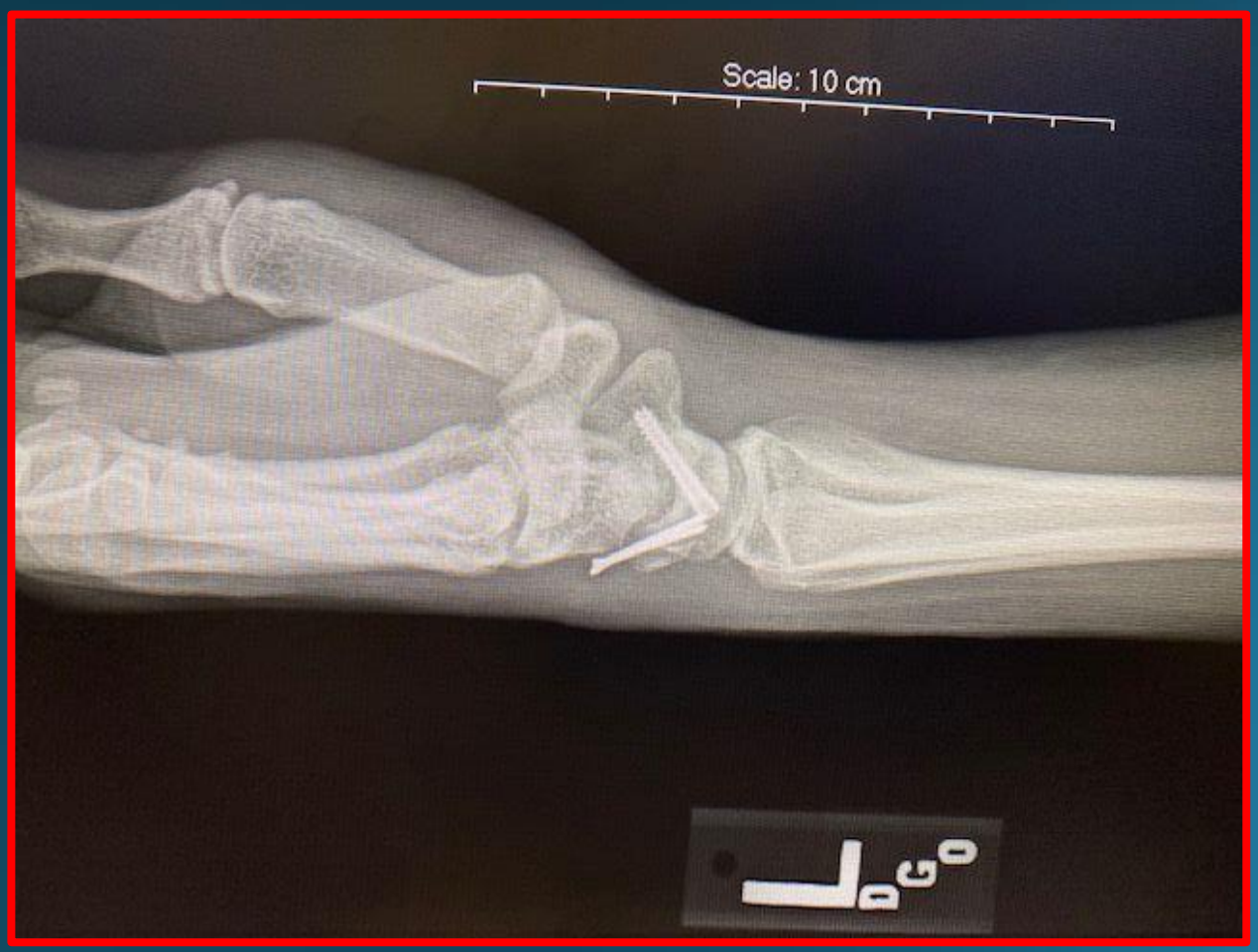

Scaphoid fracture
Ruptured radio-scapho-capitate ligament
Luno-triquetral ligament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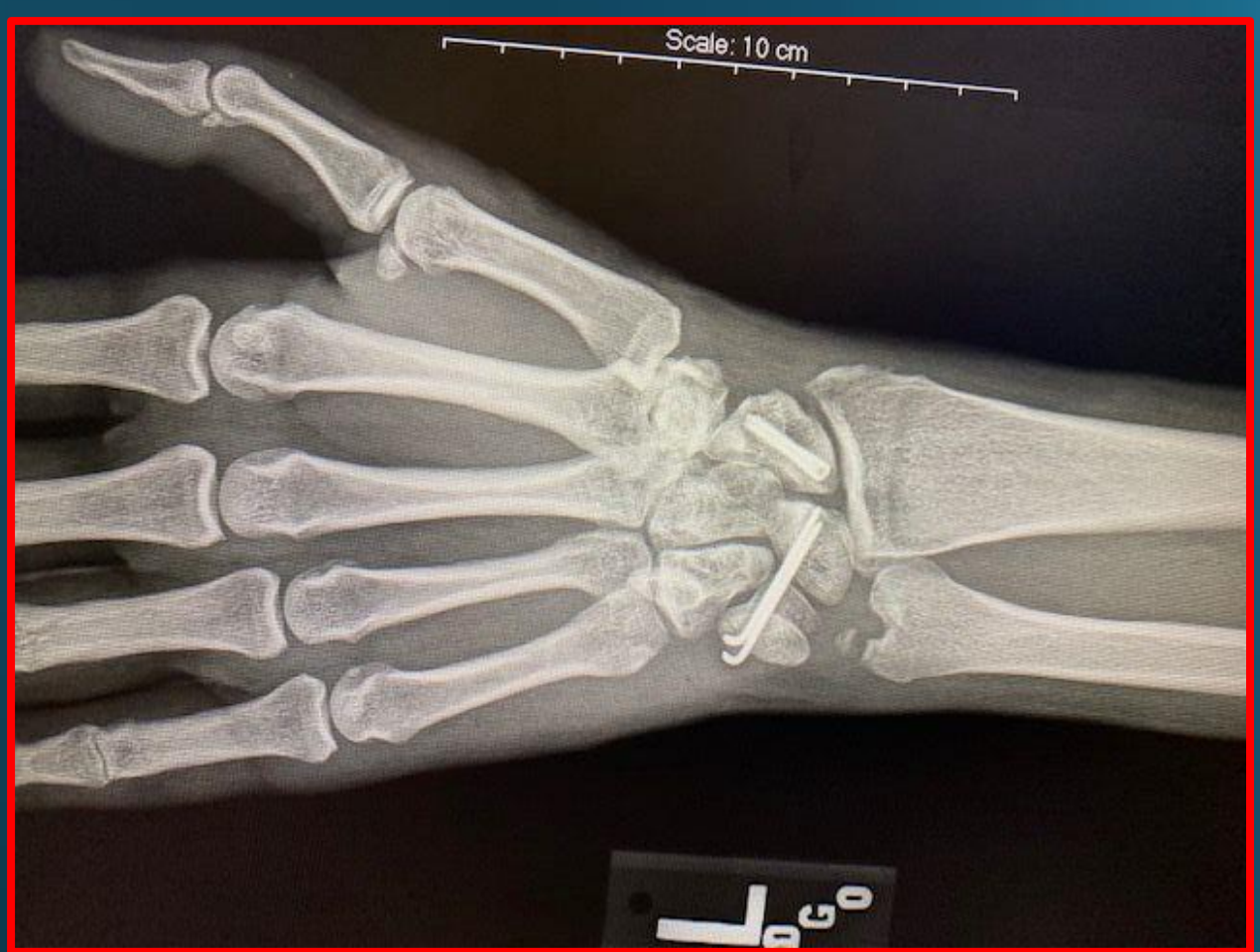
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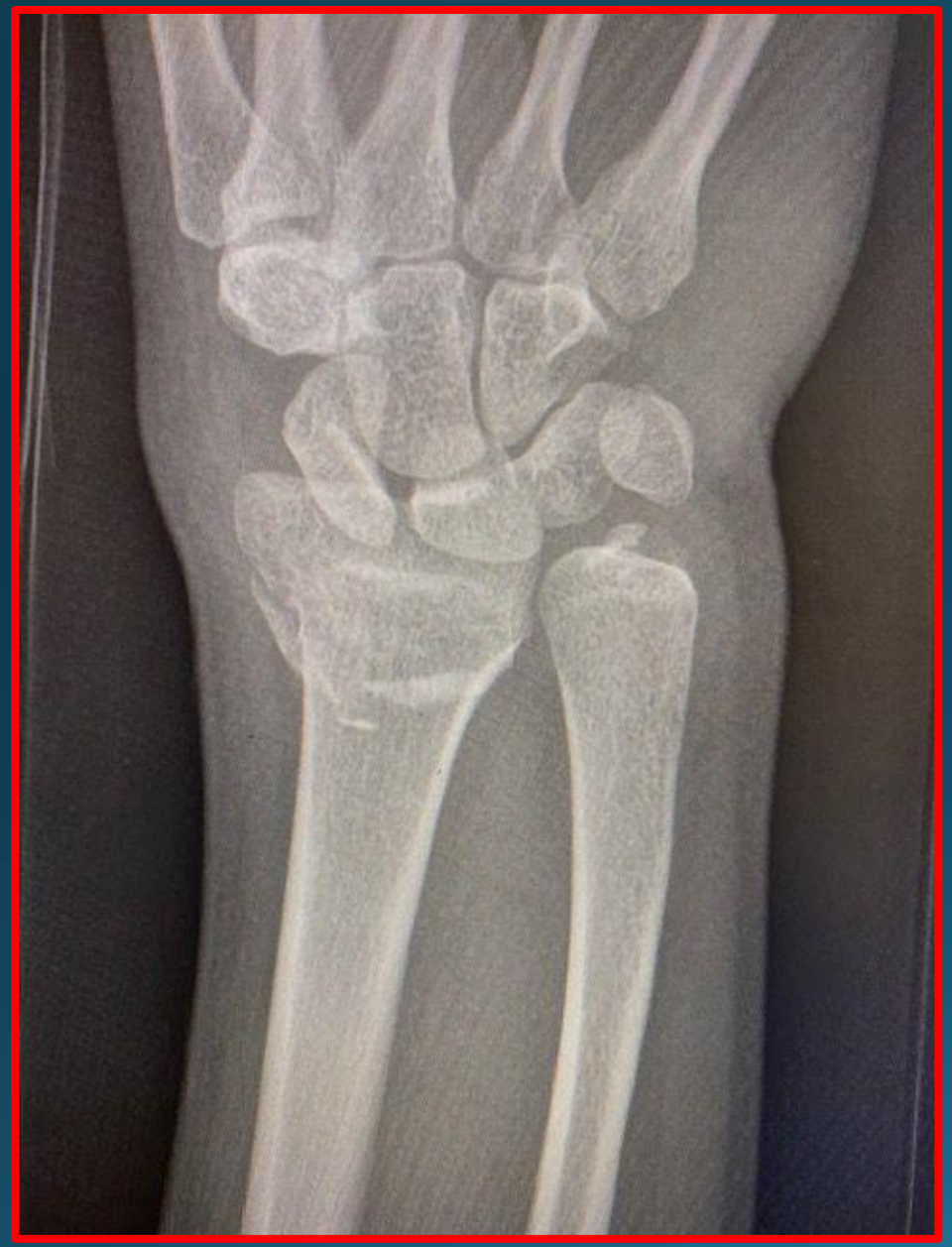
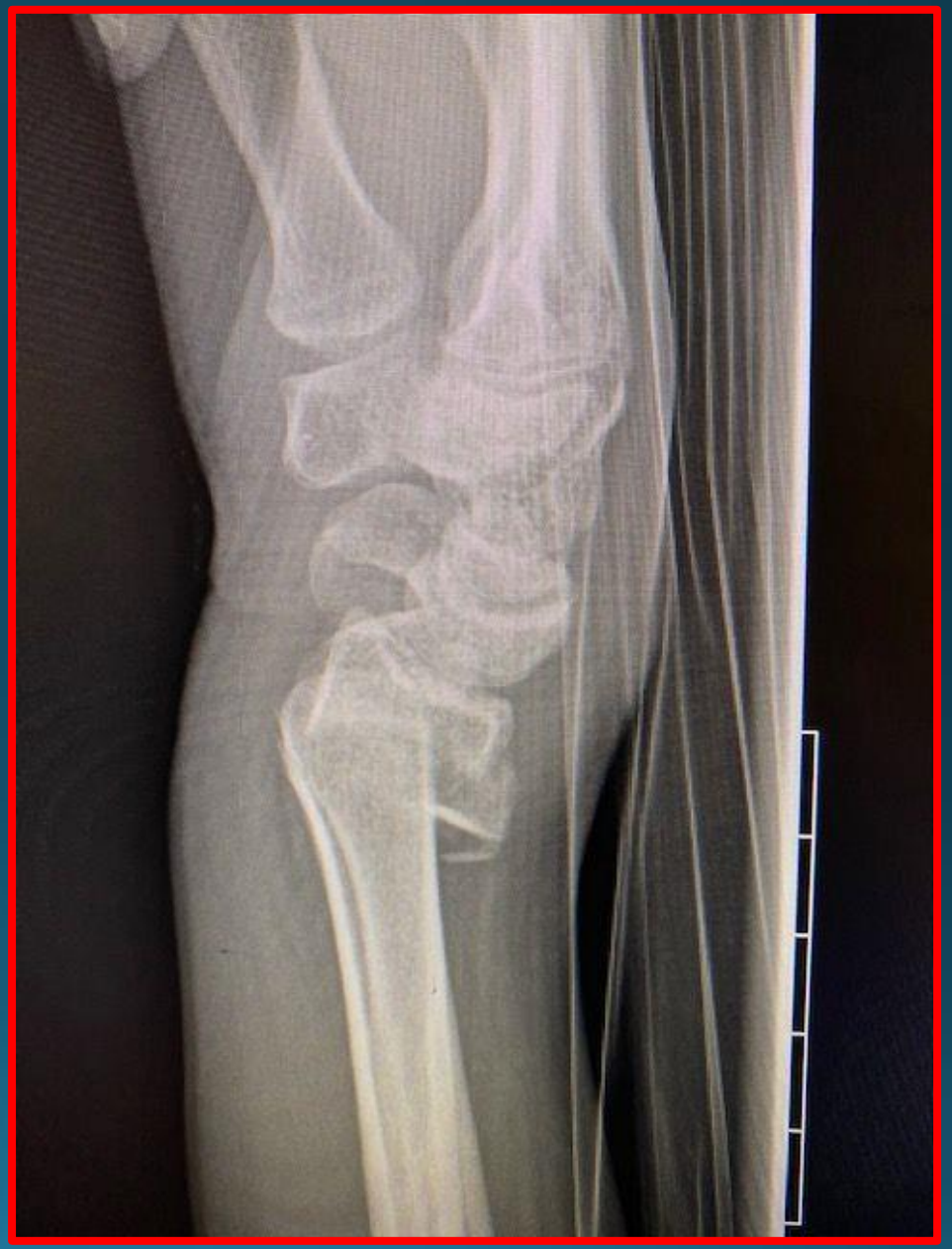
- 25 YO Female
- Dominant Extremity
- Bicycle accident
- ICU Nurse





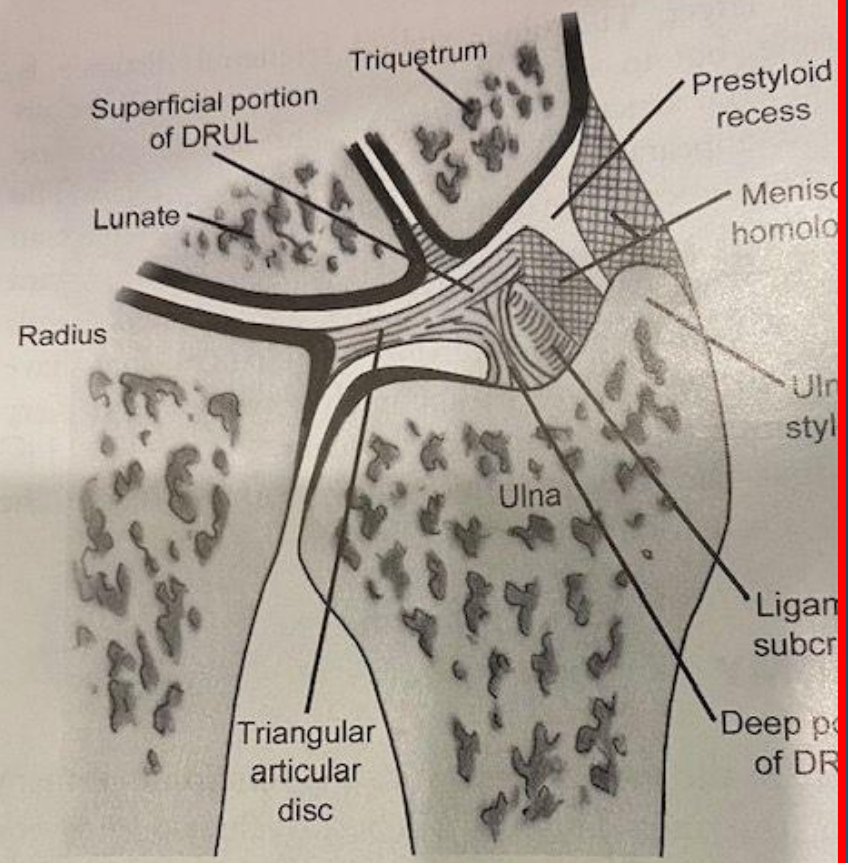
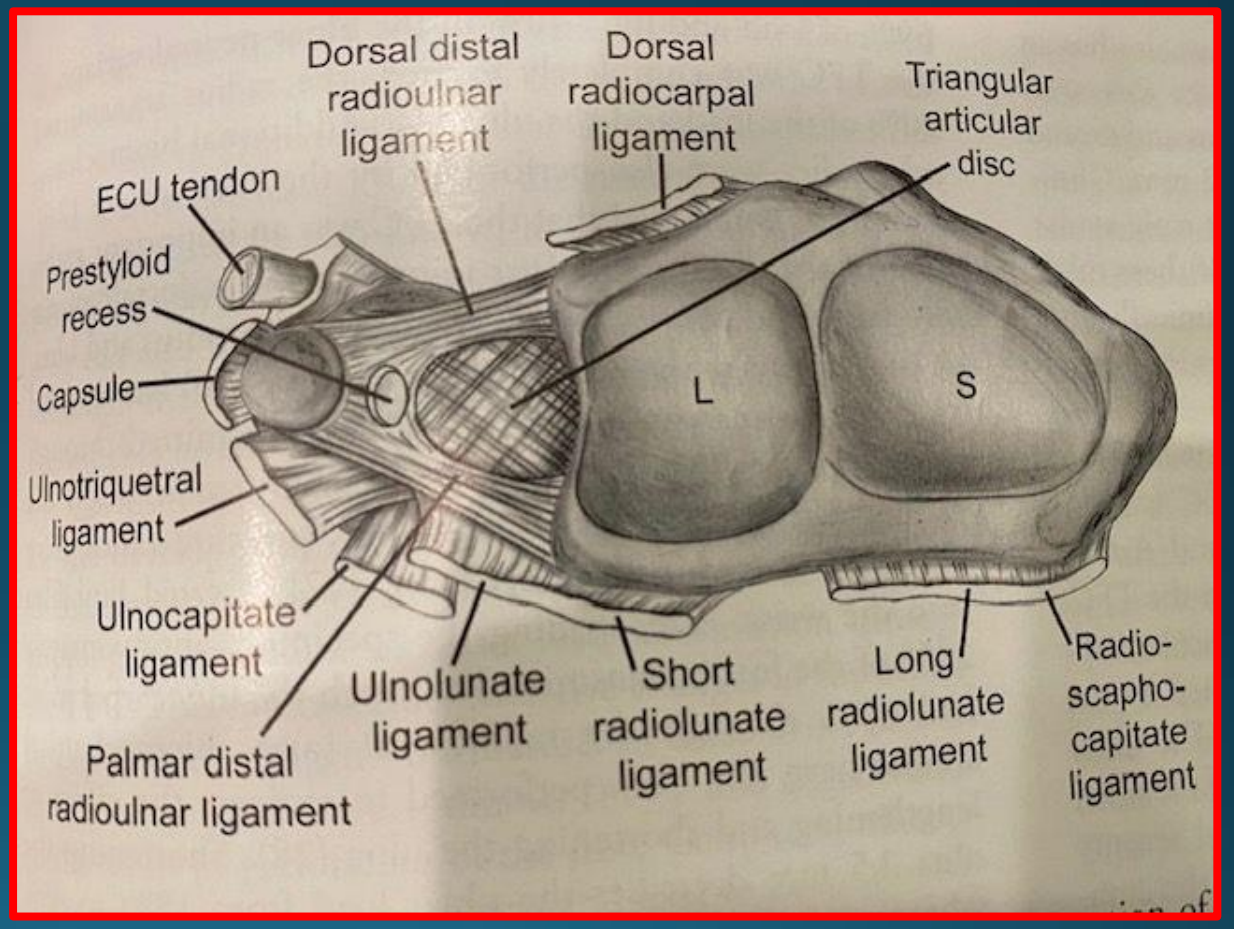
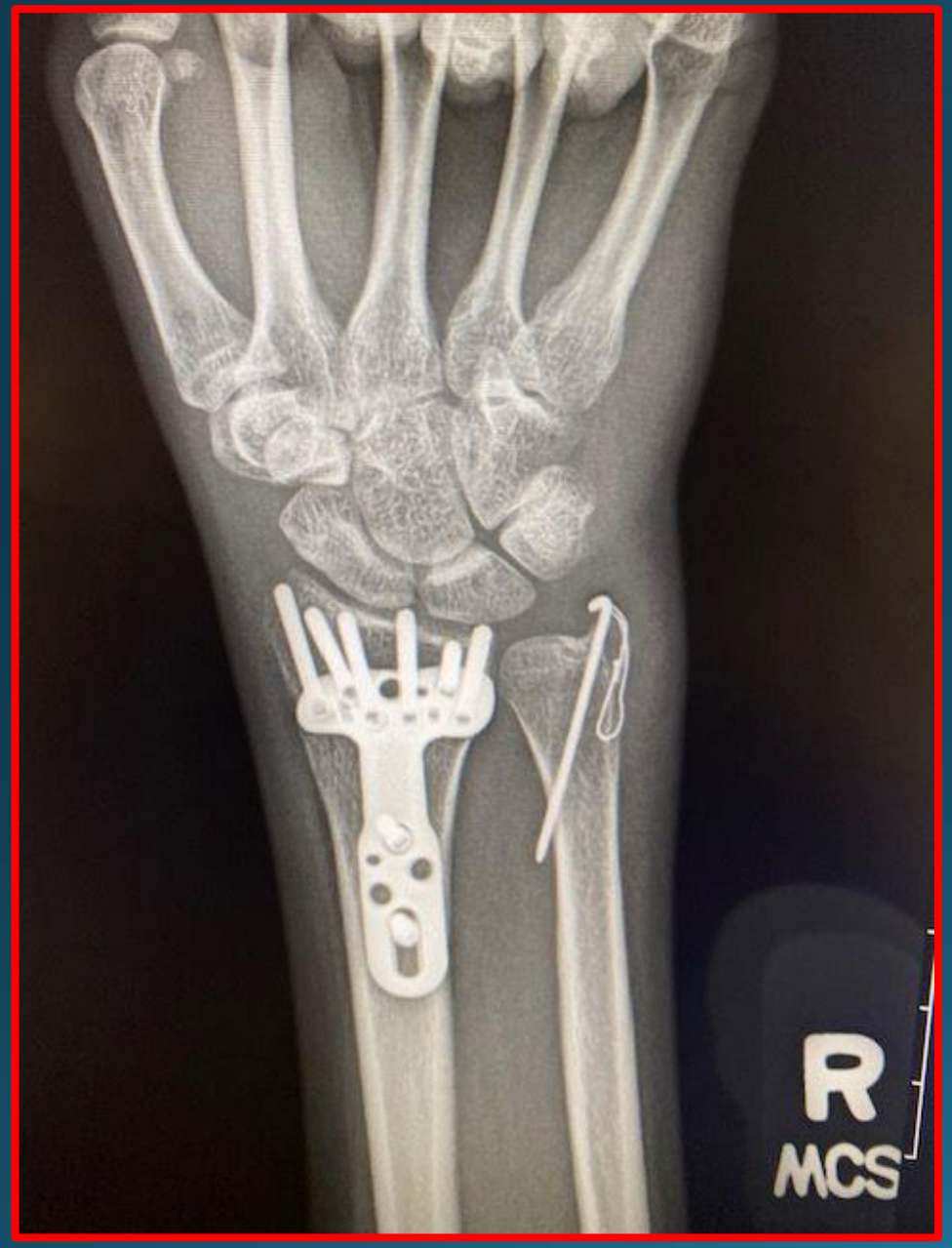


FIGURE 4. Cross section of the triangular fibrocartila
plex. The prestyloid recess communicates with the ul
space by way of a long, narrow tunnel. DRUL, distal ra
ligament.

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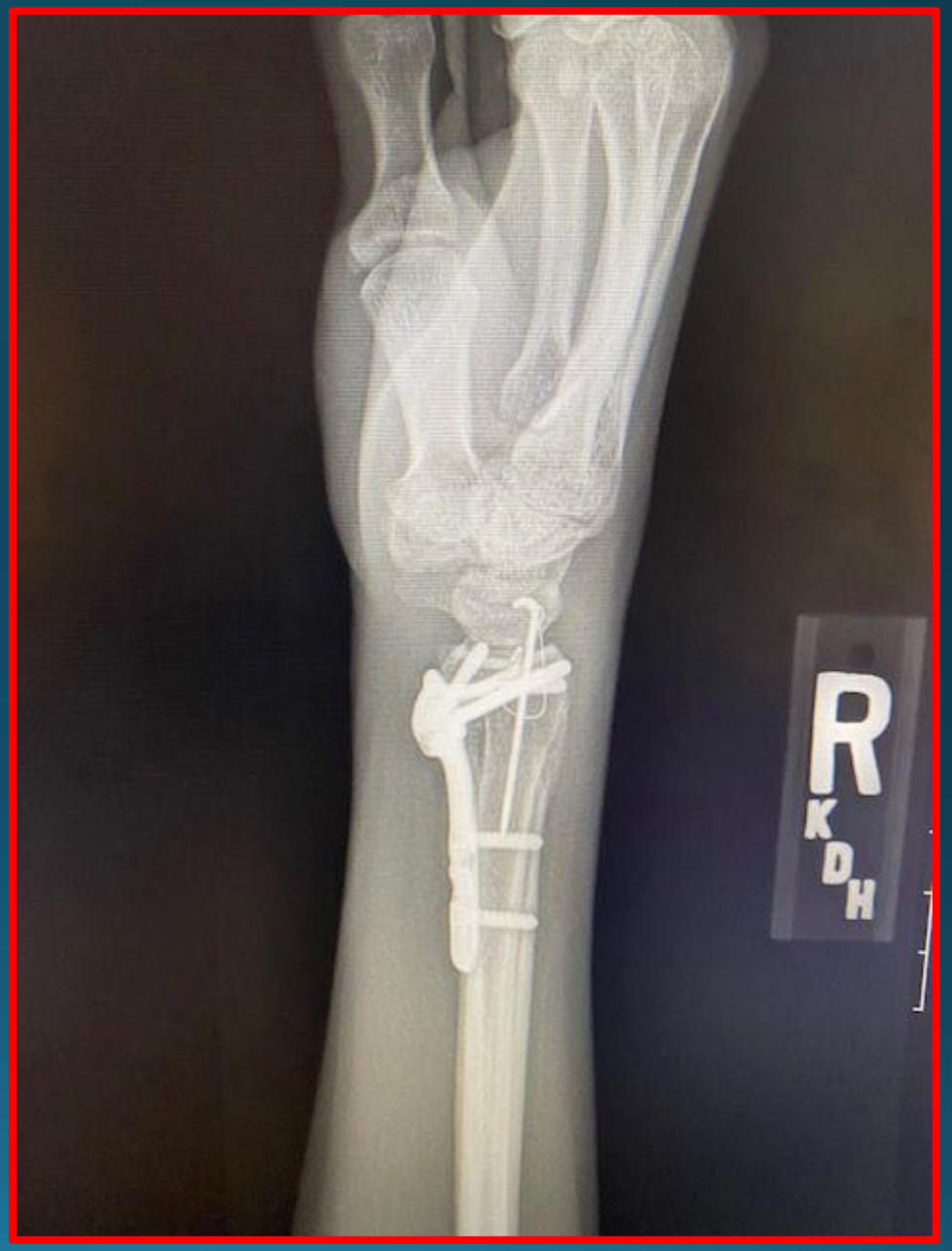
MCS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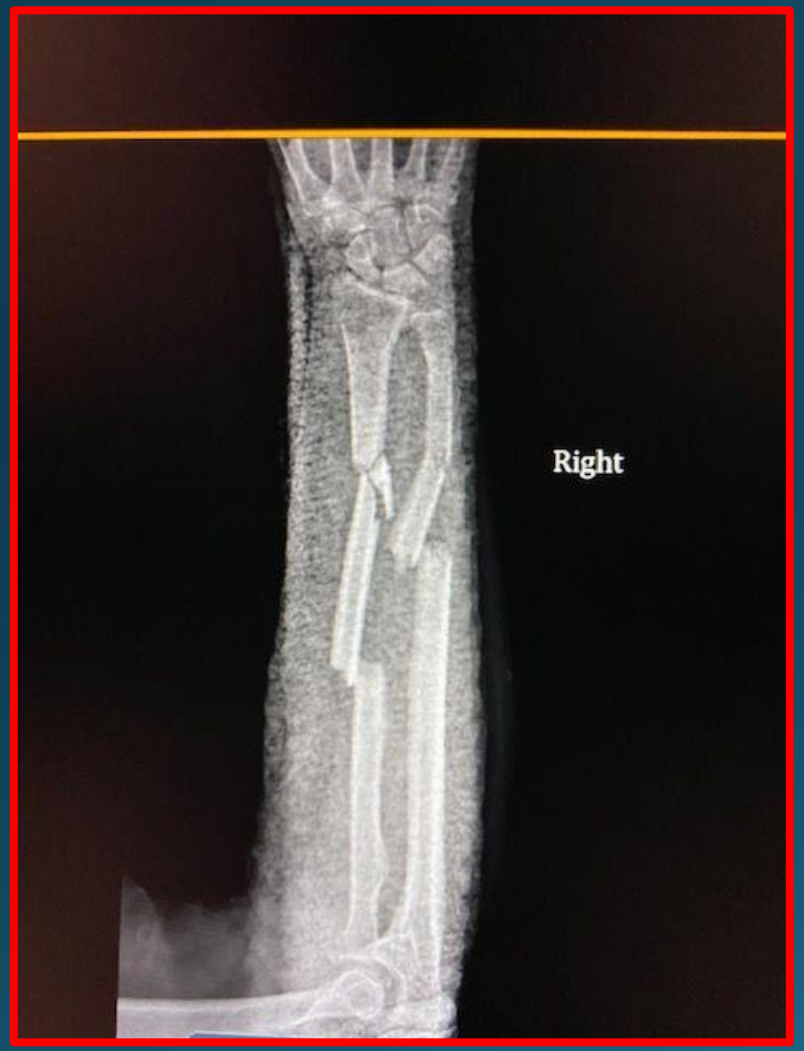
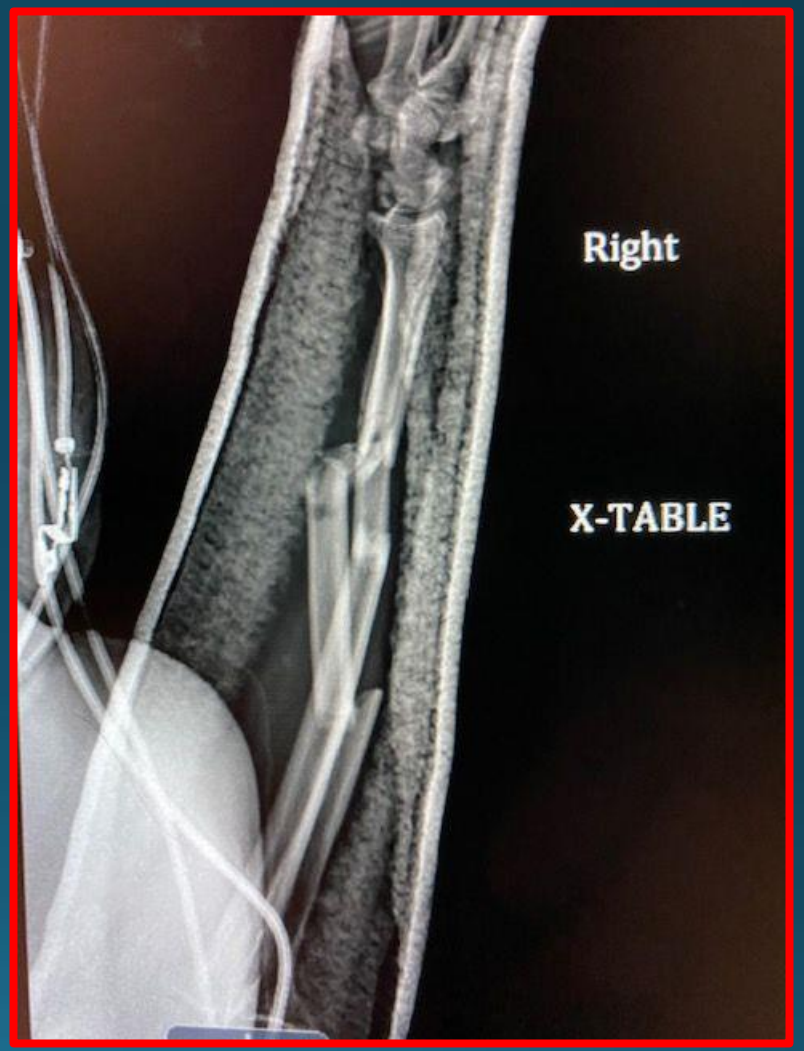
KDH

- 78 YO female
- MVA
- Dominant Extremity
- Wife of retired orthopaedic surgeon


Right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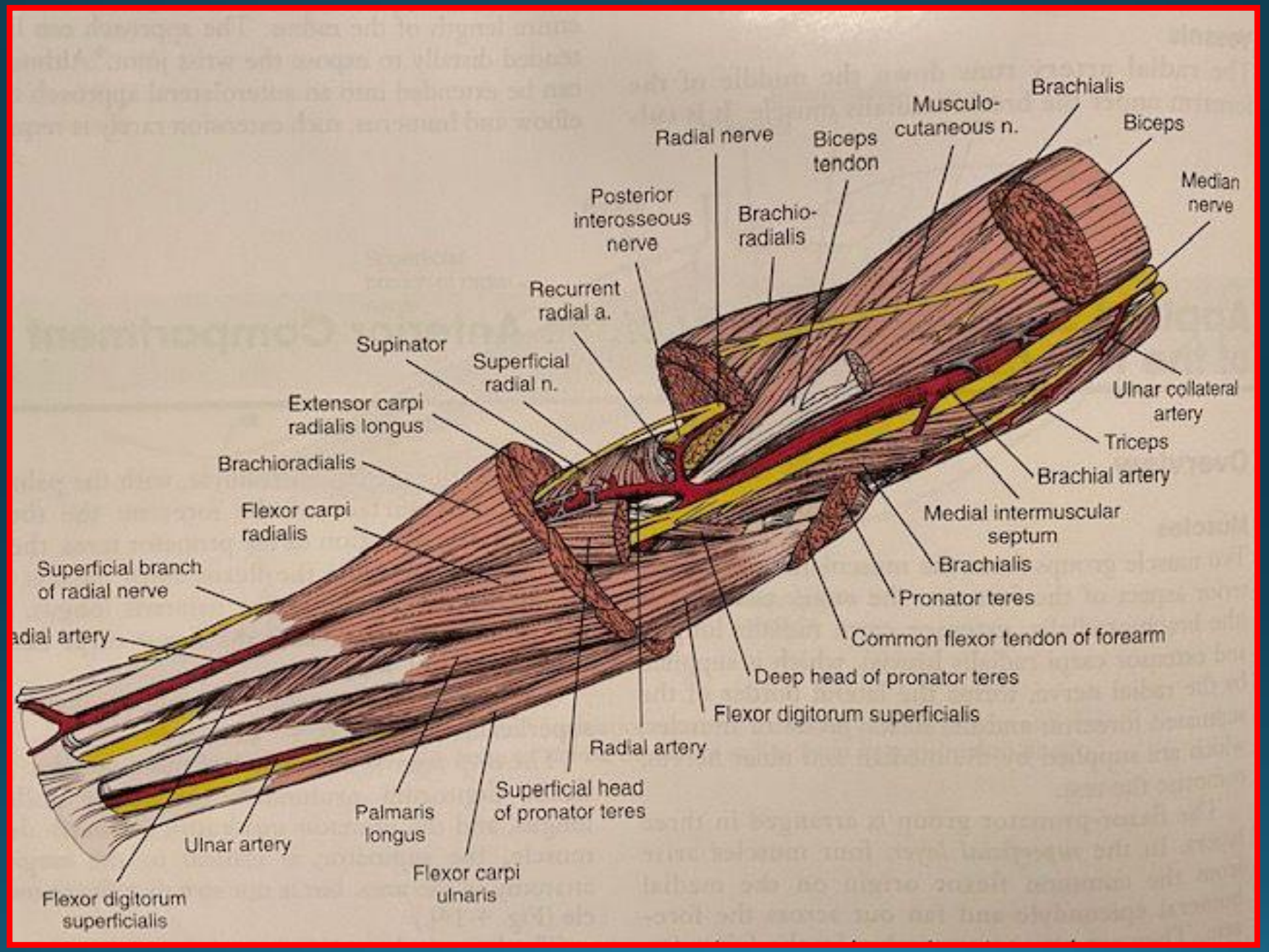
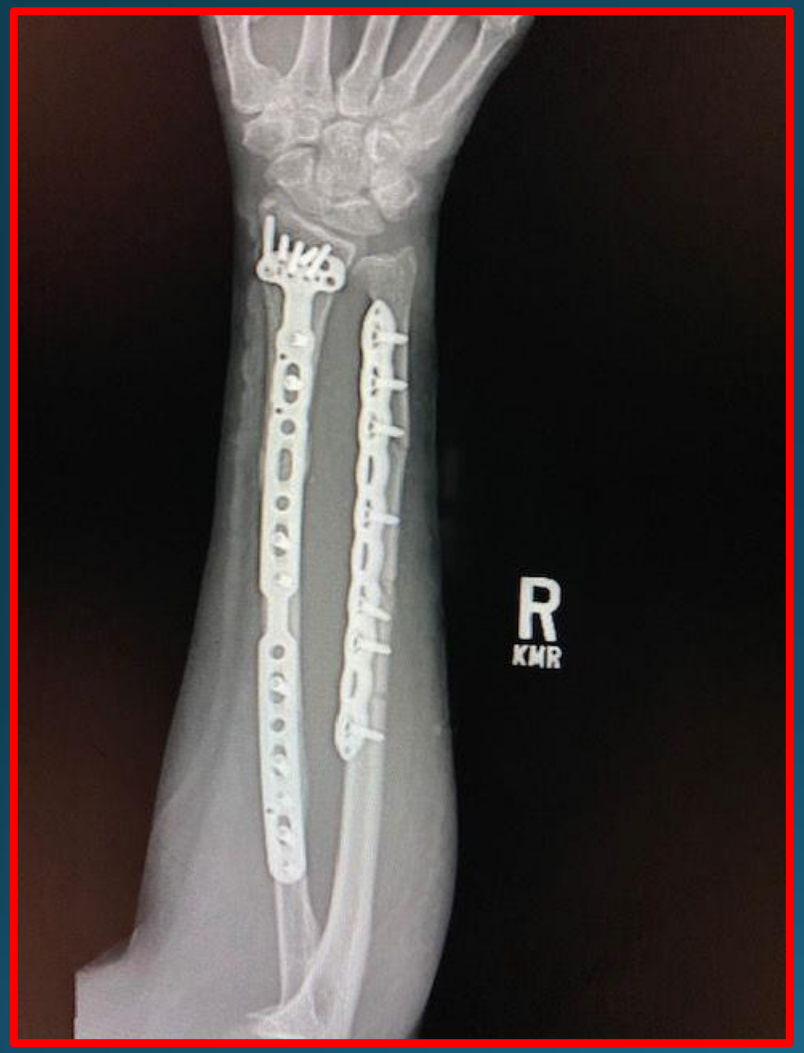
X-TABLE


Brachialis
Musculo-
cutaneous n.
Biceps
Radial nerve
Biceps
tendon
Median
nerve
Posterior
interosseous
nerve
Brachio-
radialis
Recurrent
radial a.
Supinator
Superficial
radial n.
Ulnar collateral
artery
Extensor carpi
radialis longus
Triceps
Brachioradialis
Brachial artery
Flexor carpi
radialis
Medial intermuscular
septum
Superficial branch
of radial nerve
Brachialis
Pronator teres
adial artery
Common flexor tendon of forearm
Deep head of pronator teres
Flexor digitorum superficialis
Radial artery
Palmaris
longus
Superficial head
of pronator teres
Ulnar artery
Flexor carpi
ulnaris
Flexor digitorum
superficialis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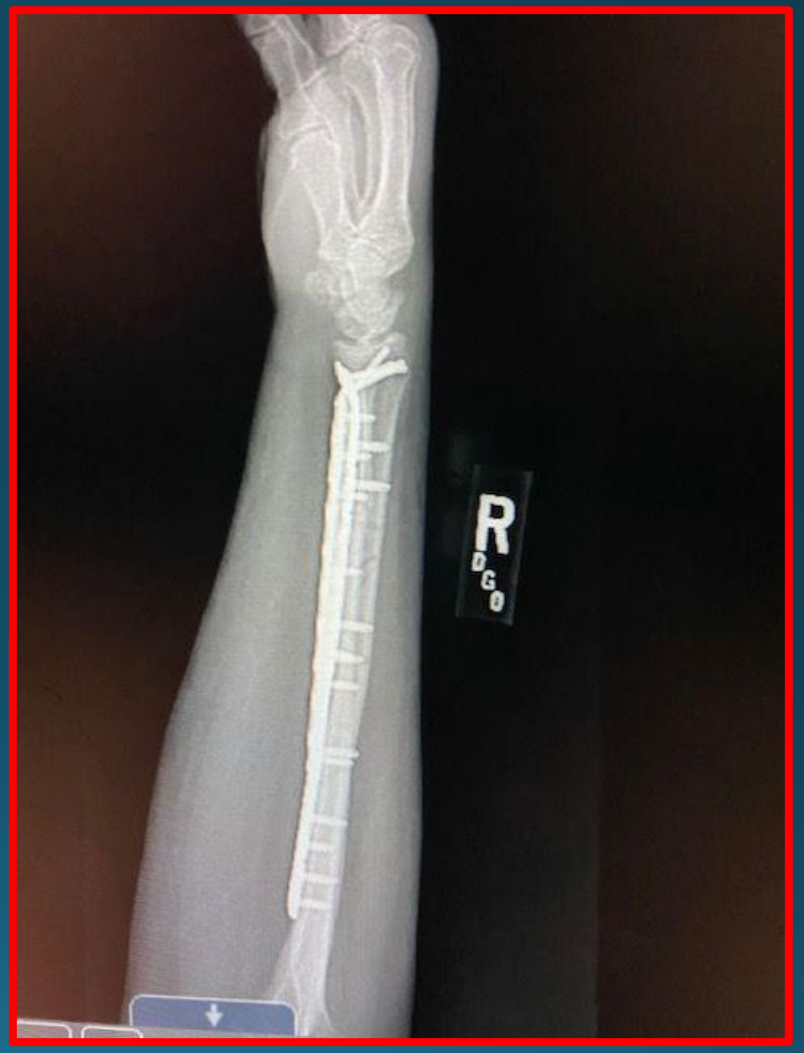
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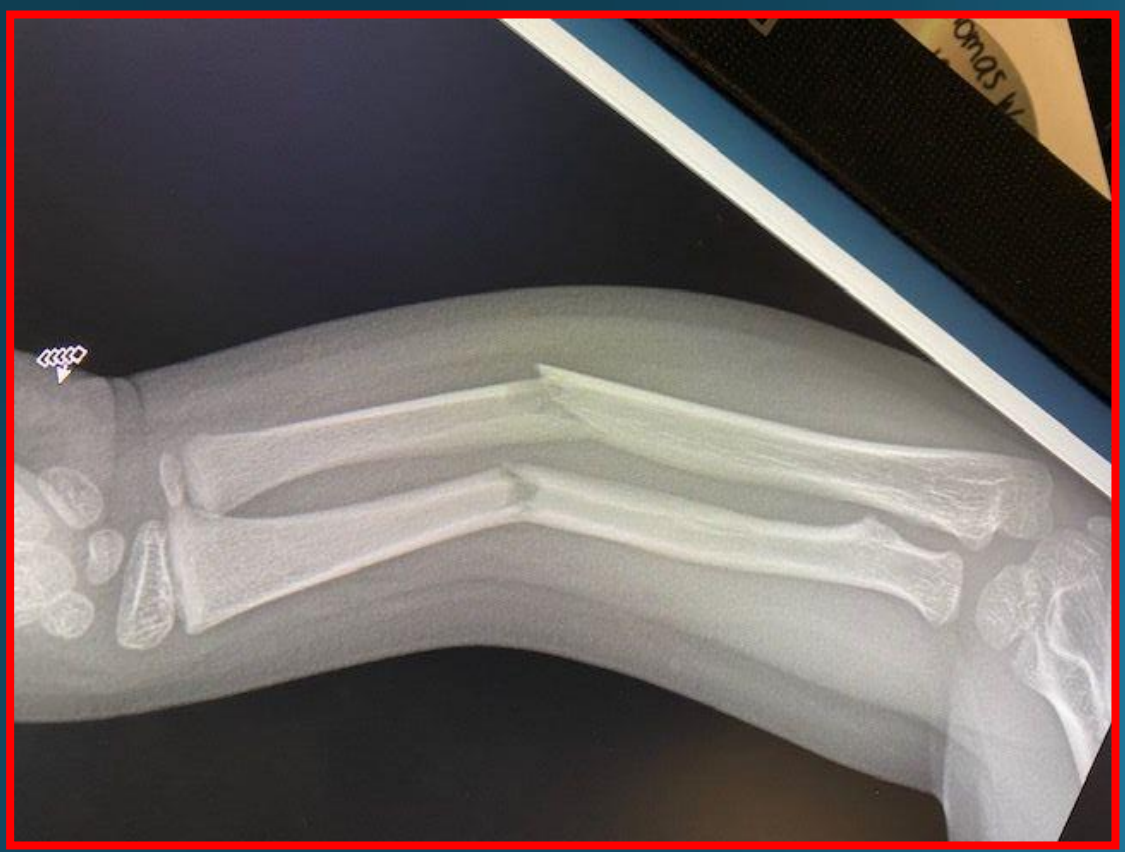
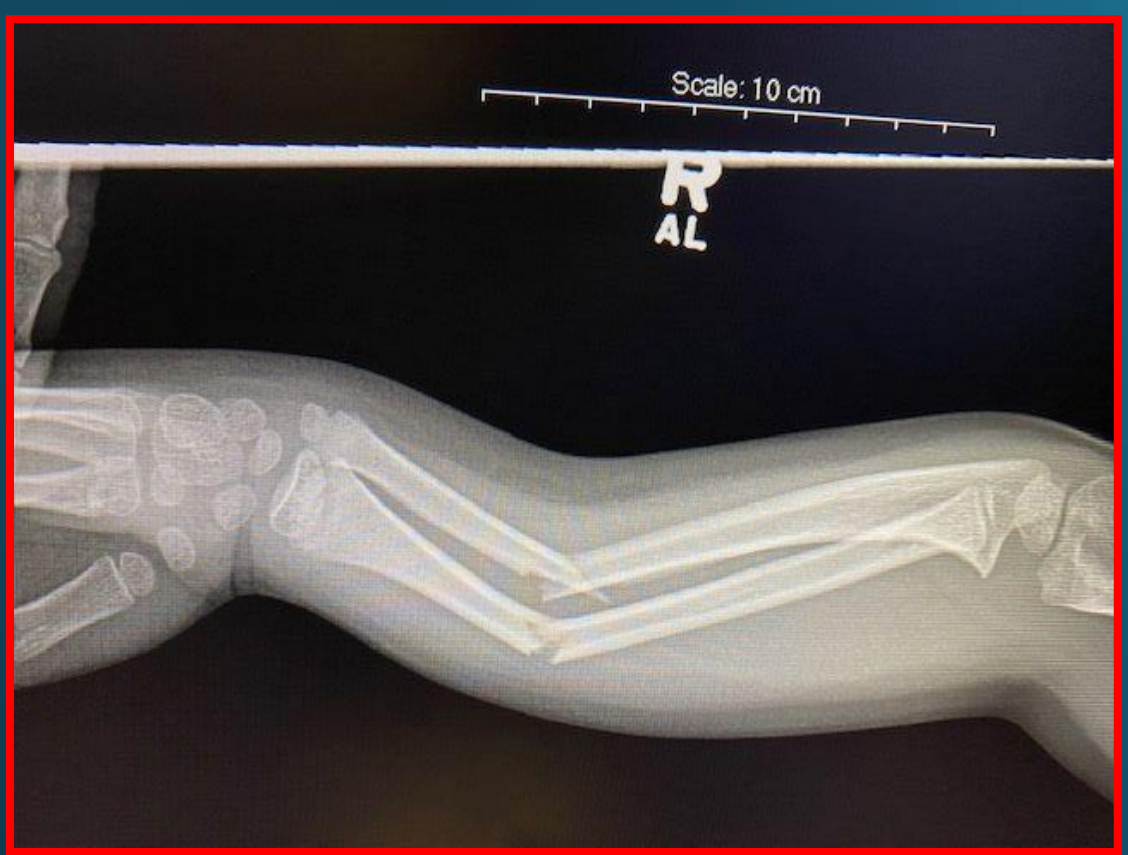
DGO

- 6 YO Female
- Dominant extremity
- Seen in out of state ER and reduced
- Presented in my clinic 2 days later
- No 2 pt in median nerve distribution

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R
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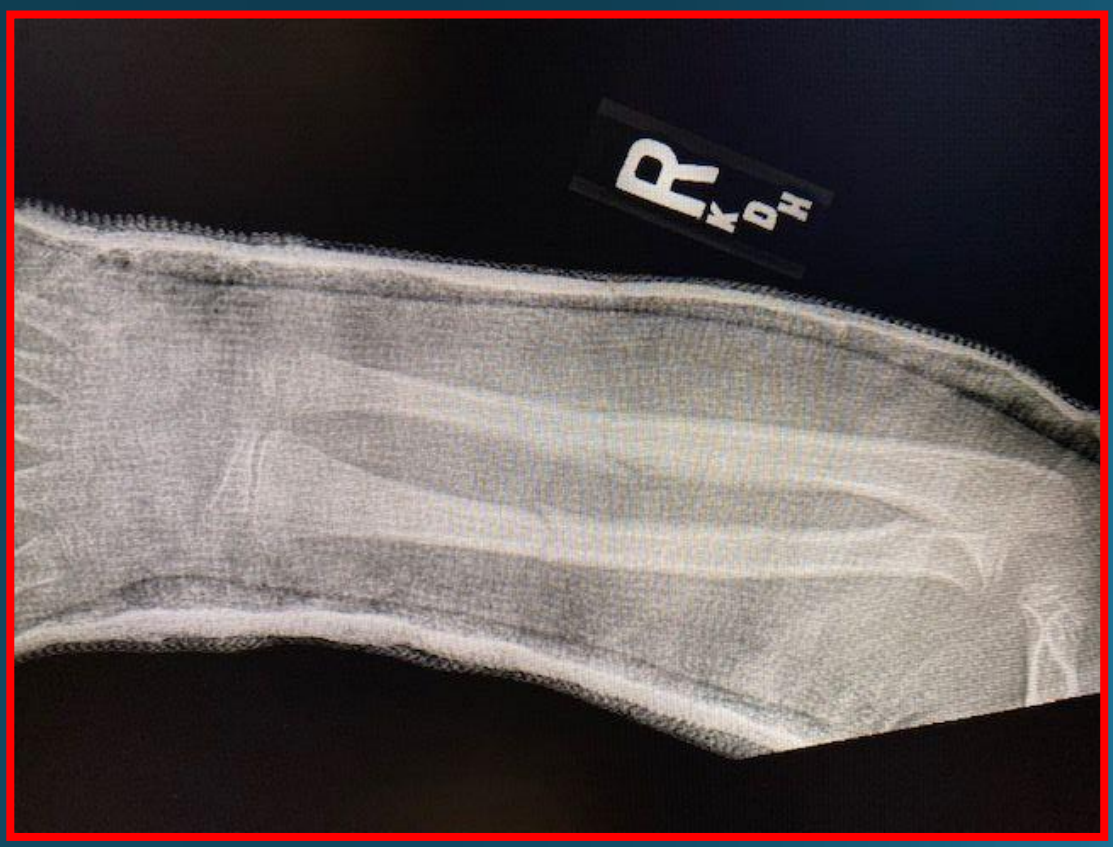
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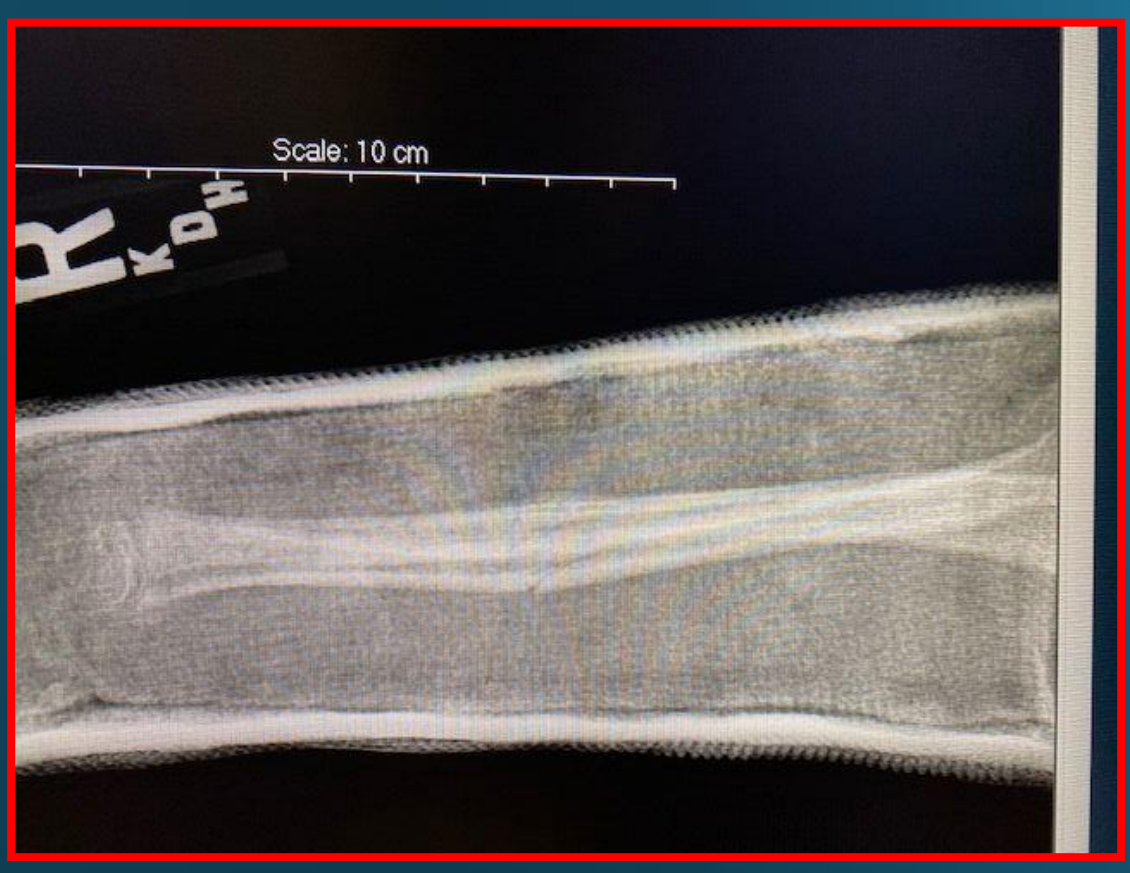
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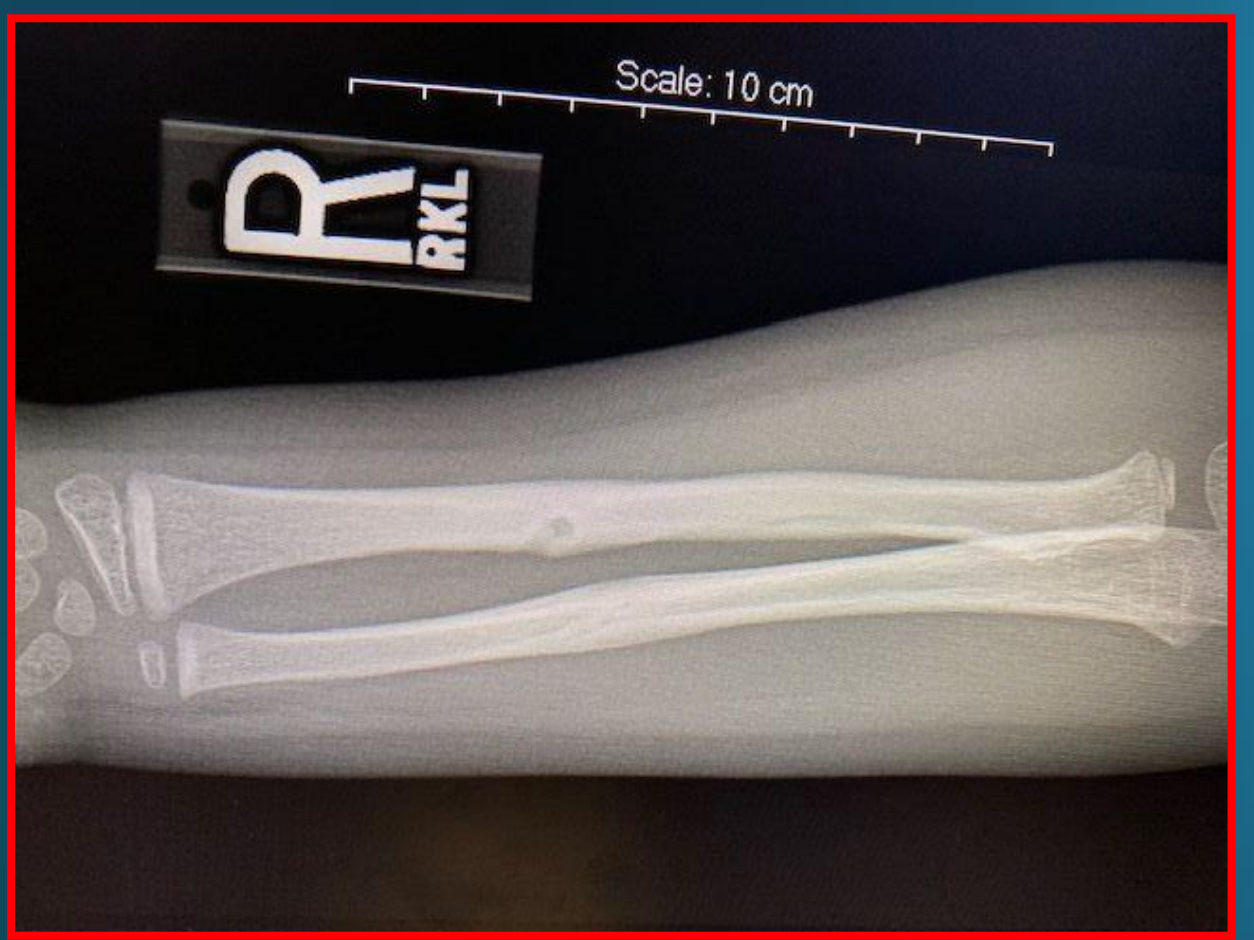
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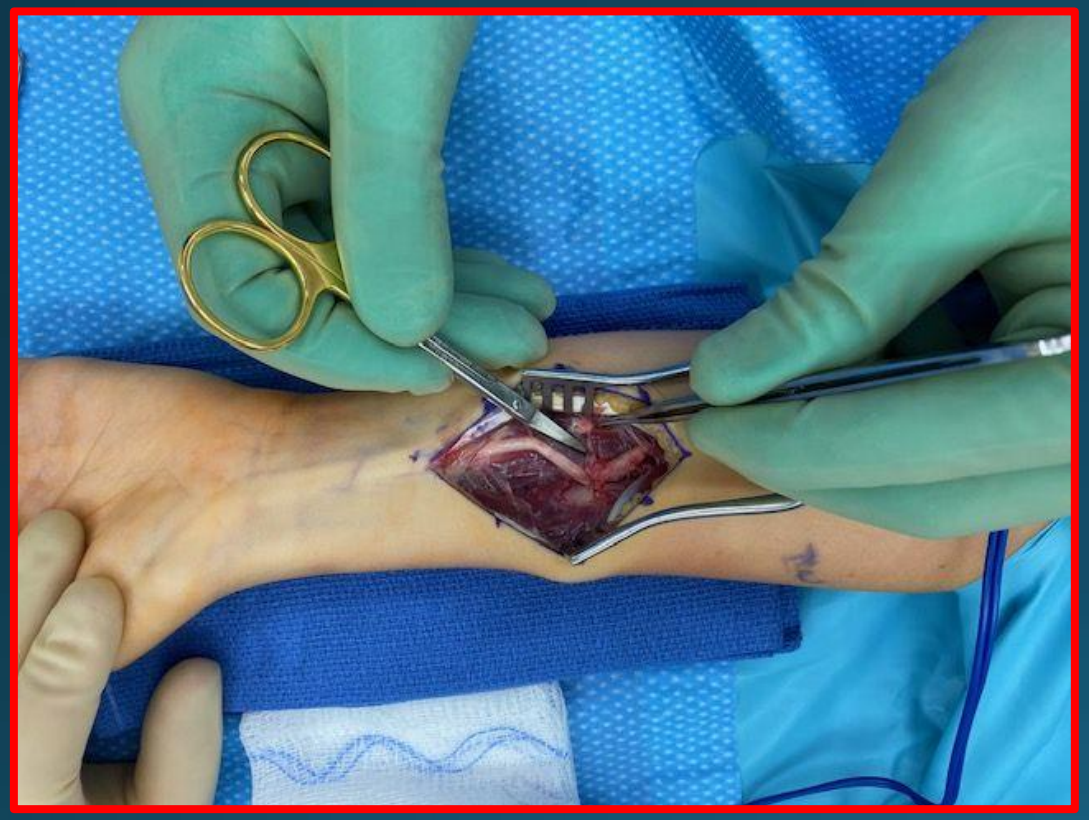
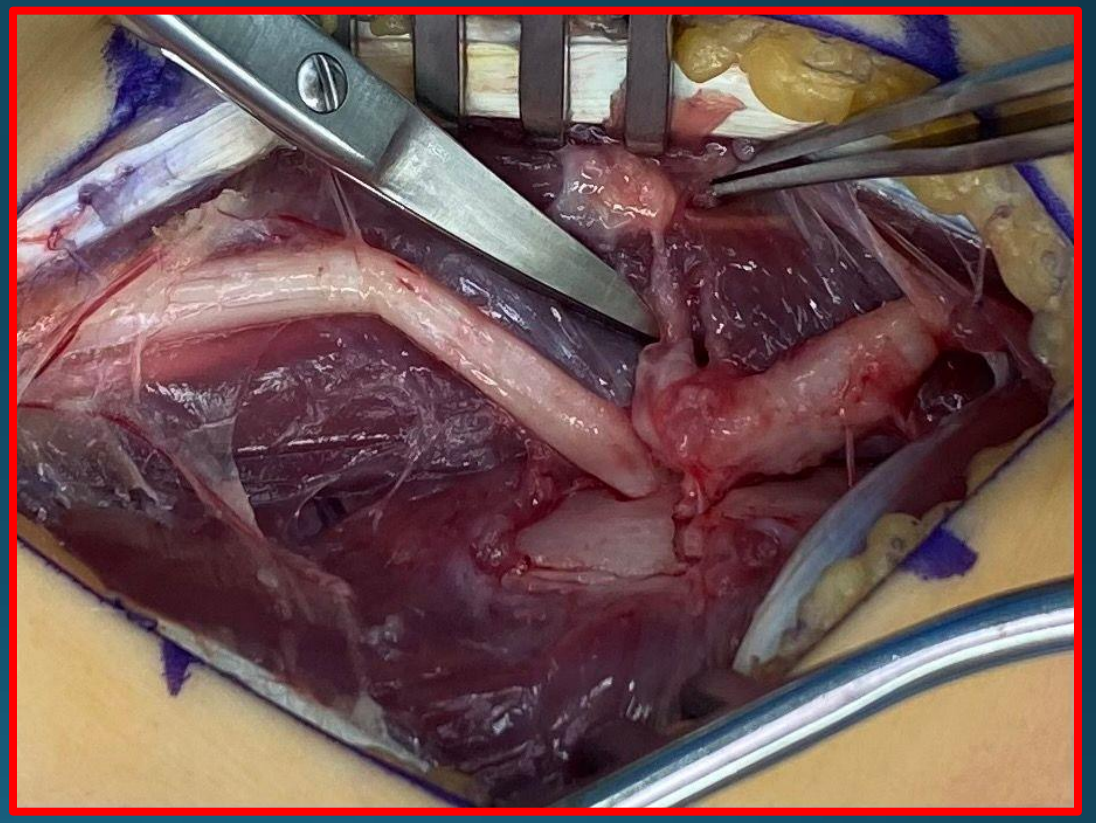
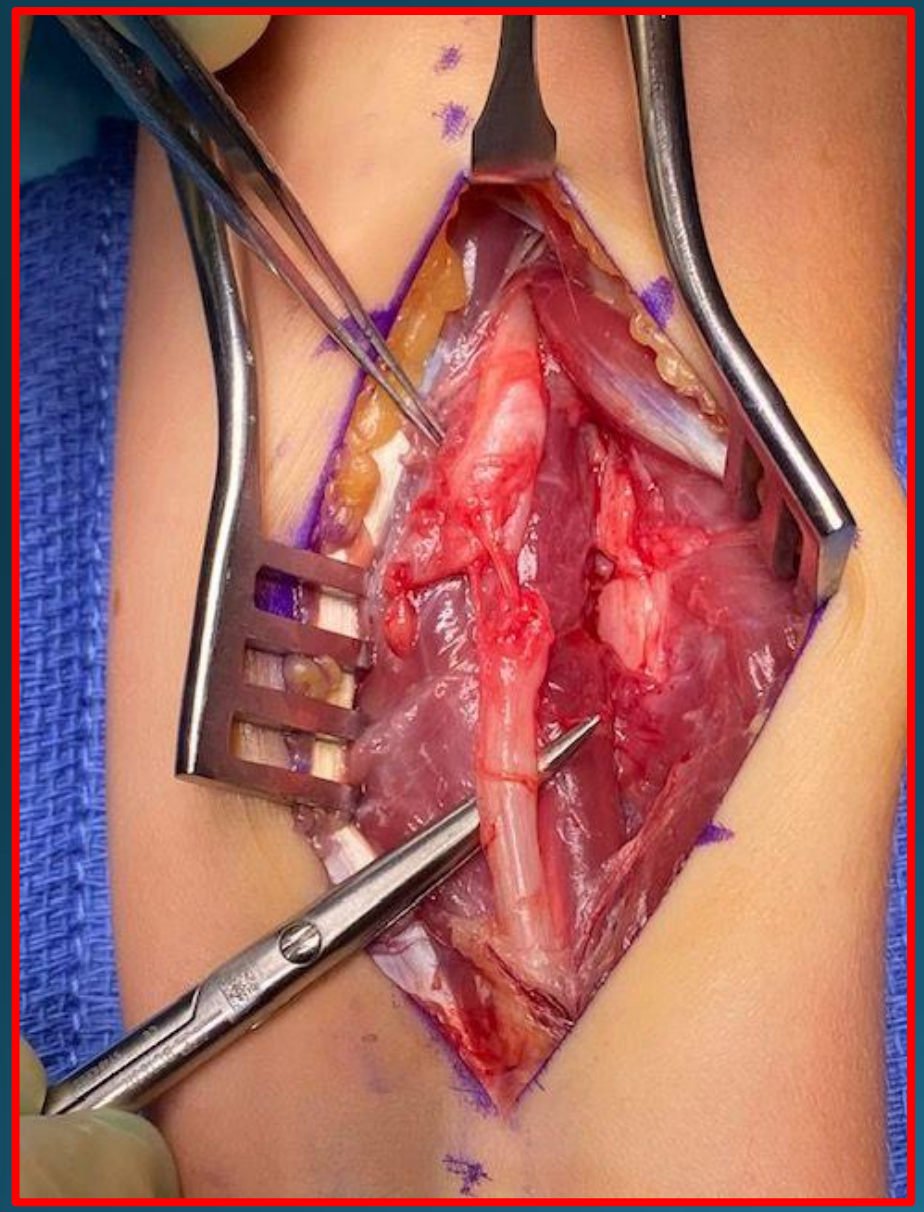
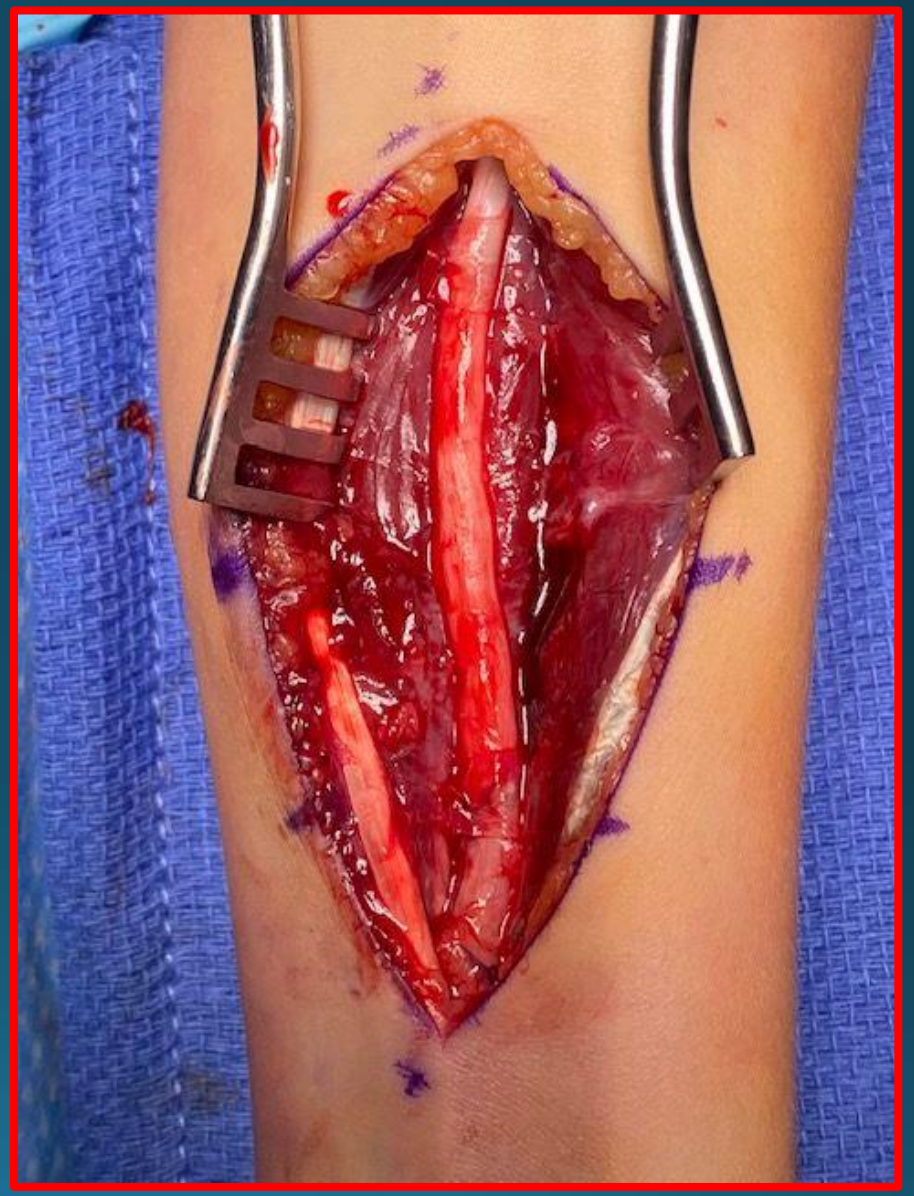
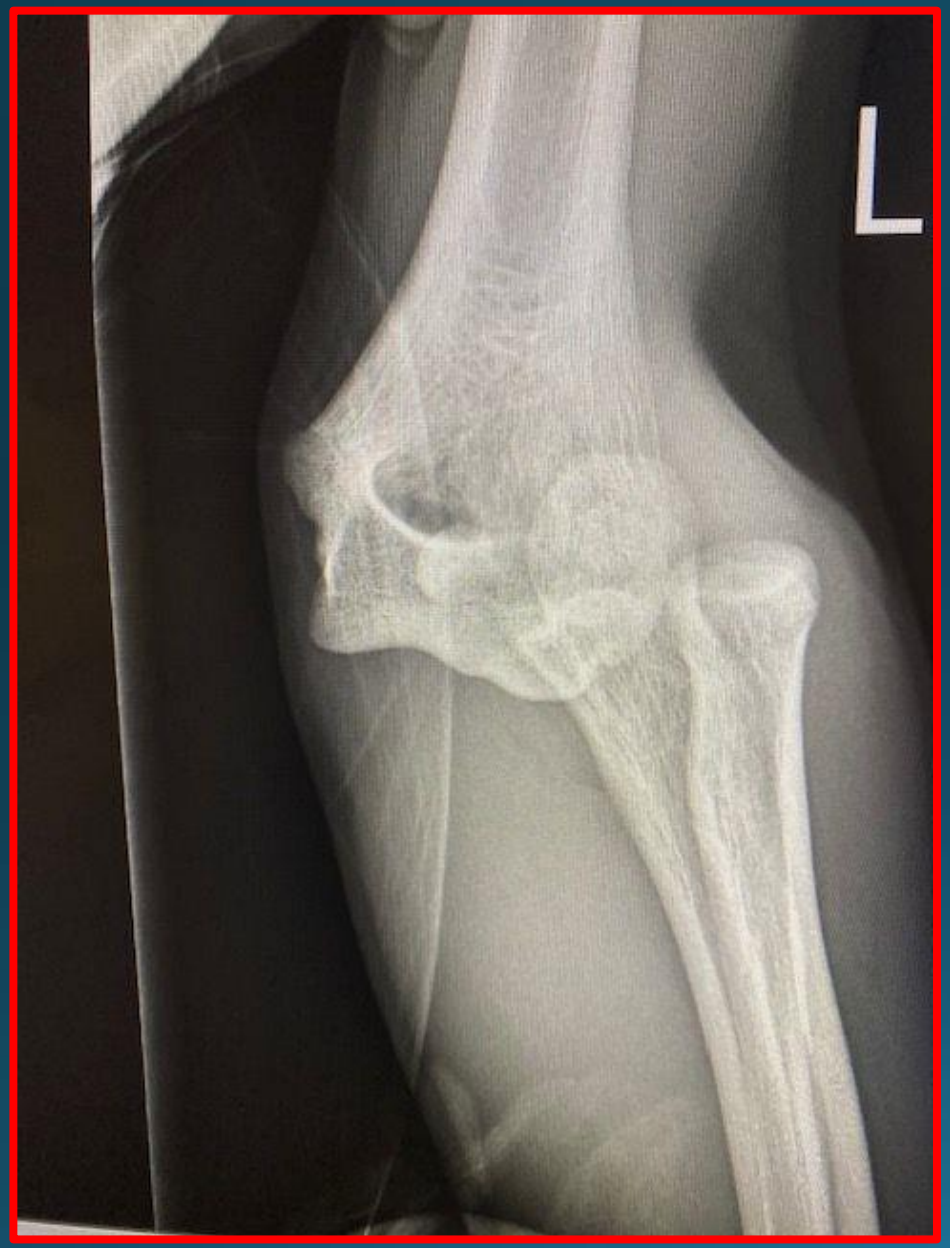








- 14 yo Female
- Nondominant Extremity
- Competitive Gymnist
- Injured elbow while performing uneven bars
- Ulnar nerve function intact
- Instagram sensation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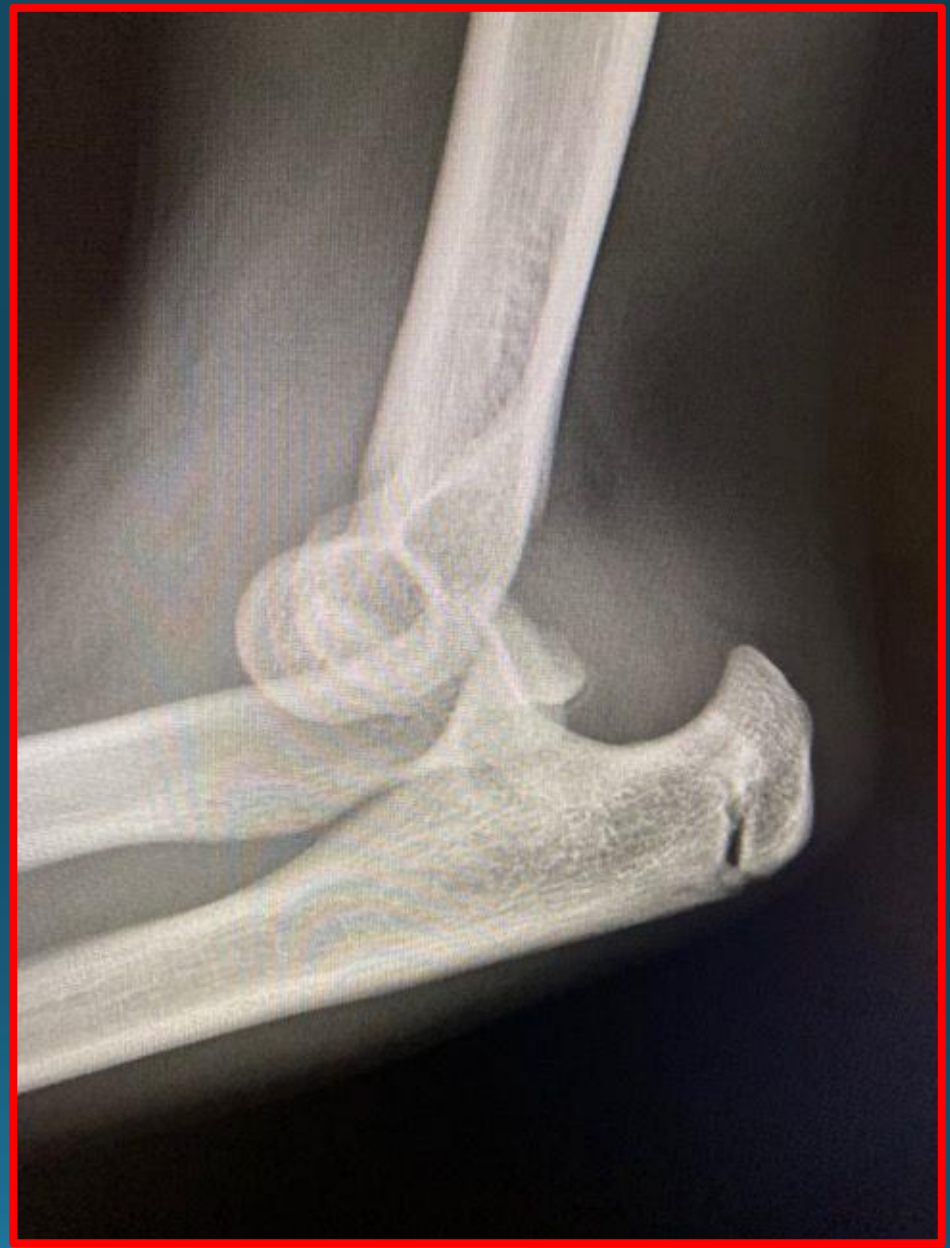

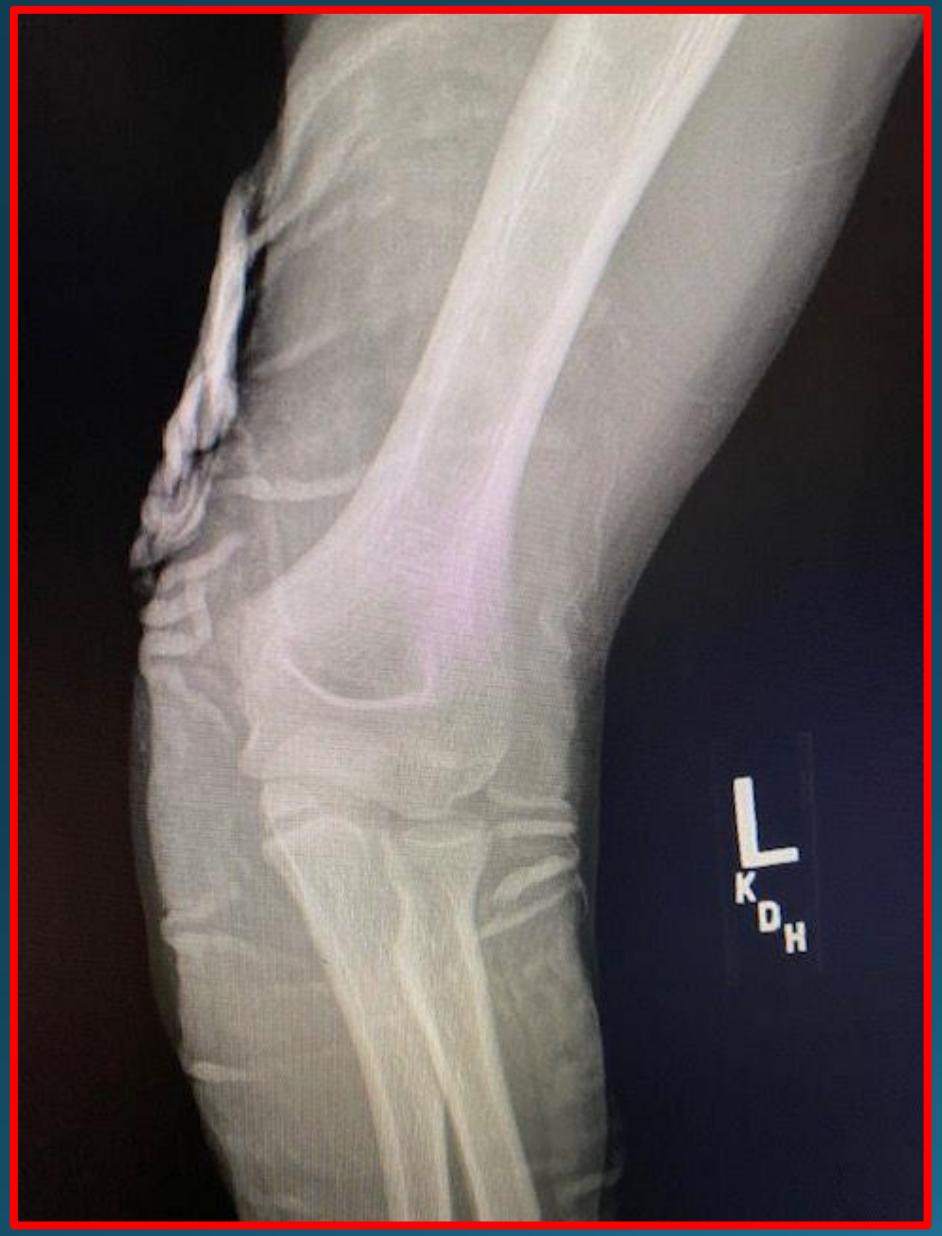
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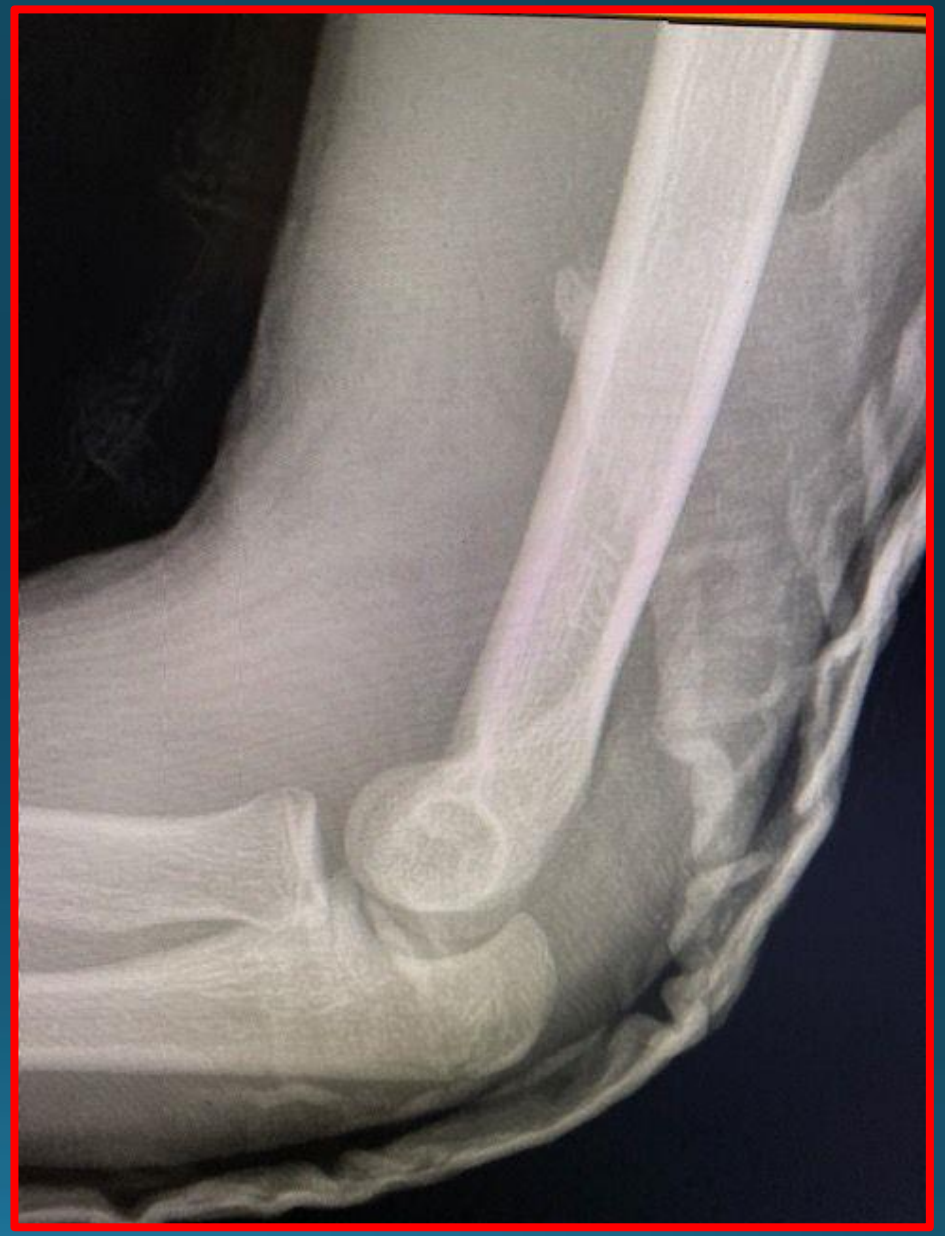


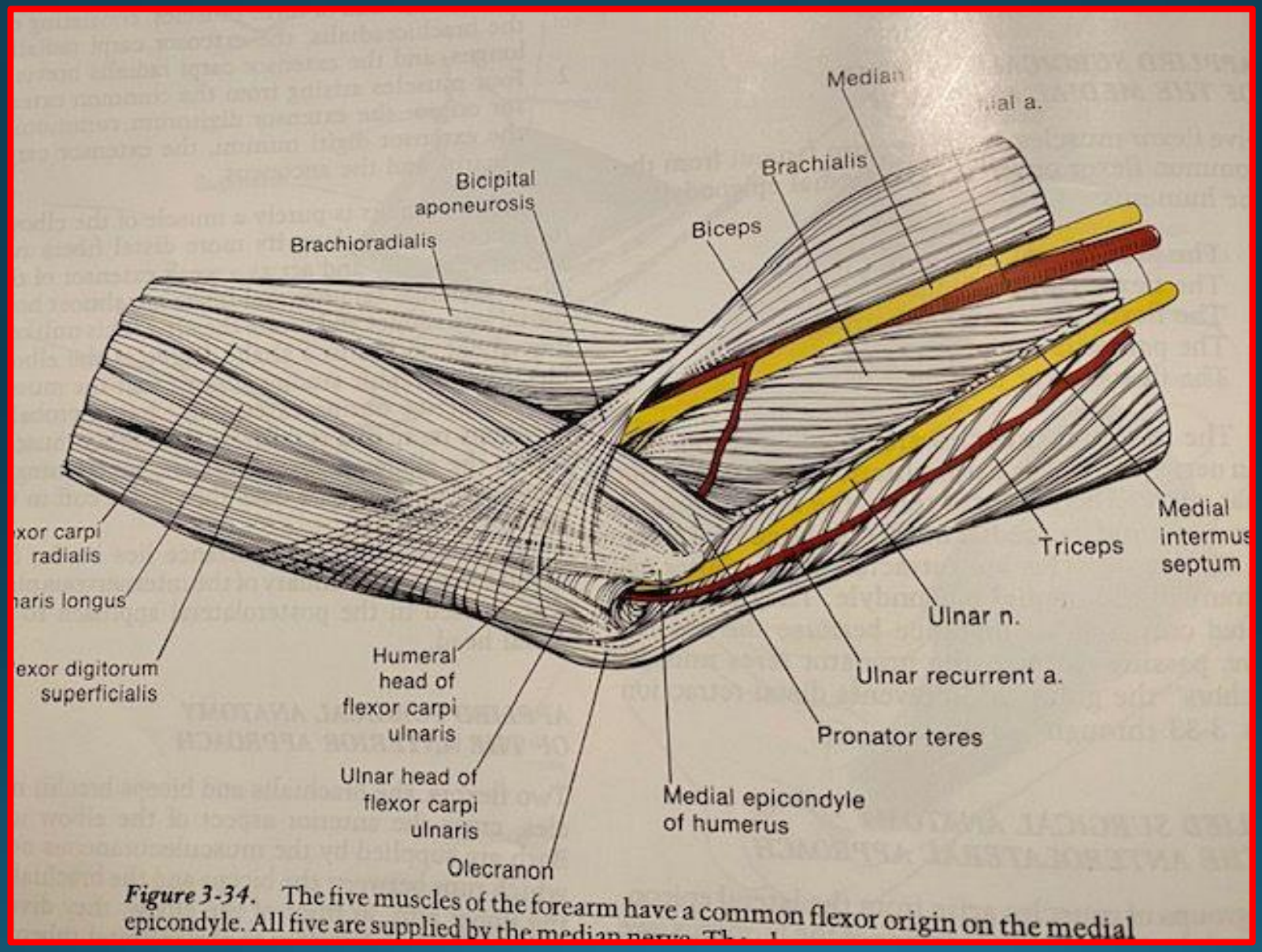
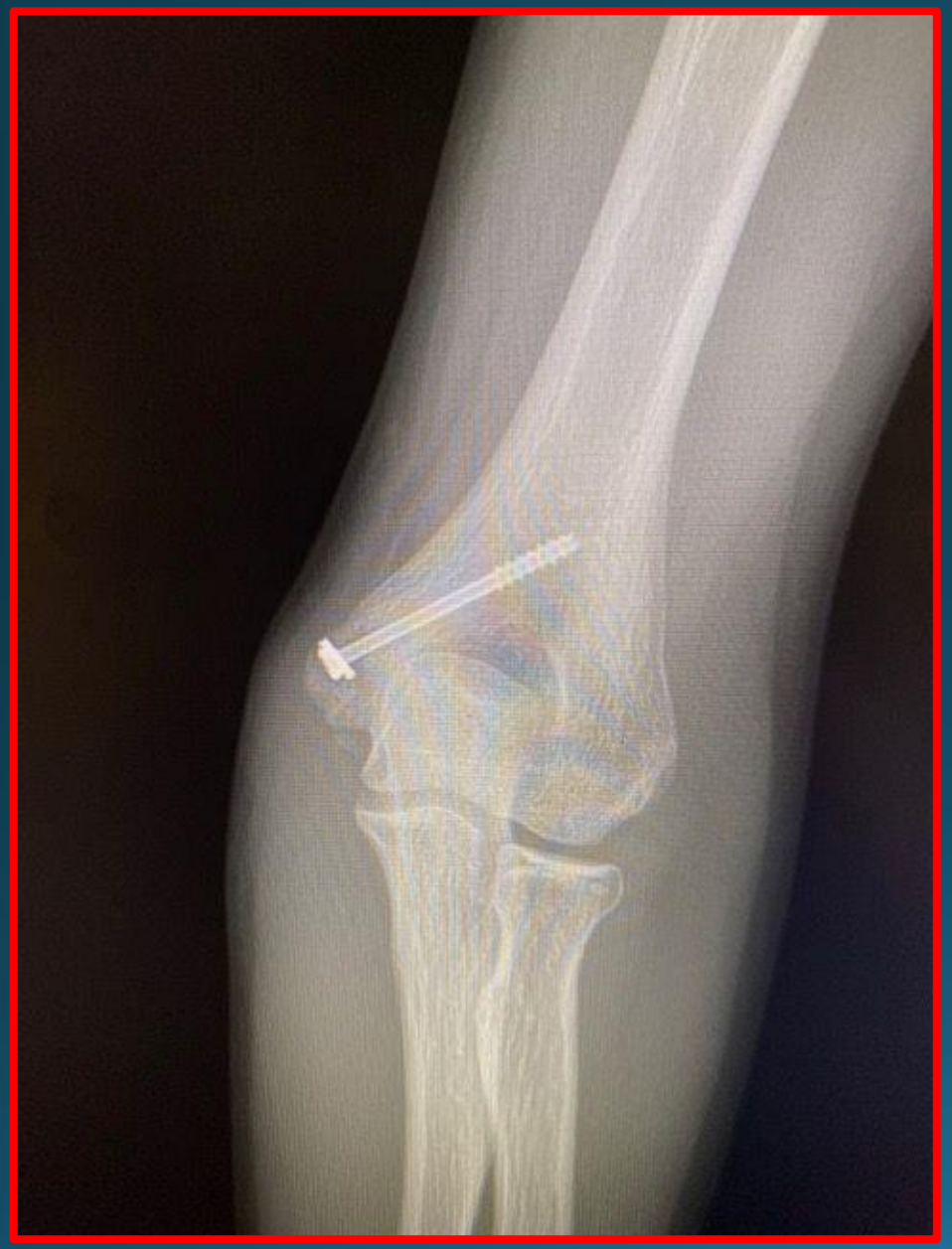
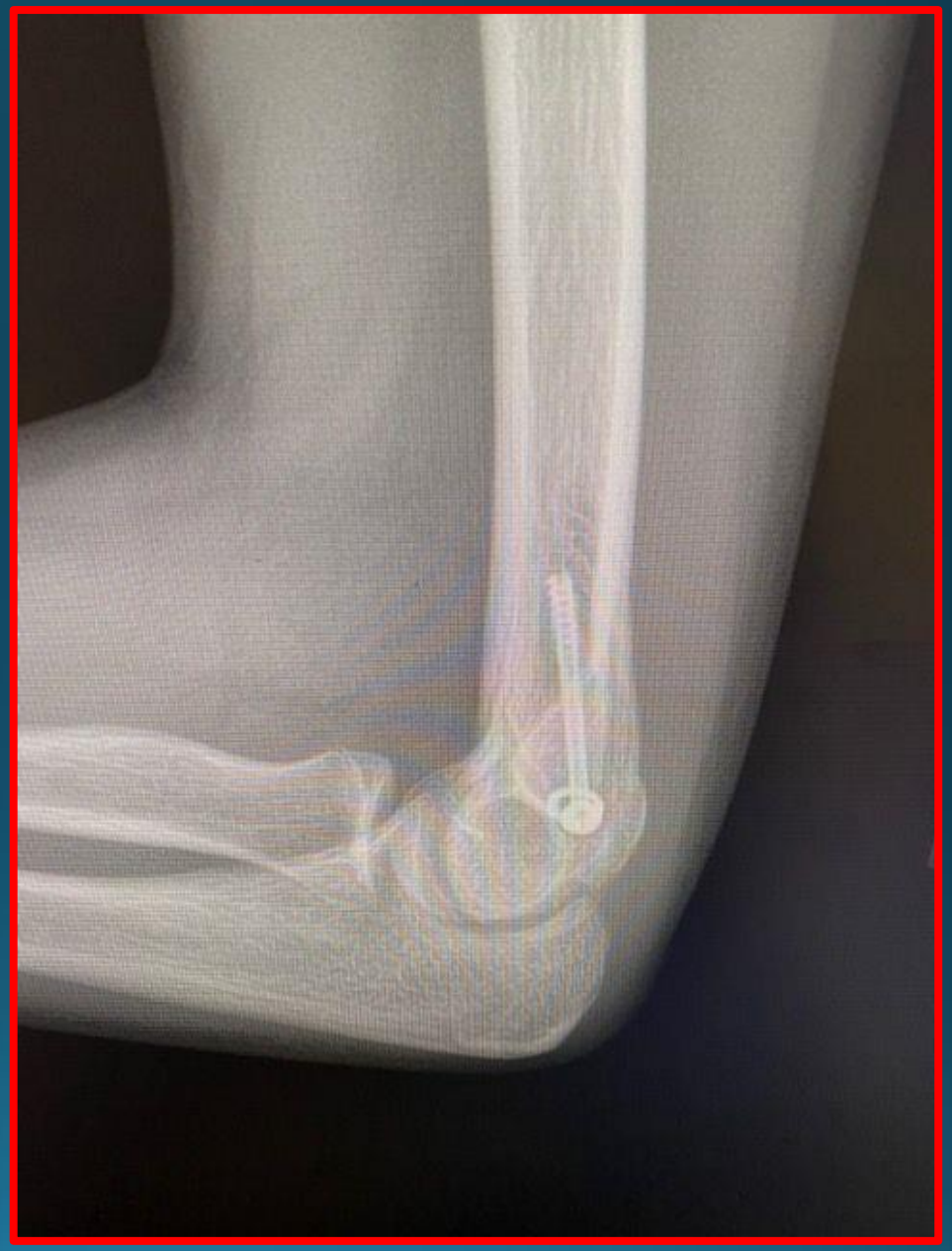
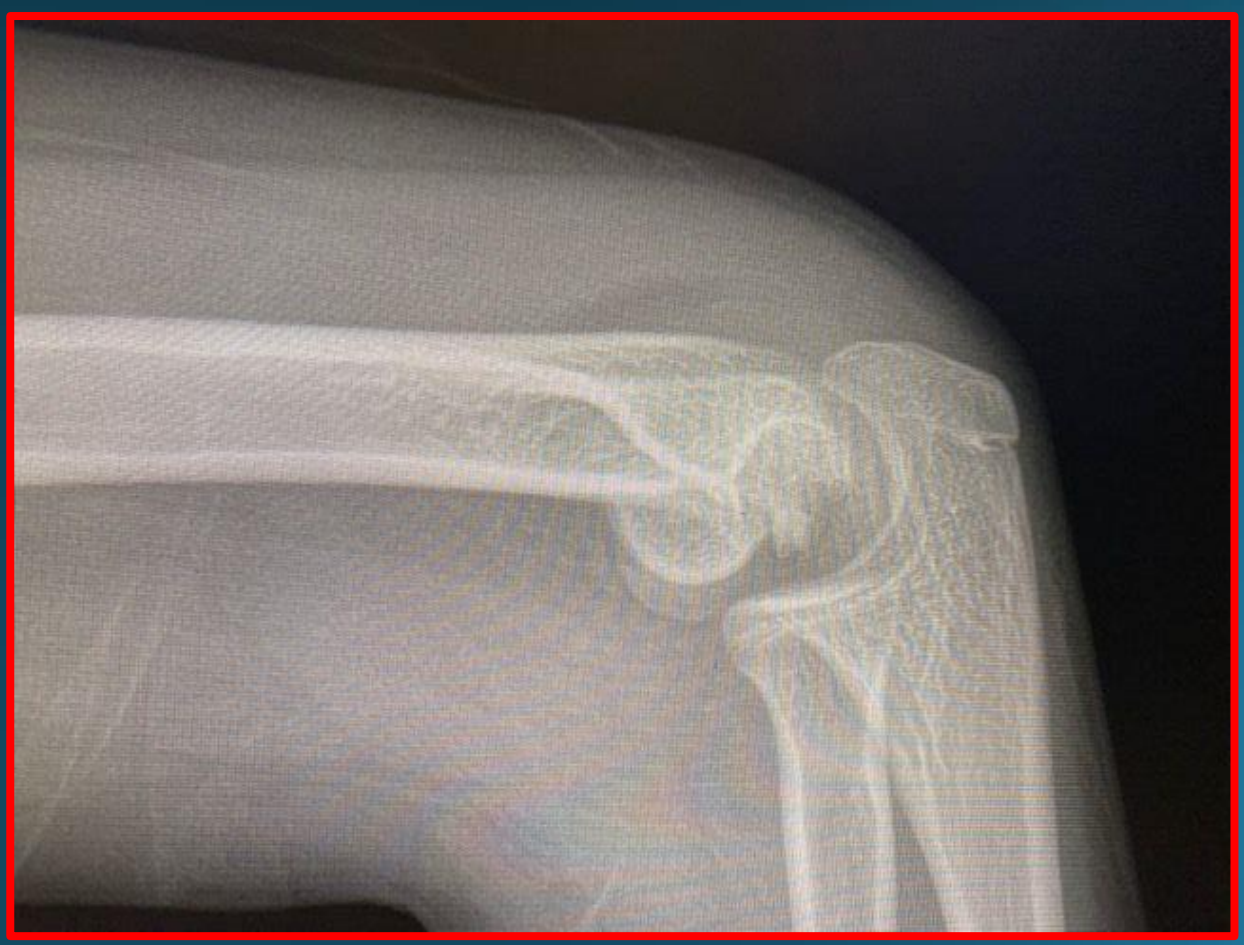


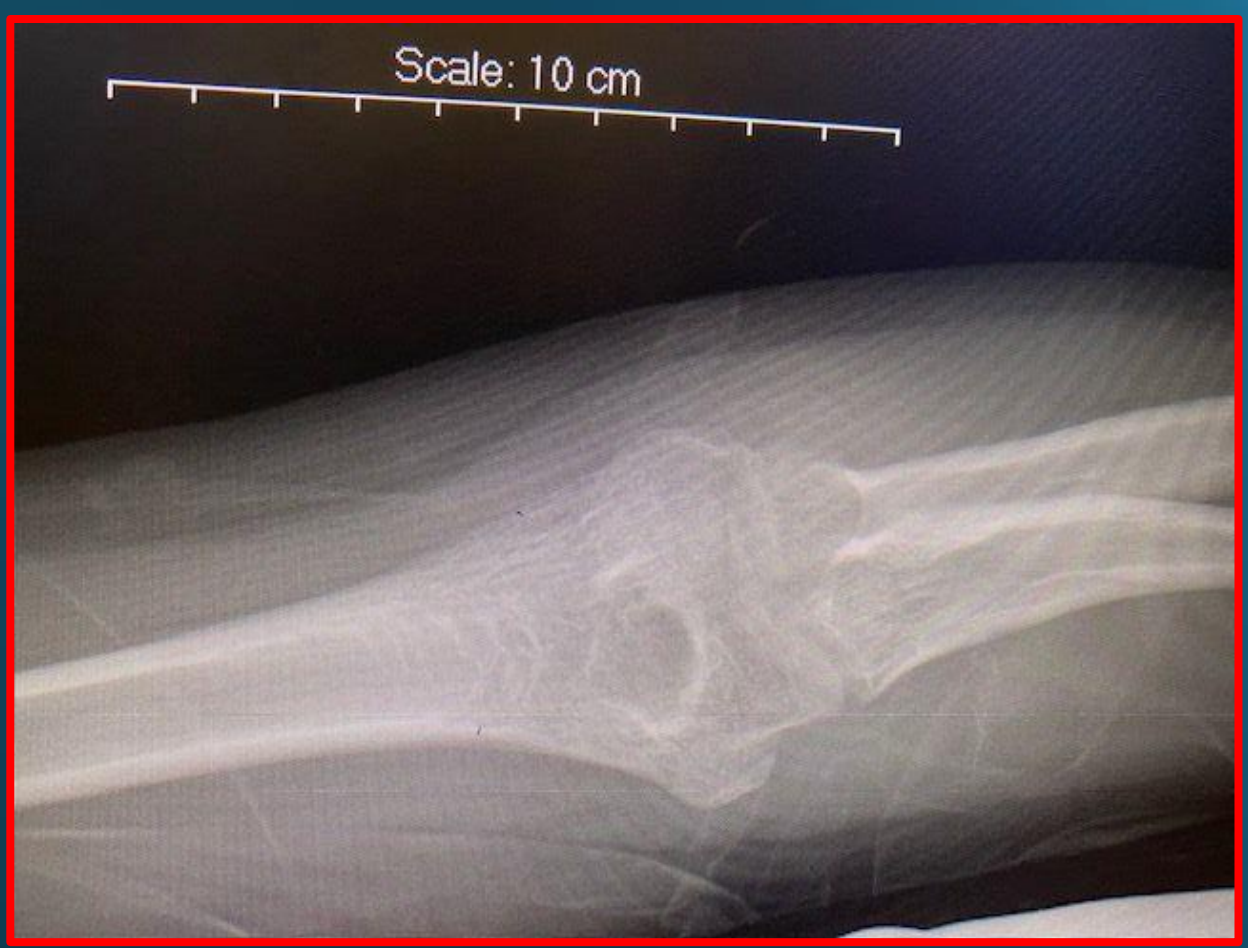
Figure 3-34. The five muscles of the forearm have a common flexor origin on the medial epicondyle. All five are supplied by the median nerve.





- 12 YO Female
- Nondominant Extremity
- Fall while riding a scooter
- Presented to my clinic 3 days after injury with sling after being seen in outside urgent care clinic

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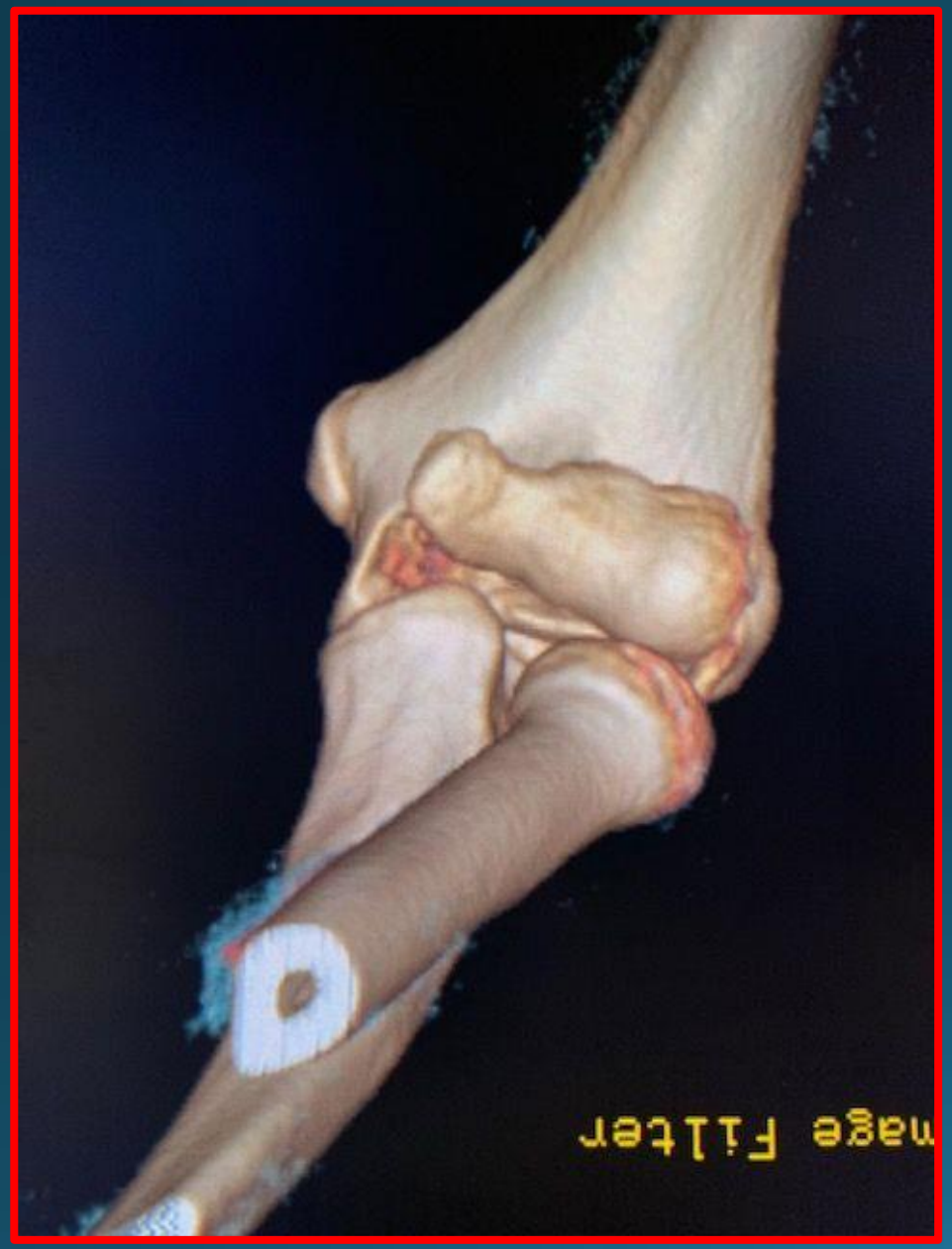

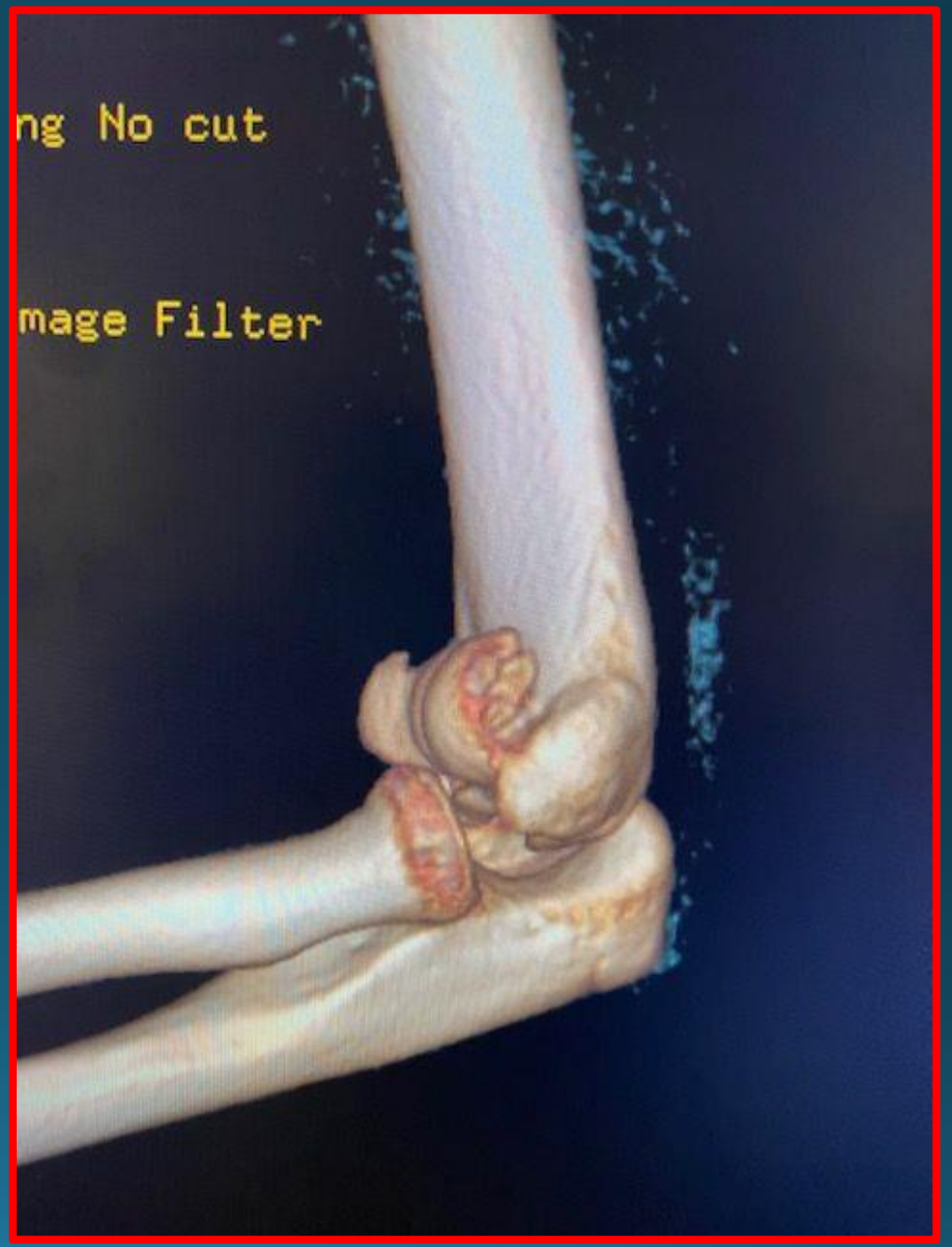
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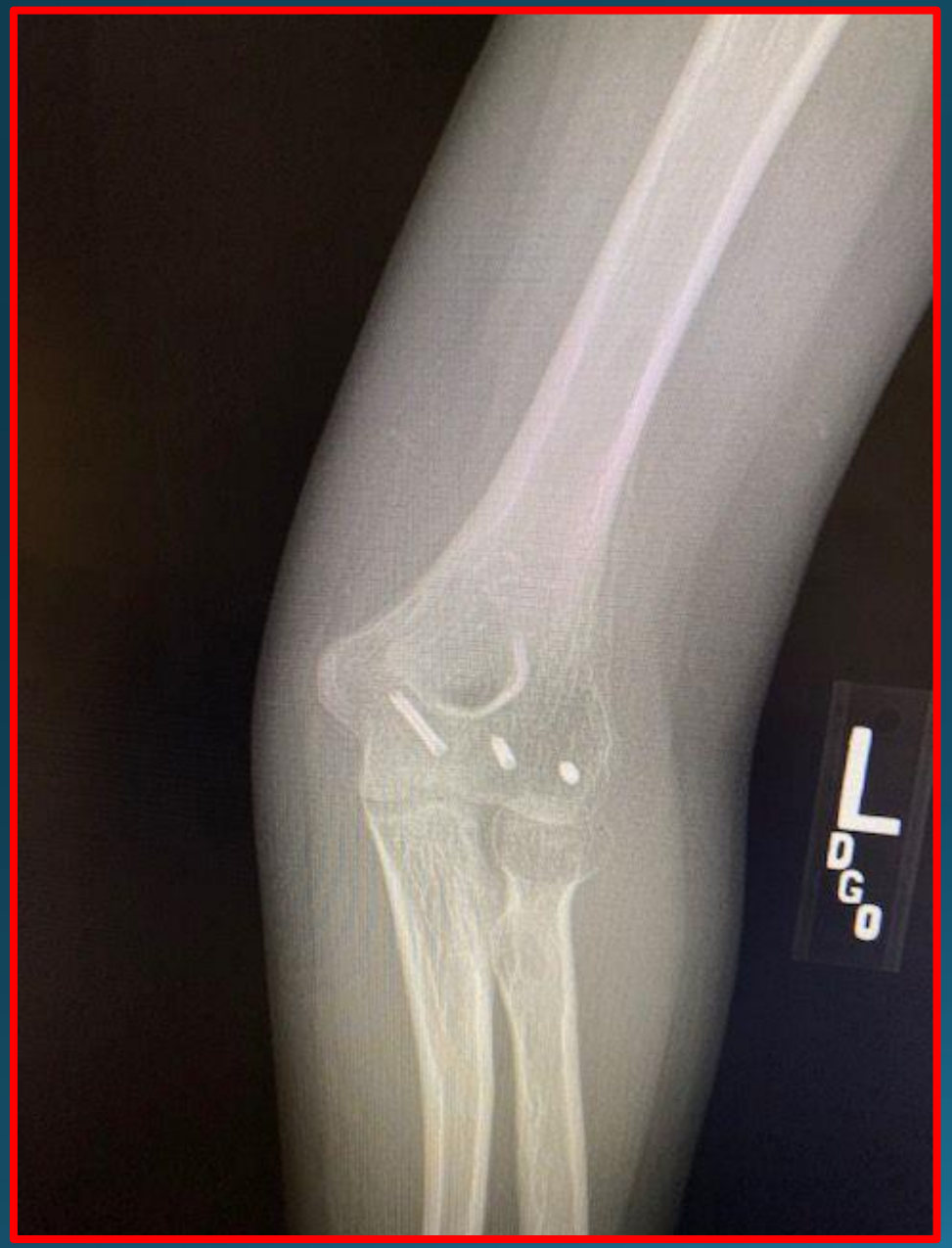
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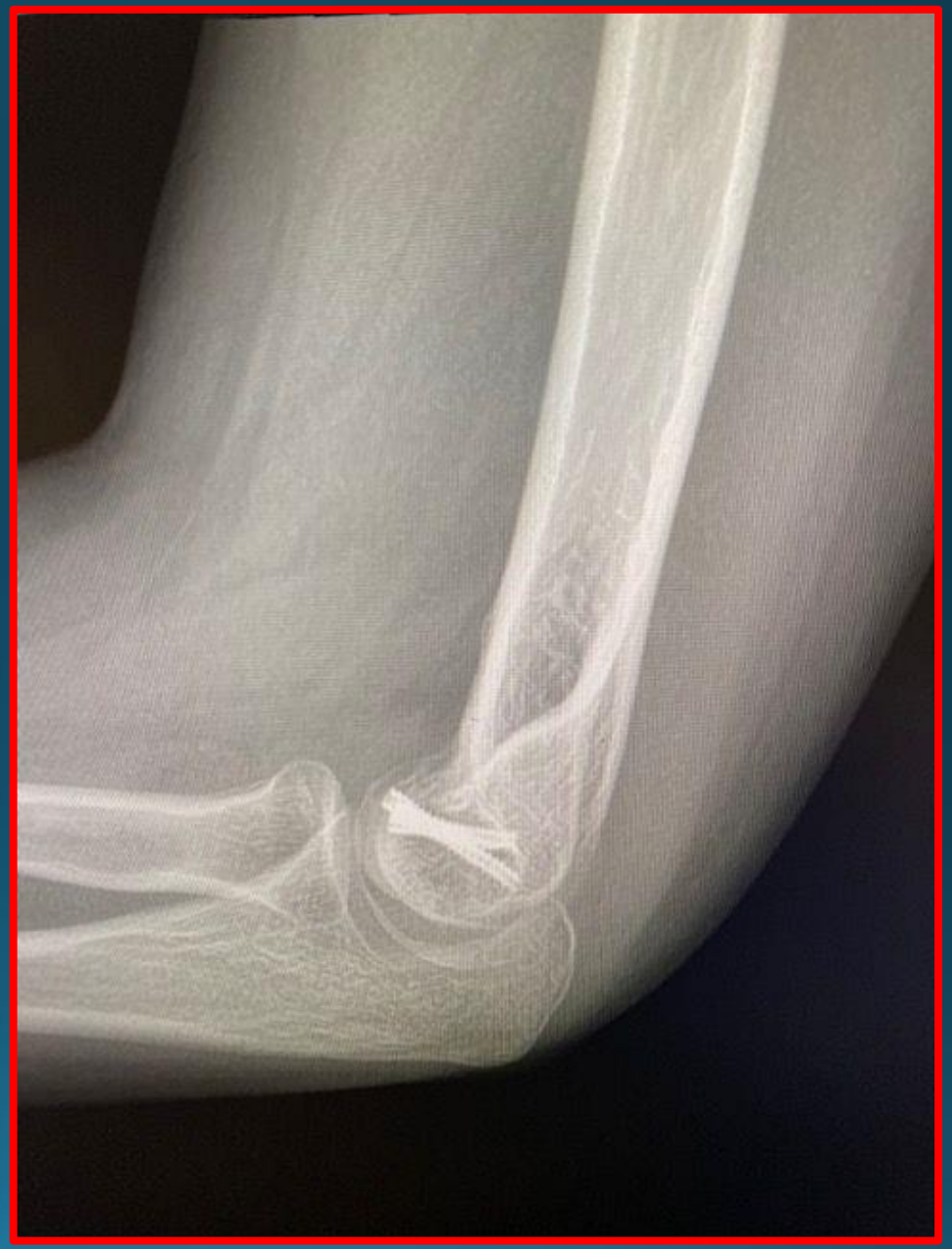
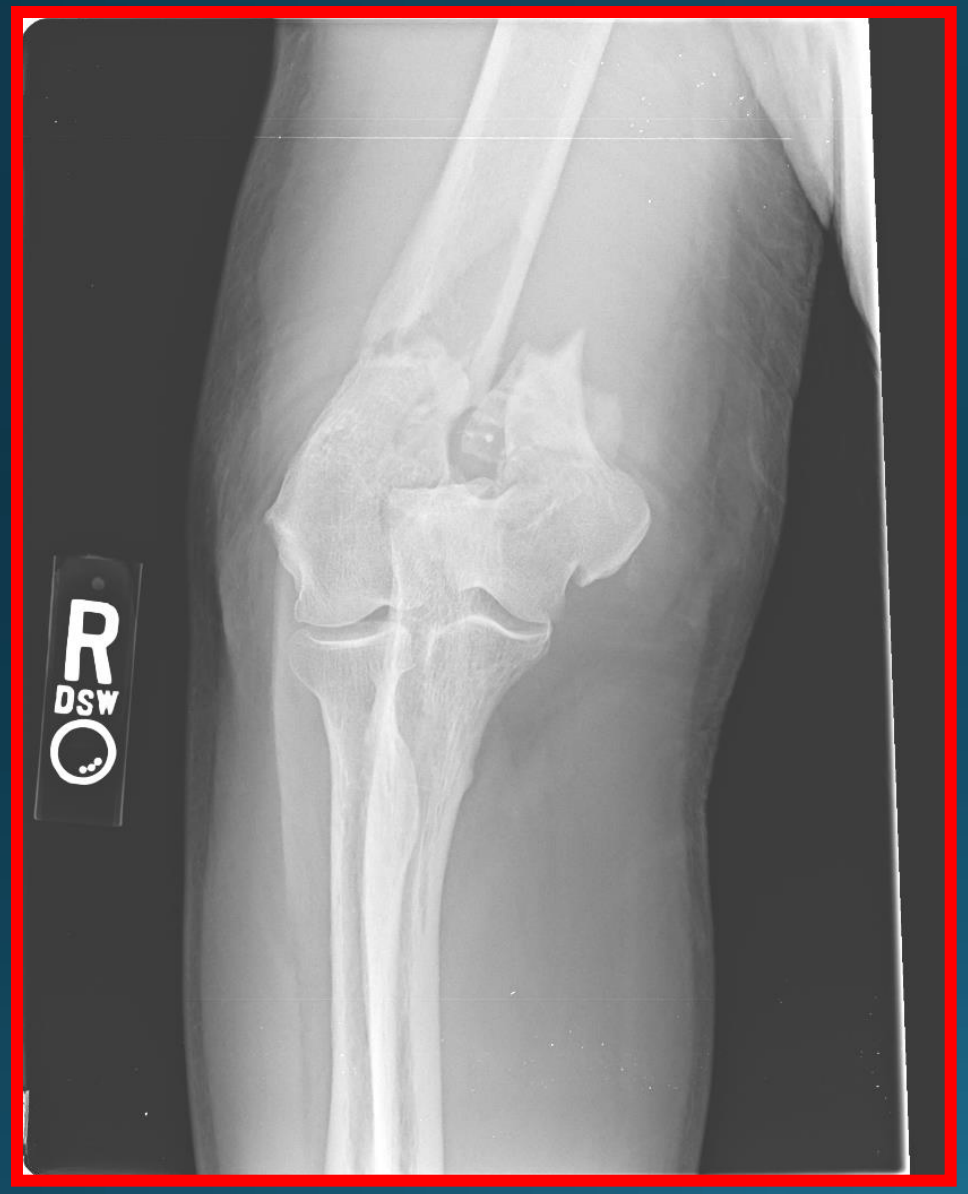
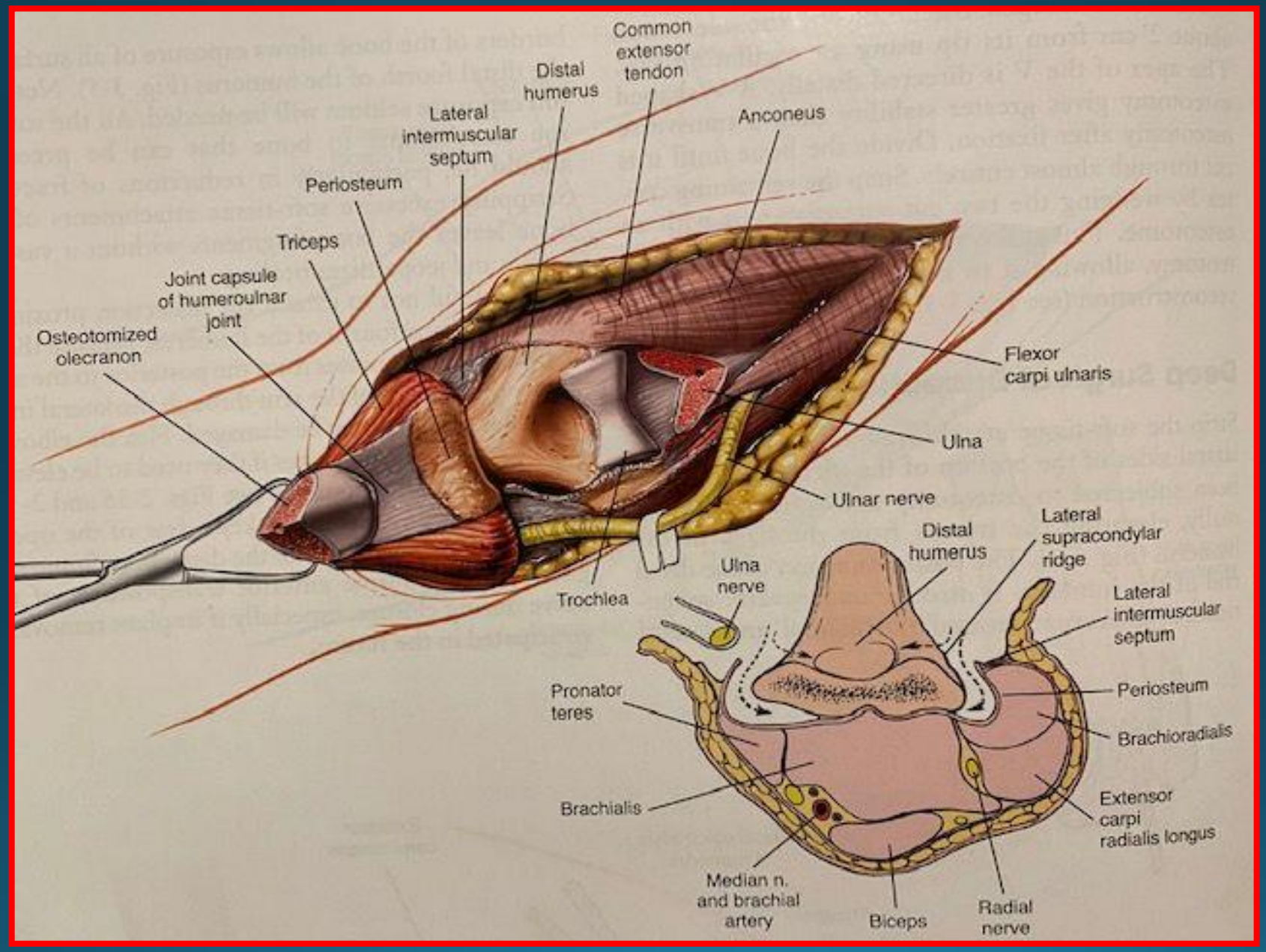
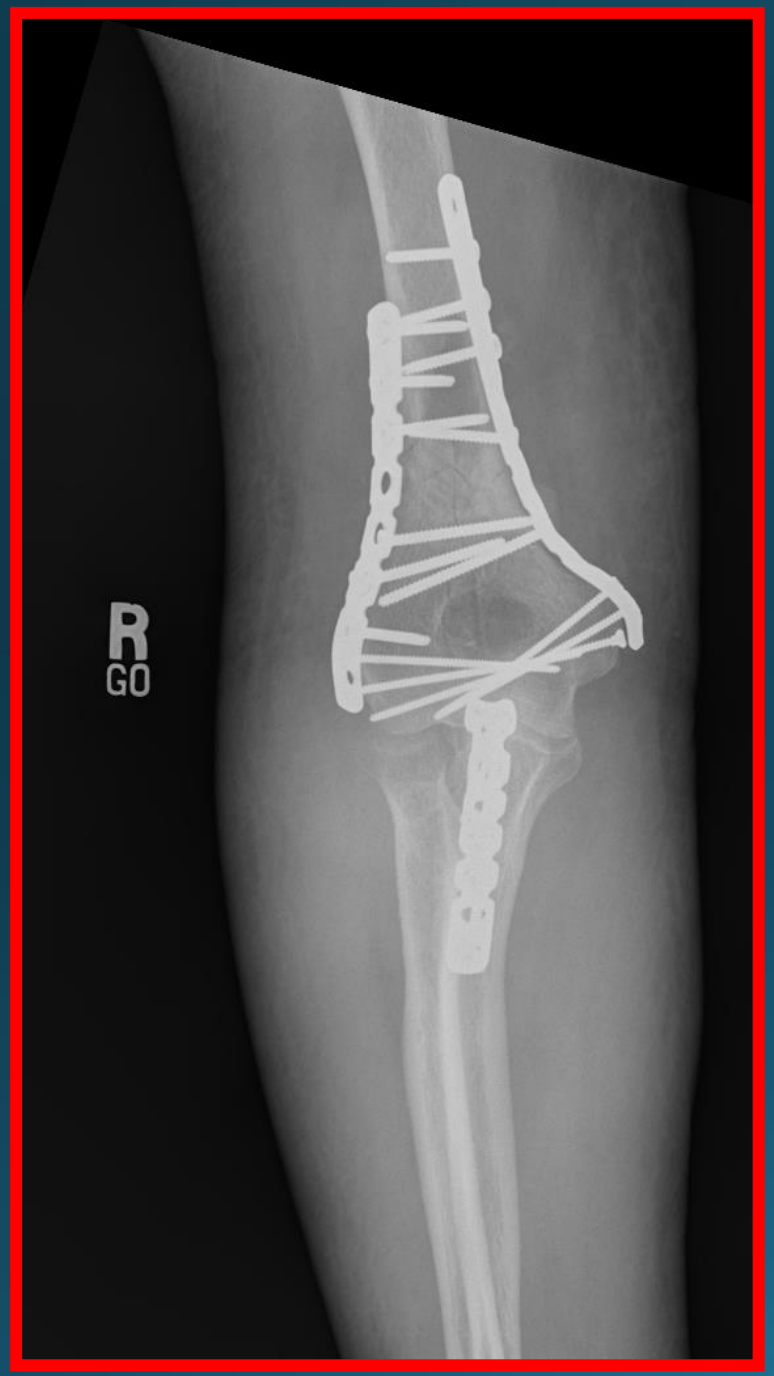


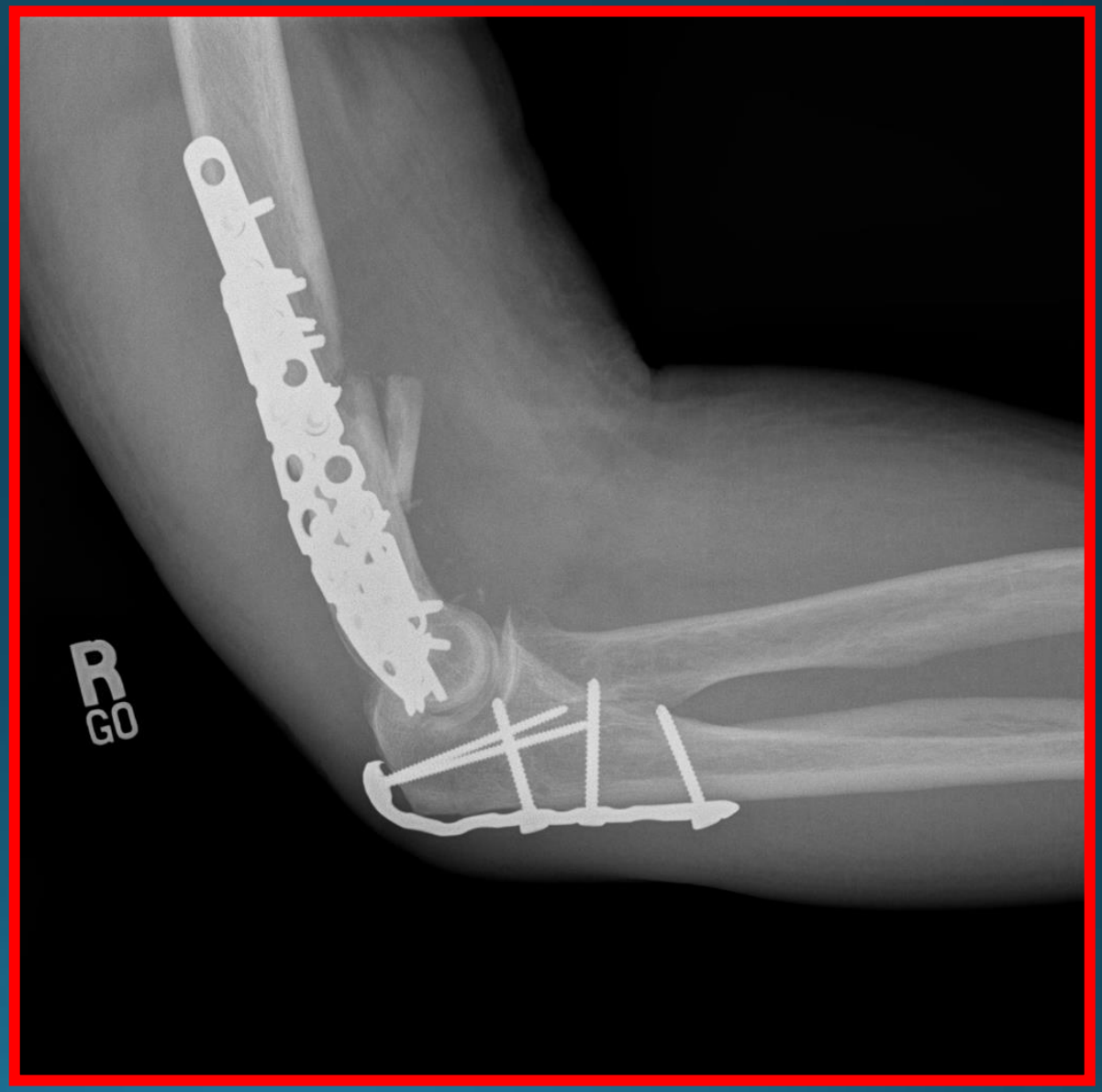
- 57 YO Male
- Dominant Extremity
- Fall from ladder
- Works in construction industry


R
DSW

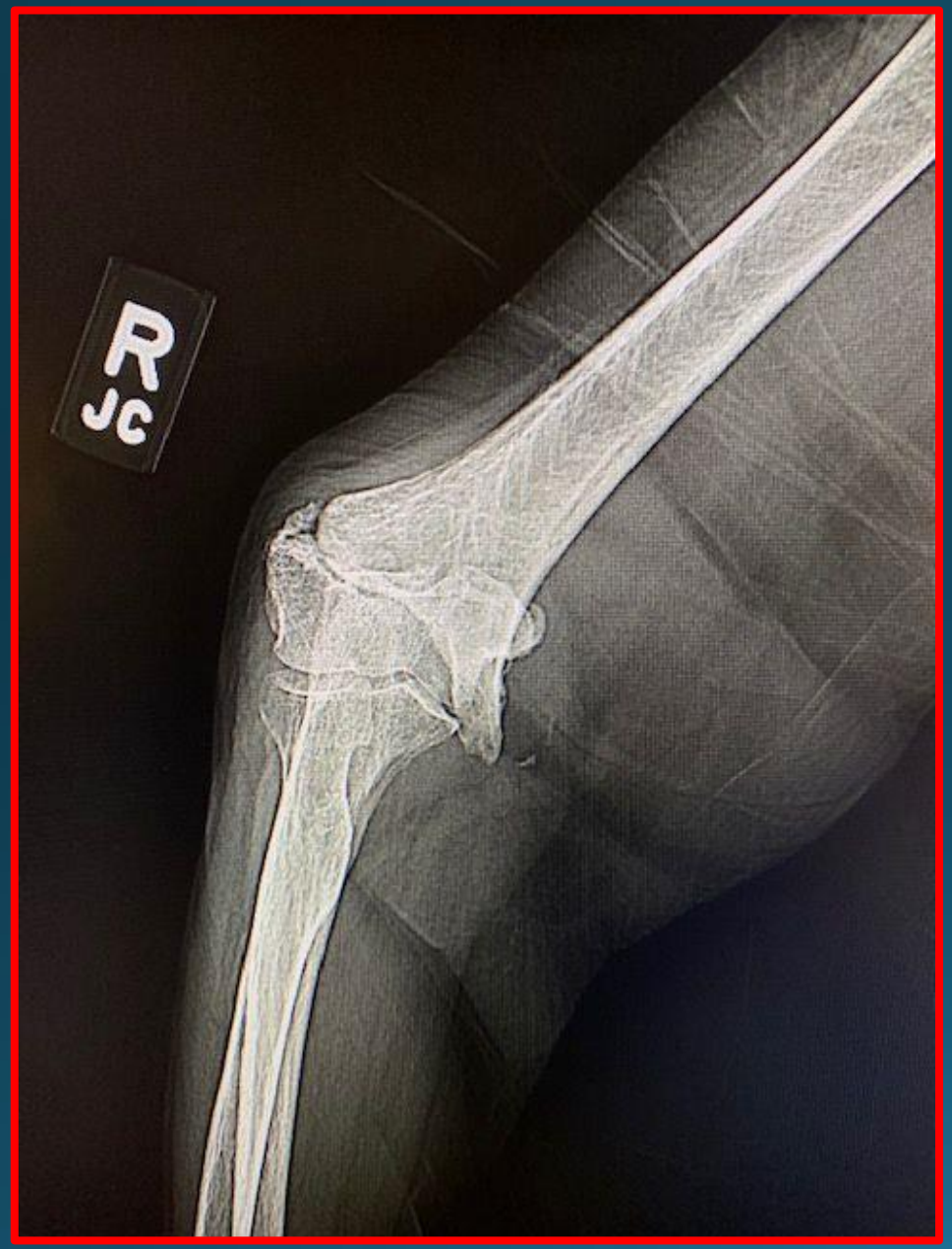

R
DSW
X-Table

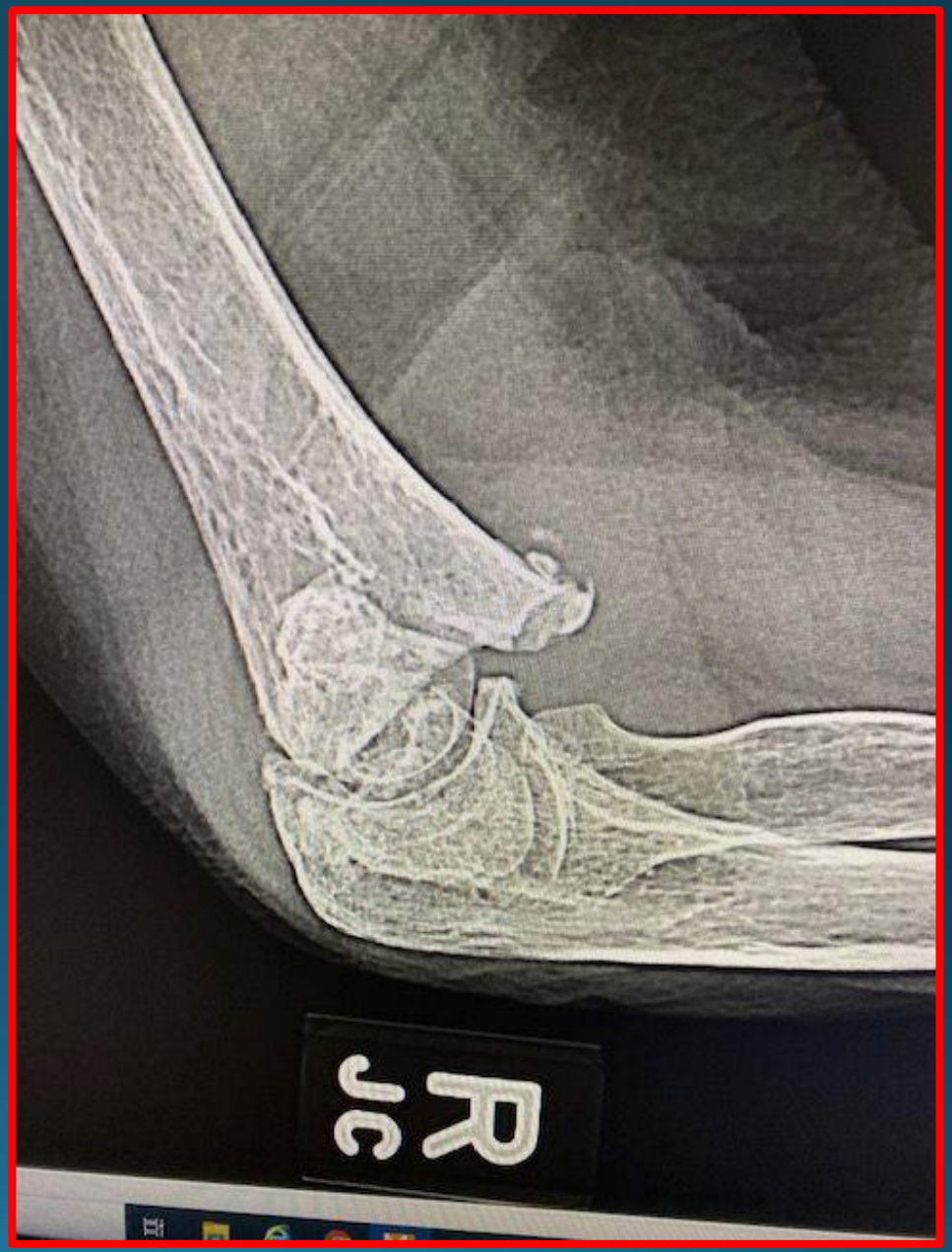

Common extensor tendon
Distal humerus
Lateral intermuscular septum
Anconeus
Periosteum
Triceps
Joint capsule of humeroulnar joint
Osteotomized olecranon
Flexor carpi ulnaris
Ulna
Ulnar nerve
Trochlea
Ulna nerve
Distal humerus
Lateral supracondylar ridge
Lateral intermuscular septum
Periosteum
Brachioradialis
Pronator teres
Brachialis
Extensor carpi radialis longus
Median n. and brachial artery
Biceps
Radial nerve

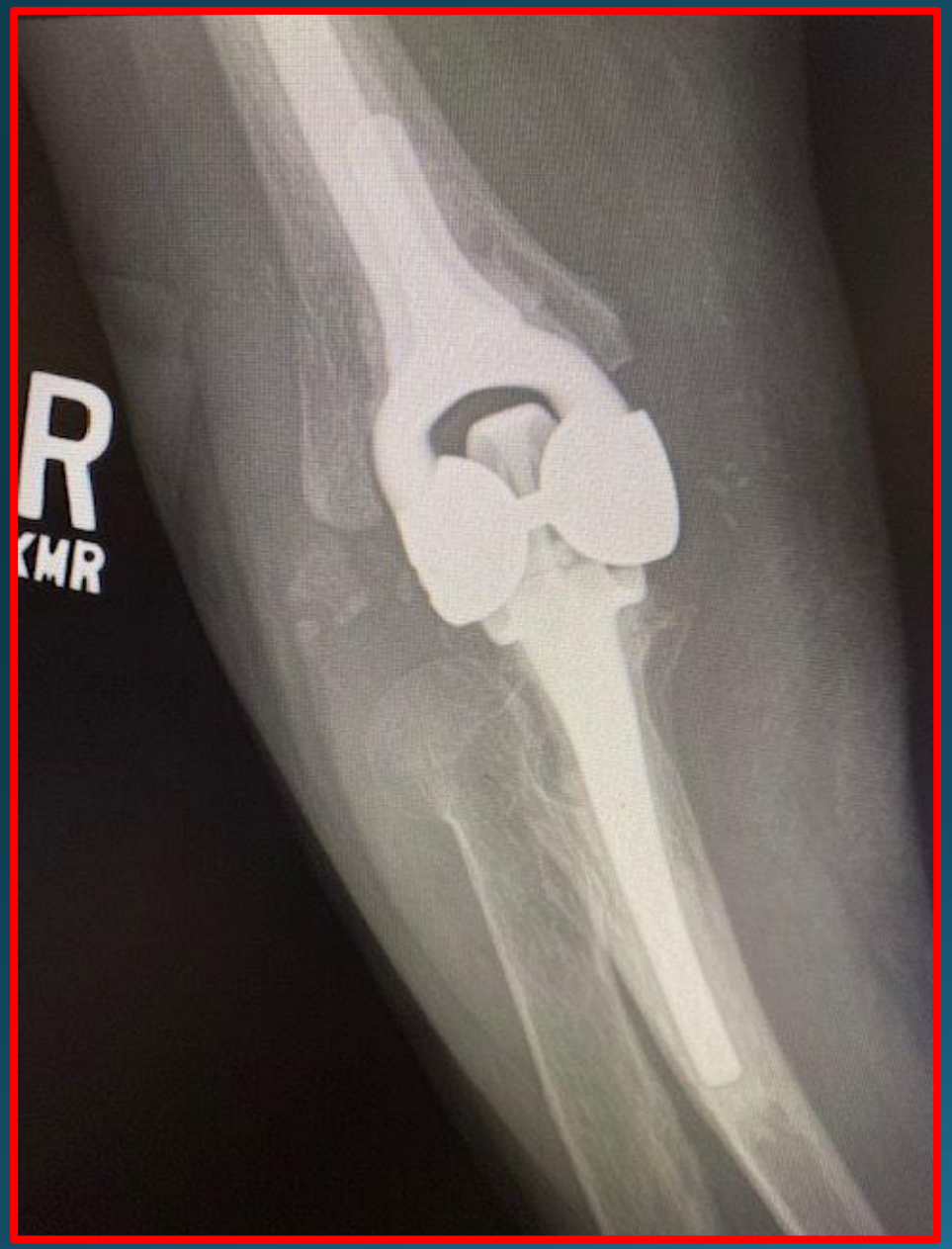

R
GO

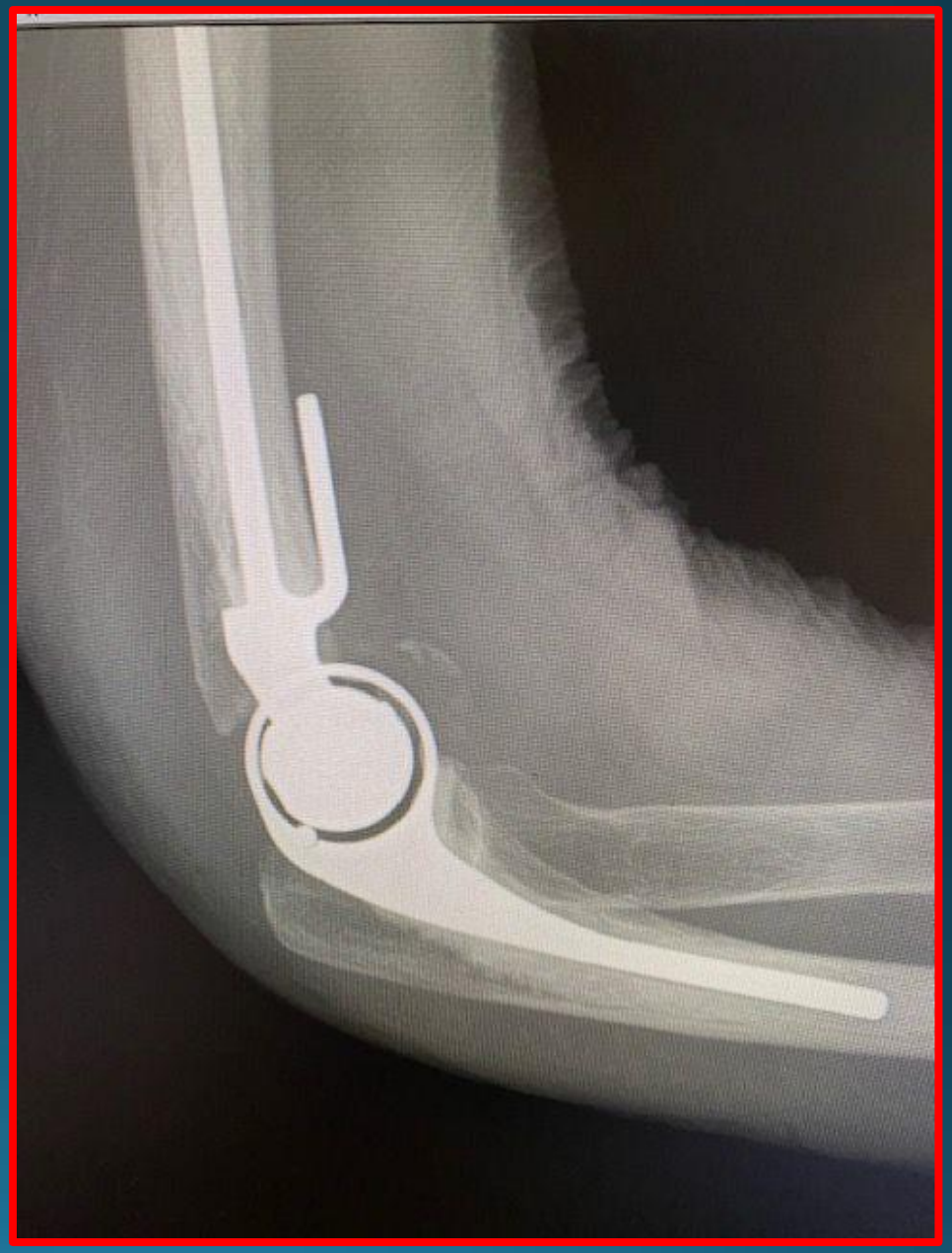

R
GO

- 81 YO Female
- Dominant extremity
- Fall 7 months prior treated in long arm cast out of state
- Persistent pain, instability, dysfunction
- Nephew is treating surgeon


R
JC


JC R


R
KMR

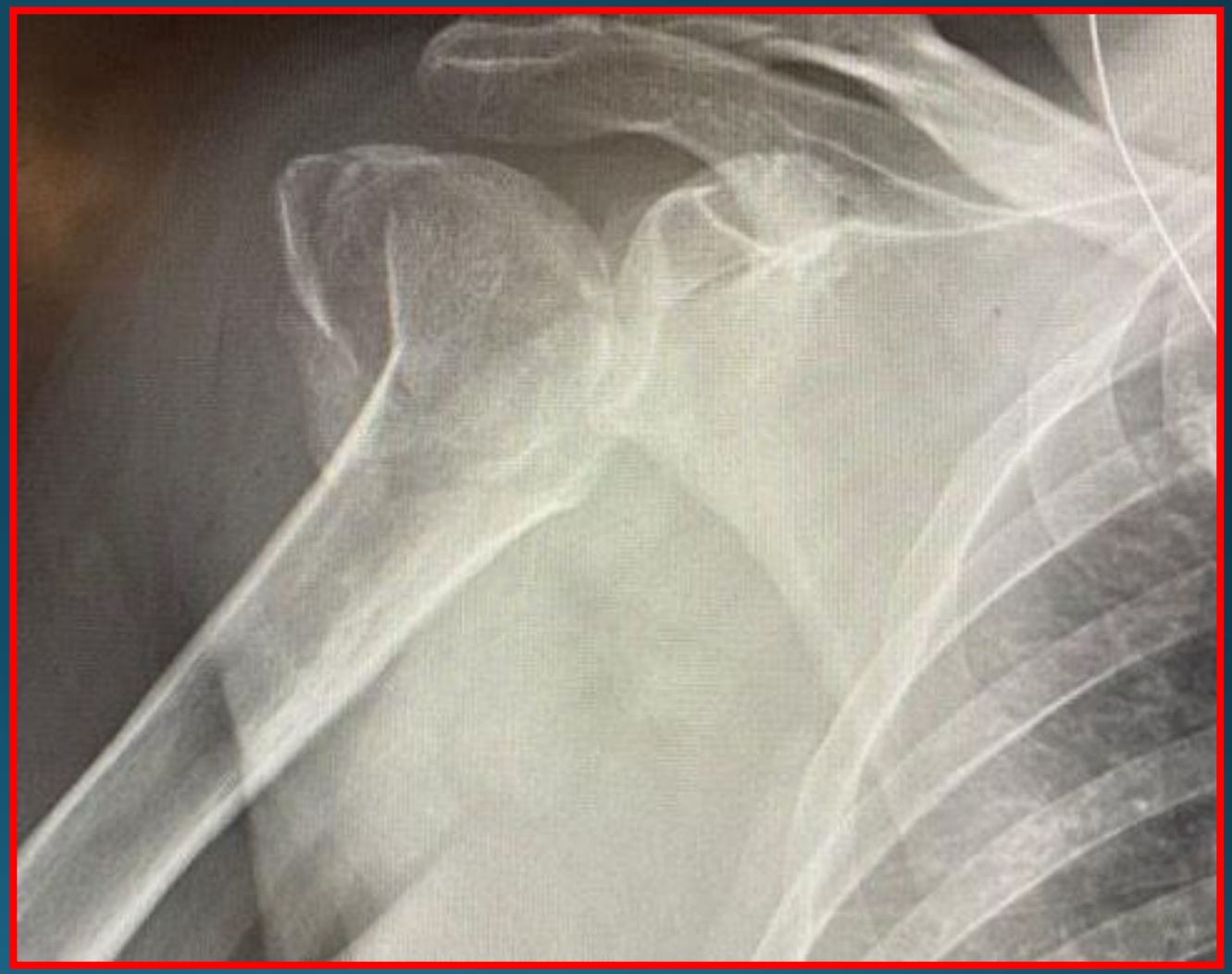


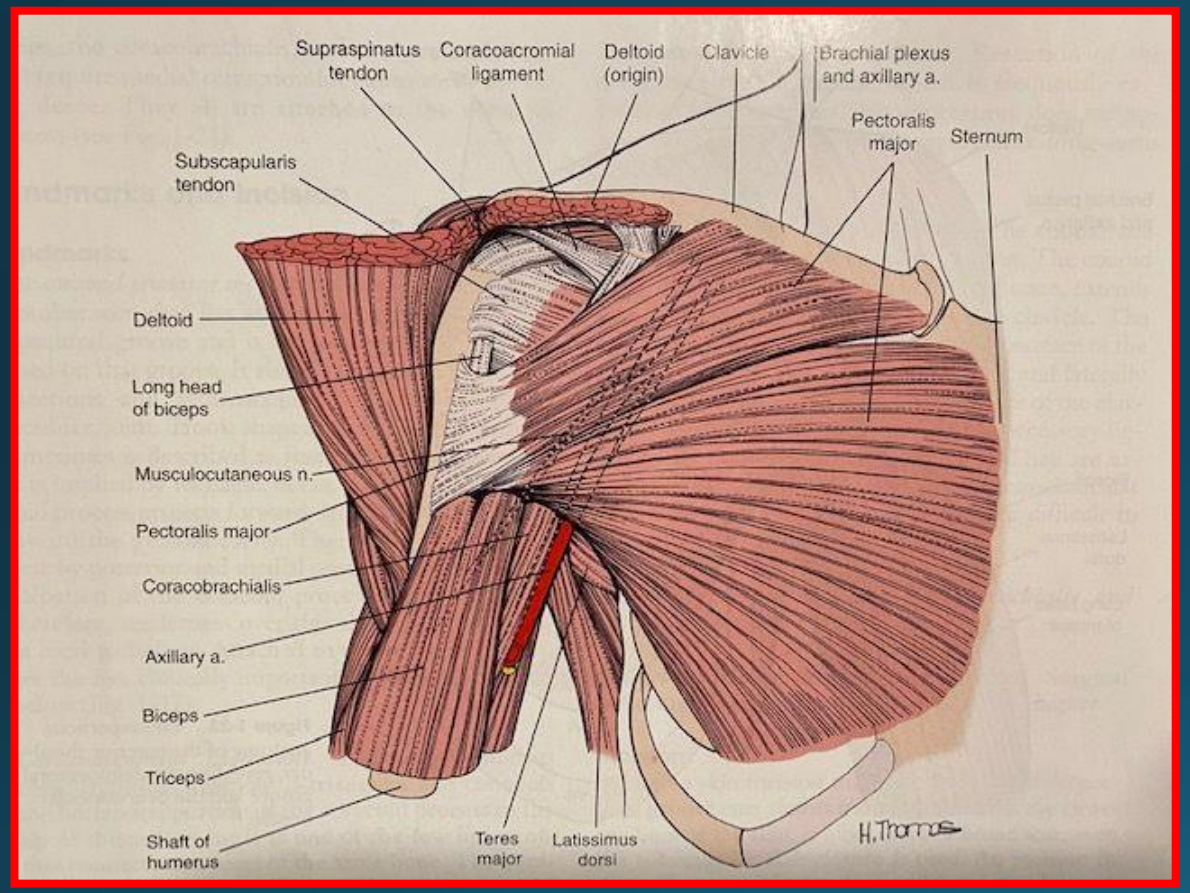
37 YO female

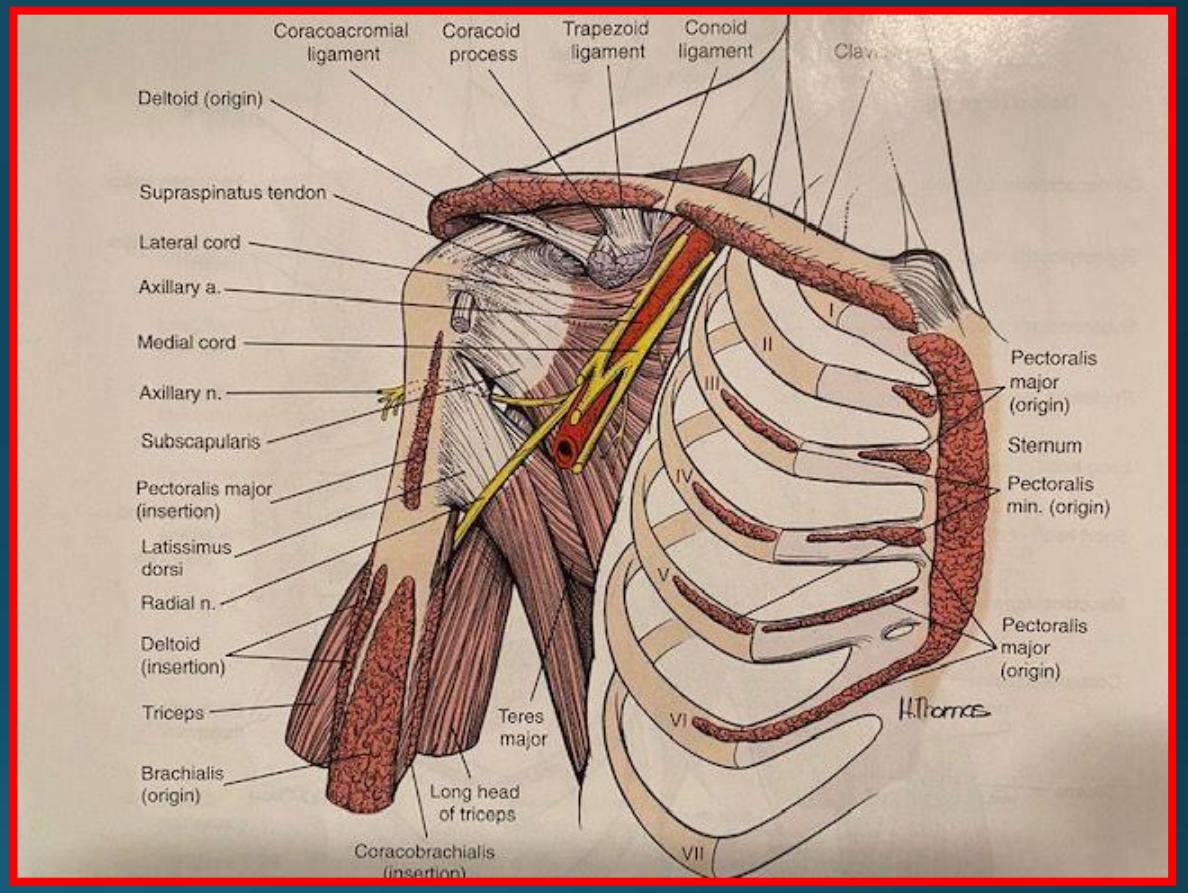
Dominant Extremity

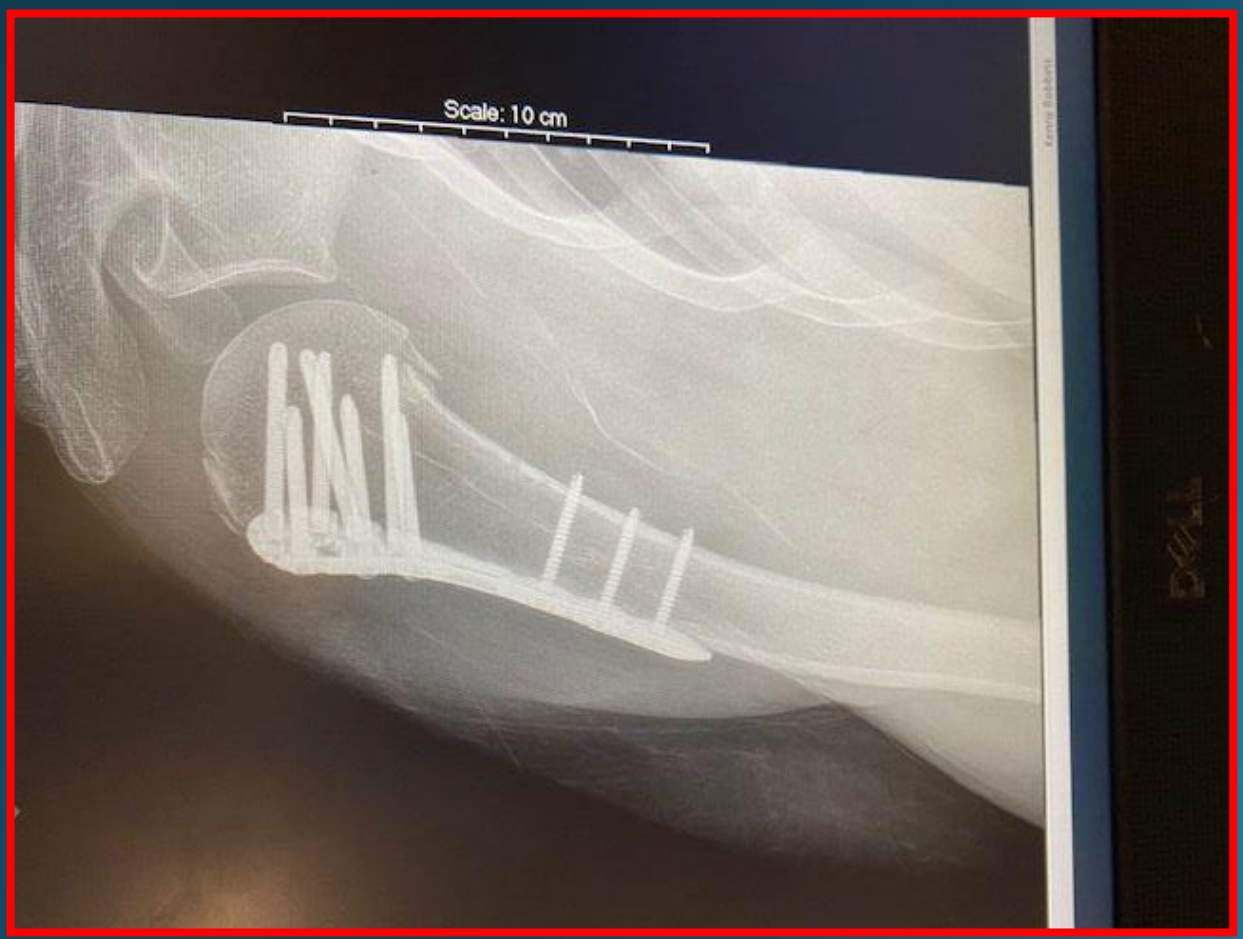
Slipped and fell on ice

Manager at retail store




Supraspinatus tendon
Coracoacromial ligament
Deltoid (origin)
Clavicle
Brachial plexus and axillary a.
Pectoralis major
Sternum
Subscapularis tendon
Deltoid
Long head of biceps
Musculocutaneous n.
Pectoralis major
Coracobrachialis
Axillary a.
Biceps
Triceps
Shaft of humerus
Teres major
Latissimus dorsi
H.Thomas


Coracoacromial ligament
Coracoid process
Trapezoid ligament
Conoid ligament
Deltoid (origin)
Supraspinatus tendon
Lateral cord
Axillary a.
Medial cord
Axillary n.
Subscapularis
Pectoralis major (insertion)
Latissimus dorsi
Radial n.
Deltoid (insertion)
Triceps
Brachialis (origin)
Teres major
Long head of triceps
Coracobrachialis (insertion)
I
II
III
IV
V
VI
VII
Pectoralis major (origin)
Sternum
Pectoralis min. (origin)
Pectoralis major (origin)
H.Thomas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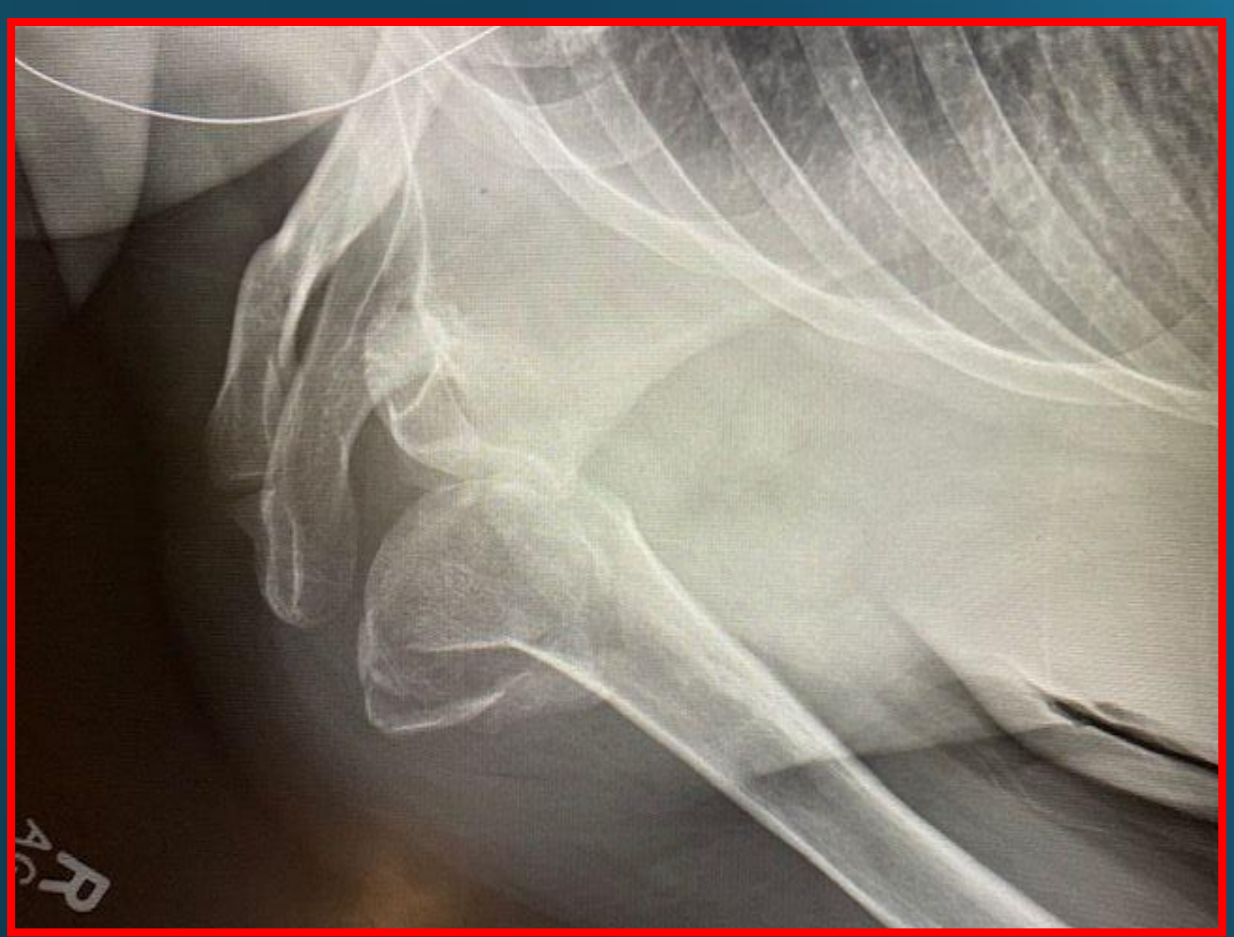
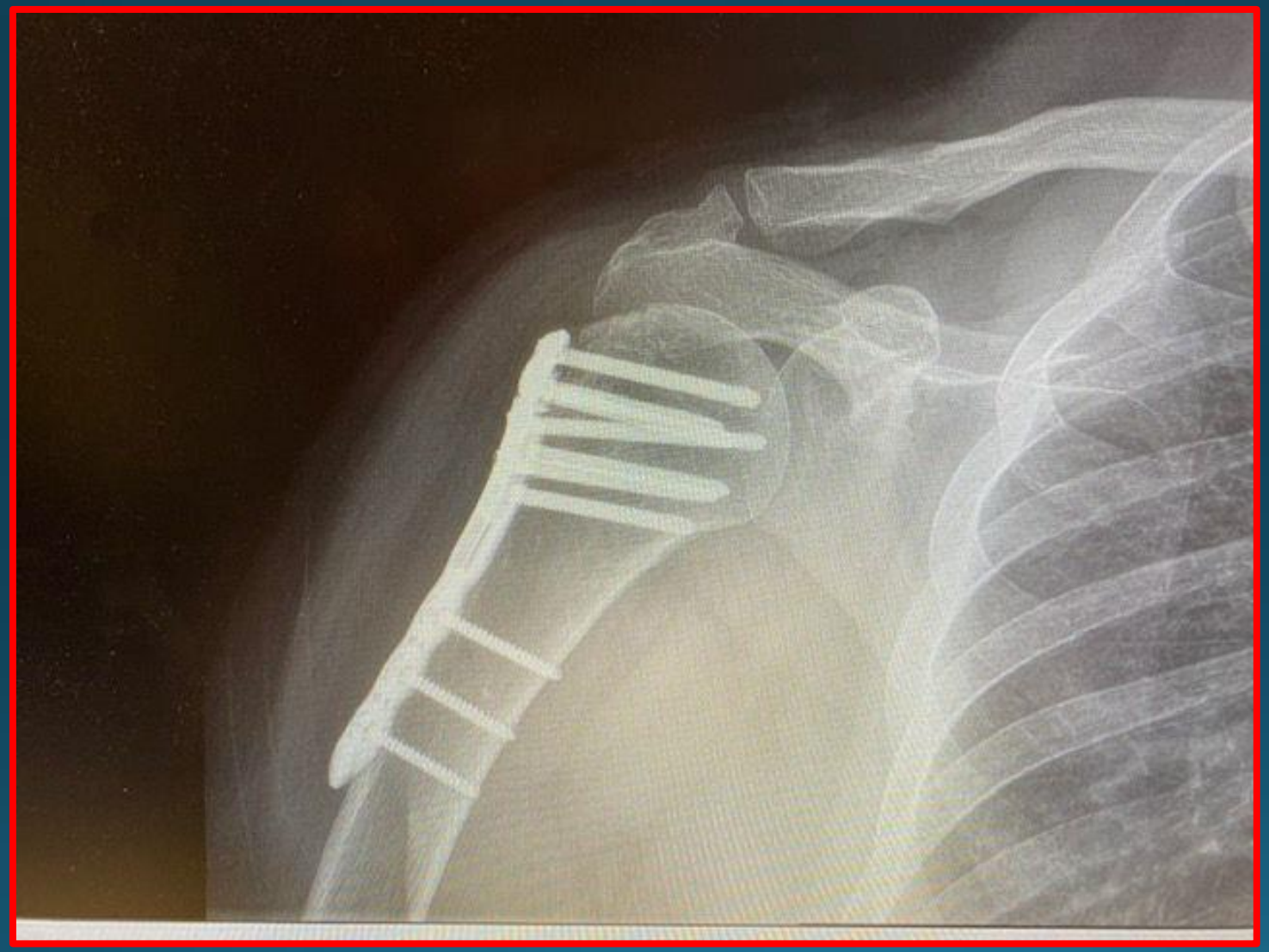
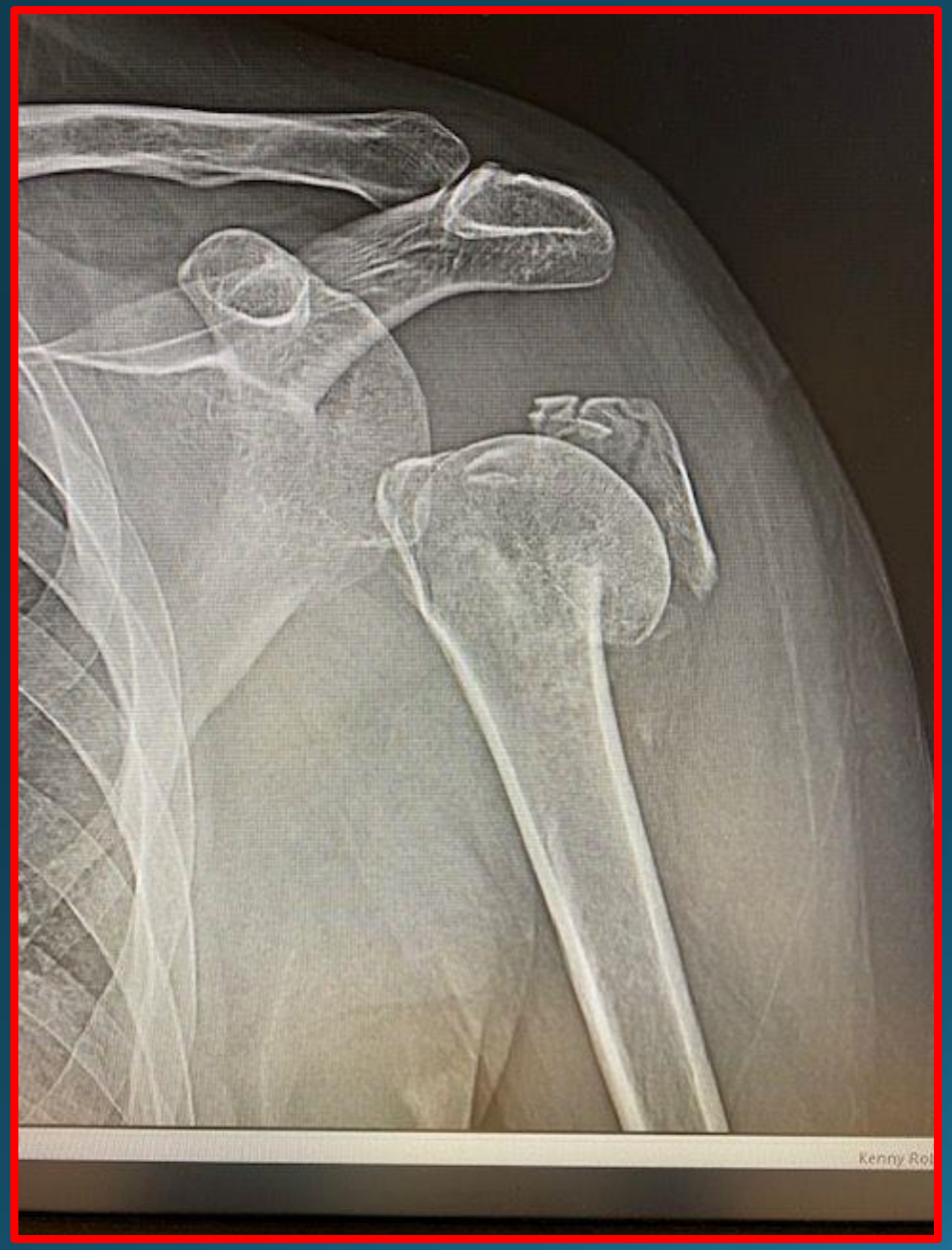
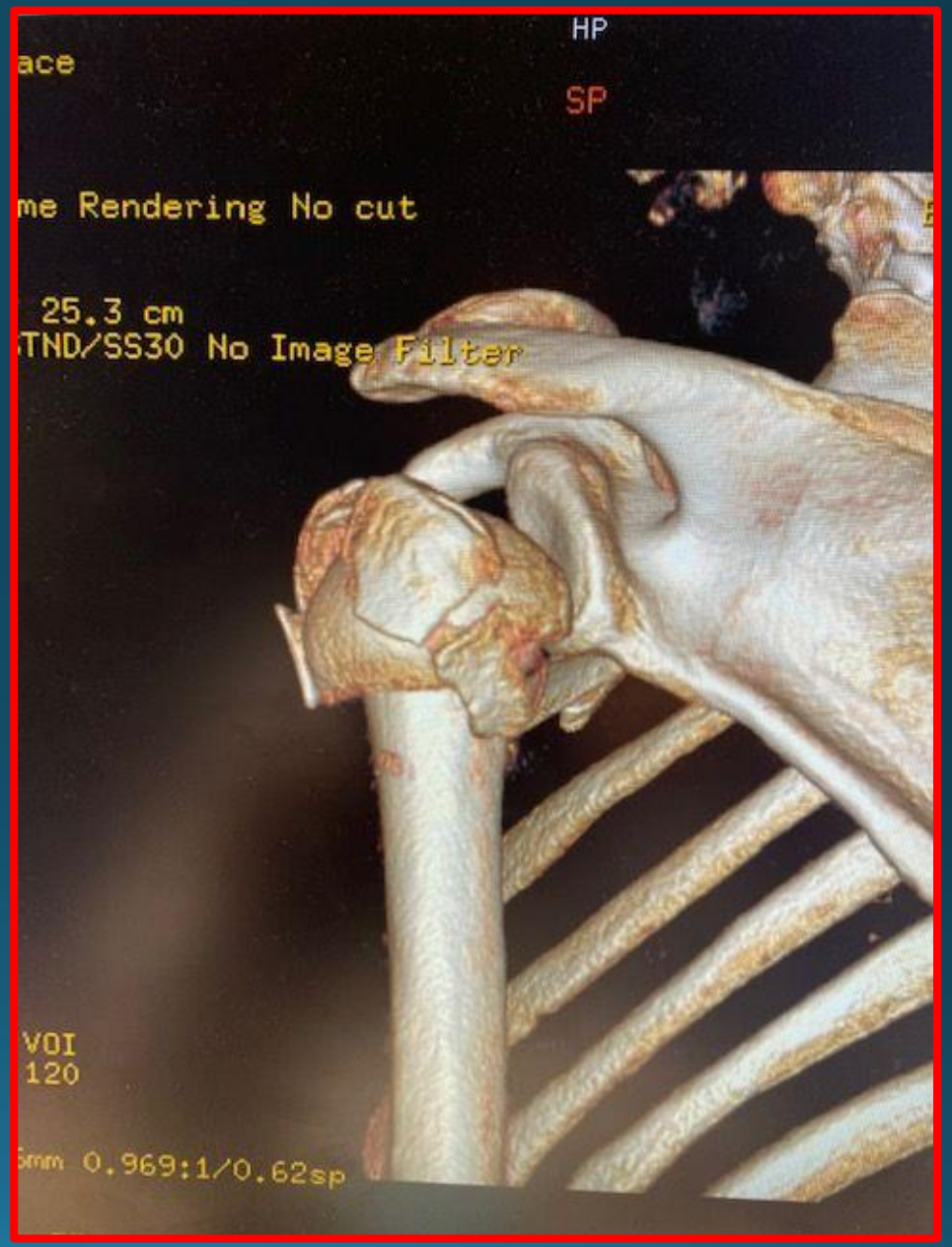




- 52 YO Male
- Fall from Ladder
- Nondominant Extremity
- Accountant

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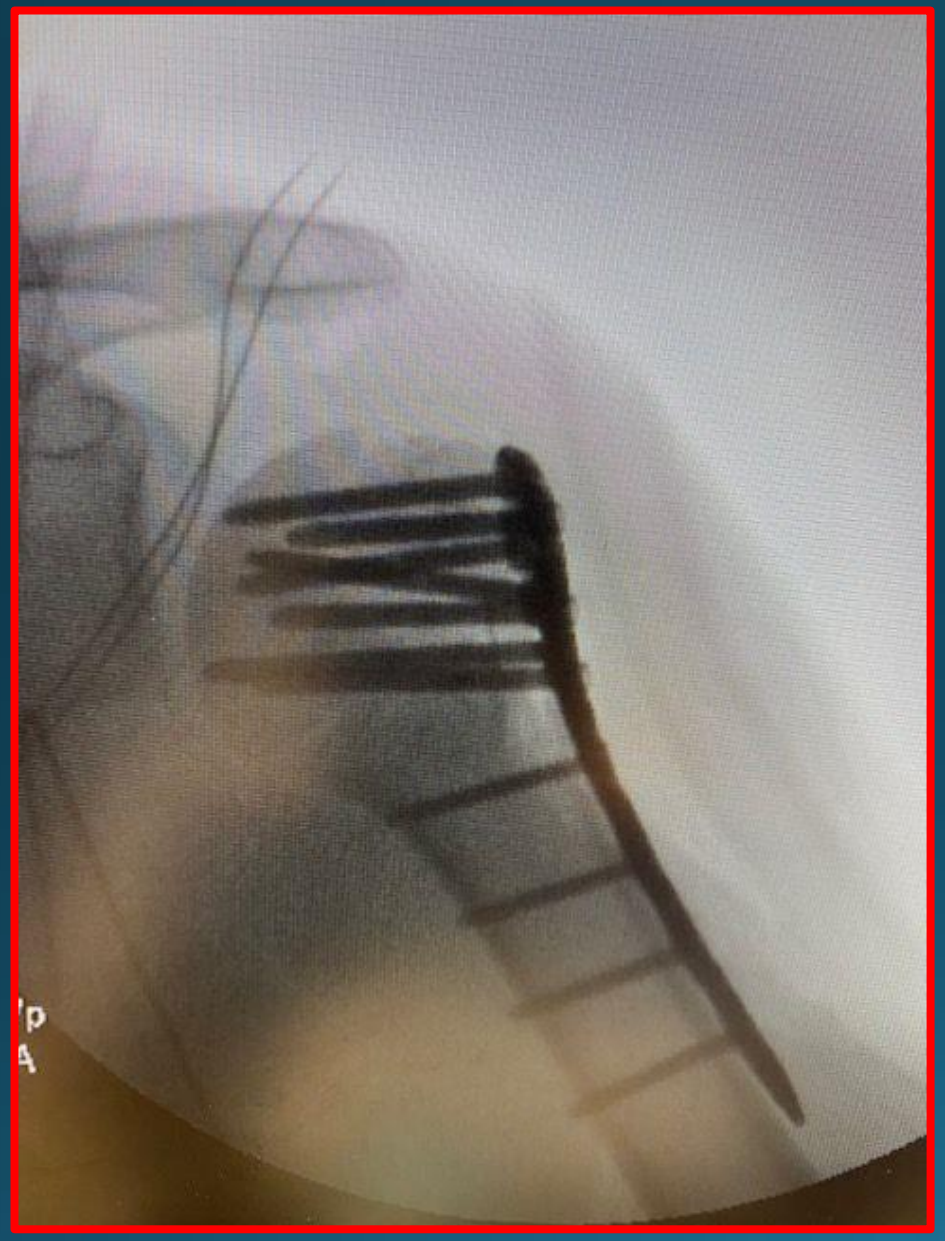
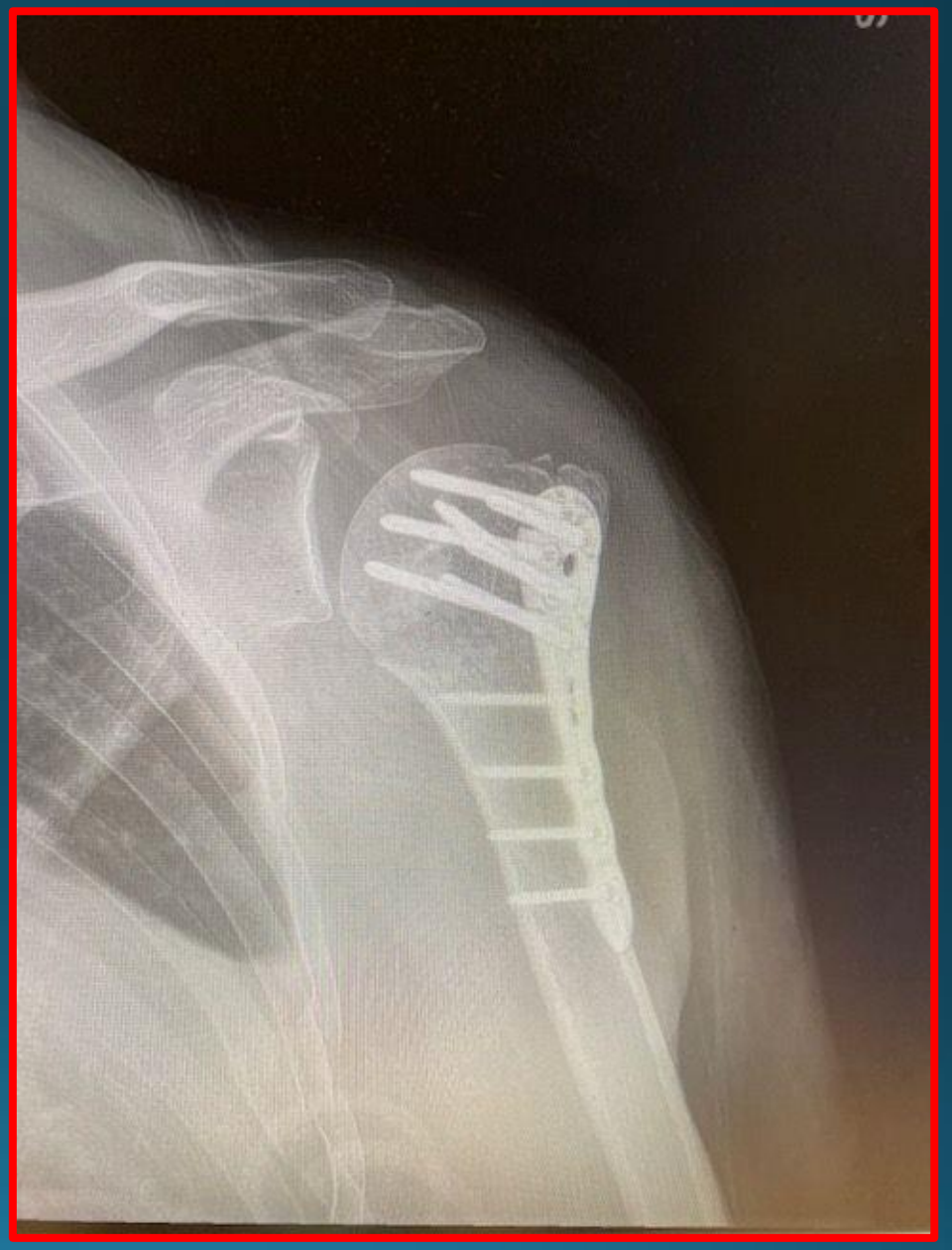
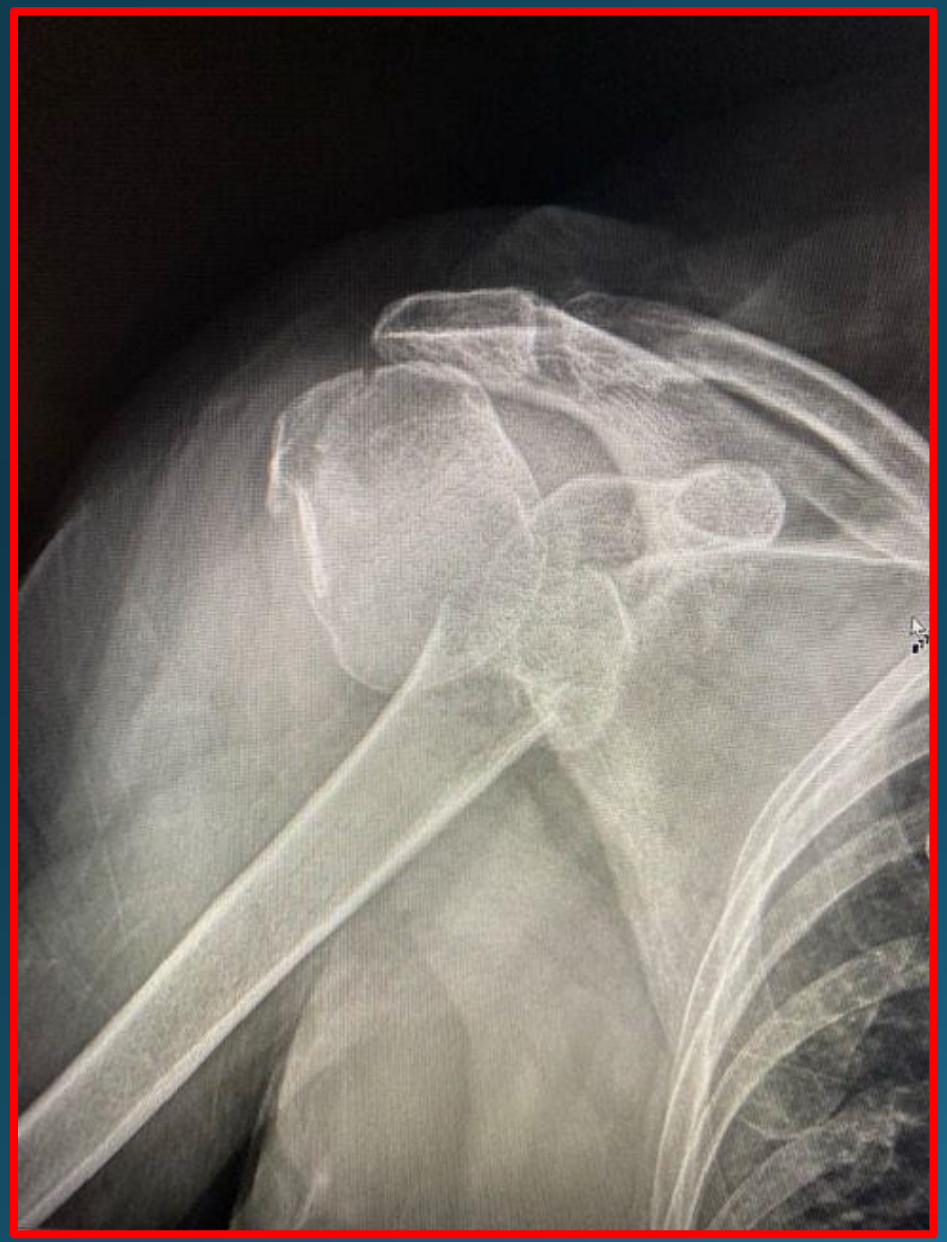
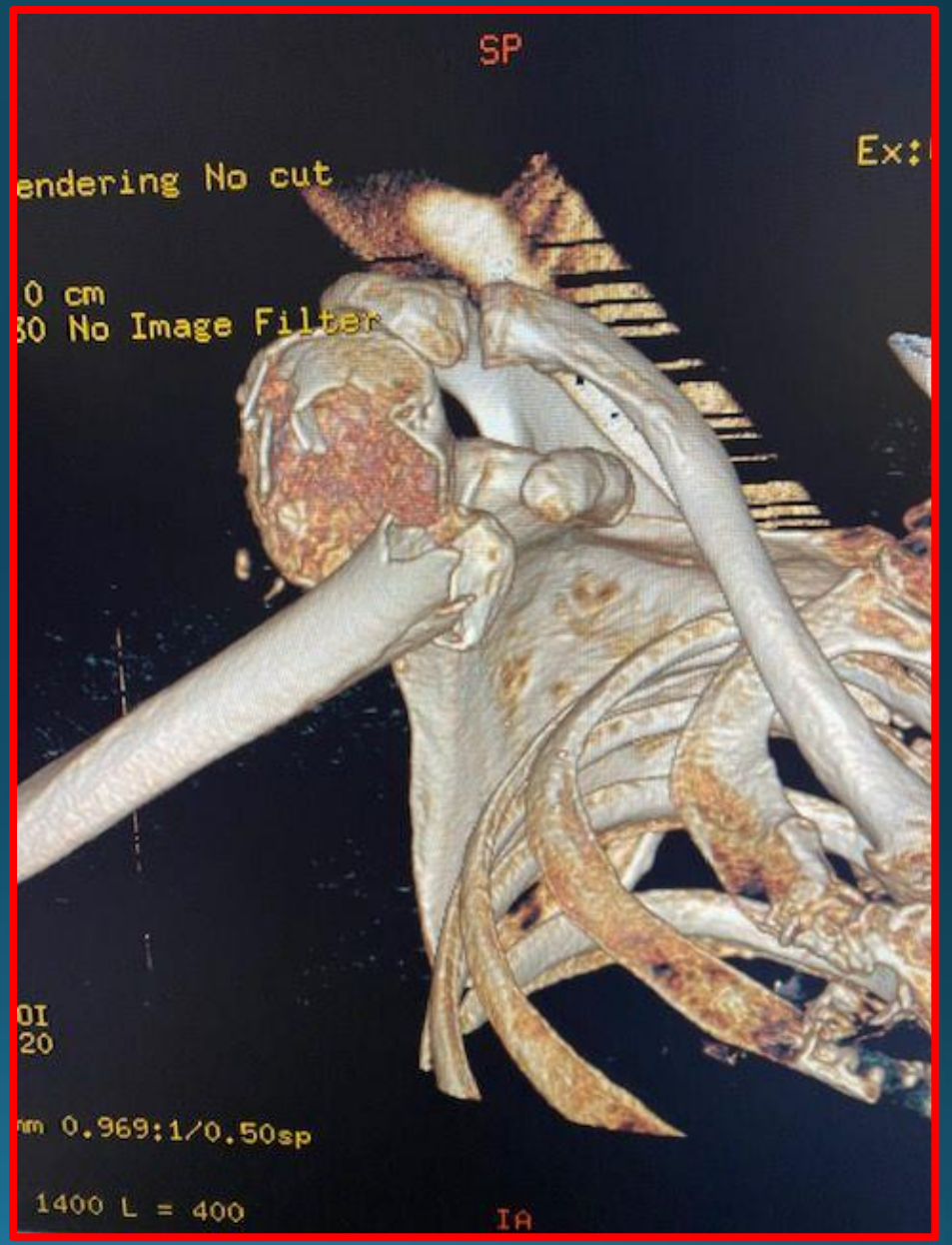




- 70 YO Female
- Dominant extremity
- Trip and fall
- H/O known rotator cuff pathology

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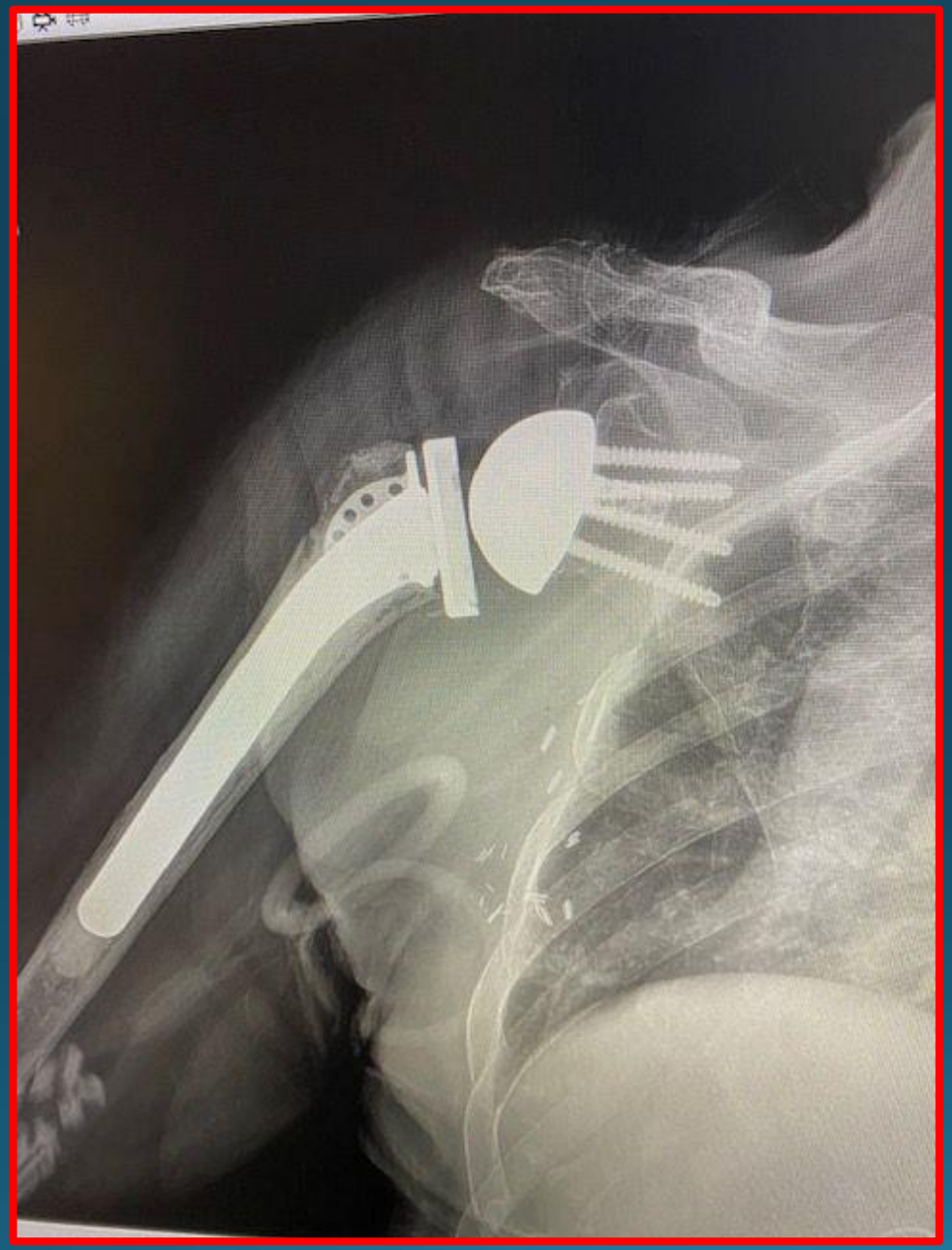
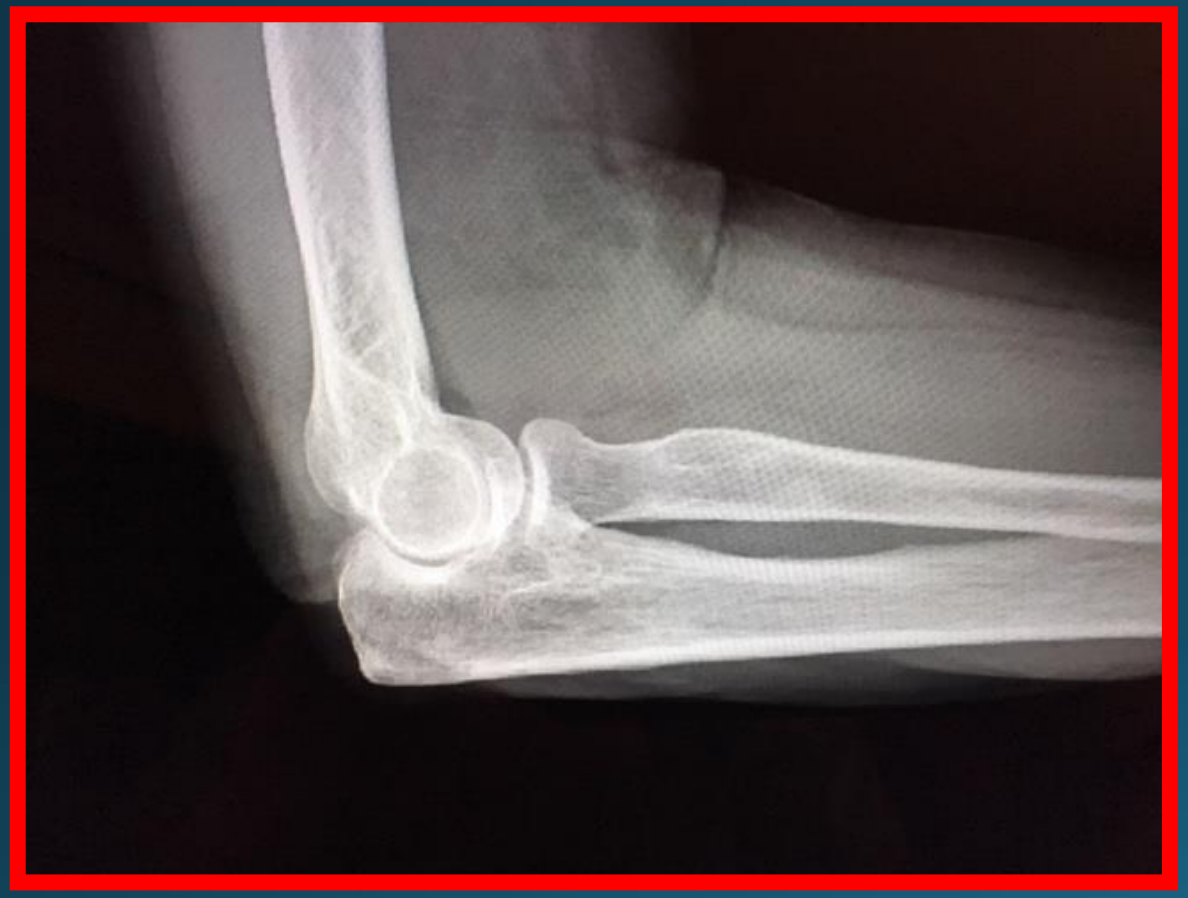
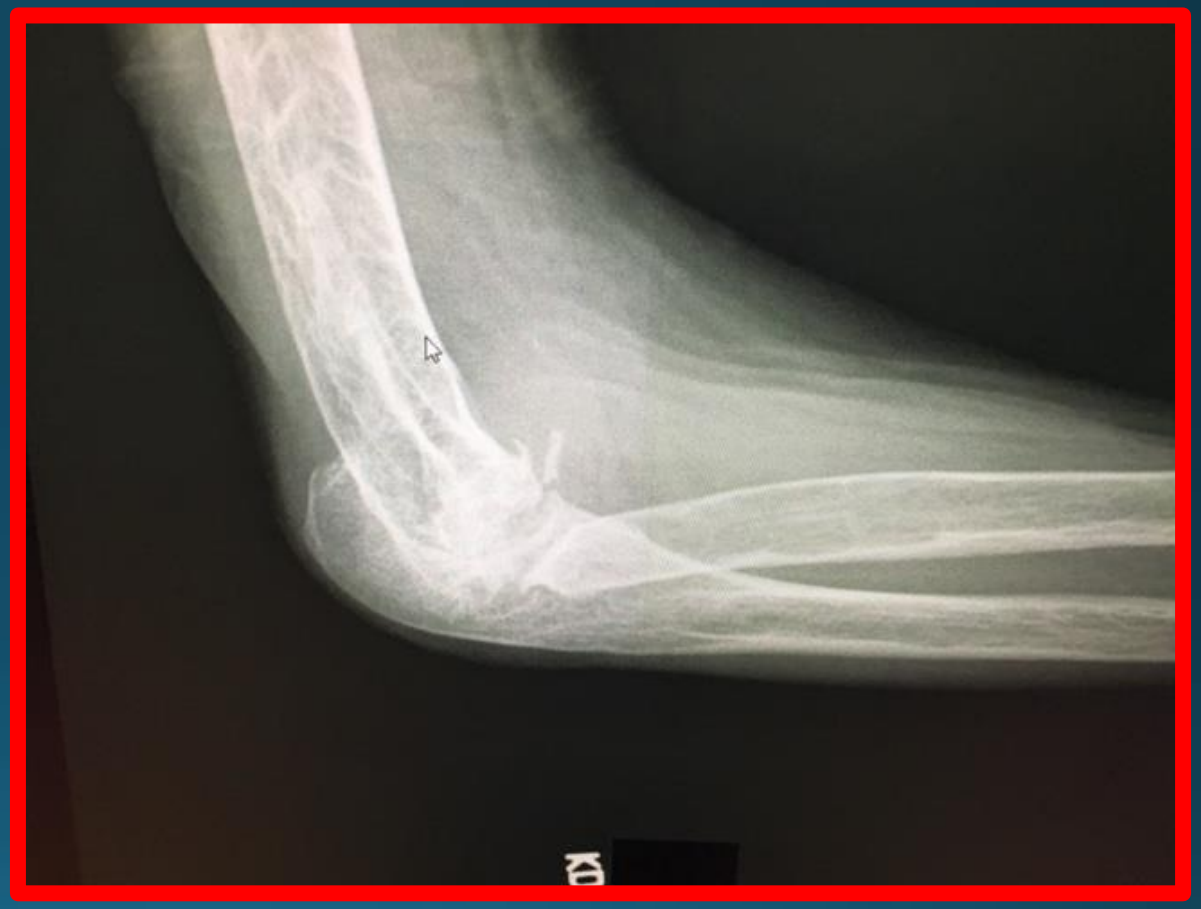
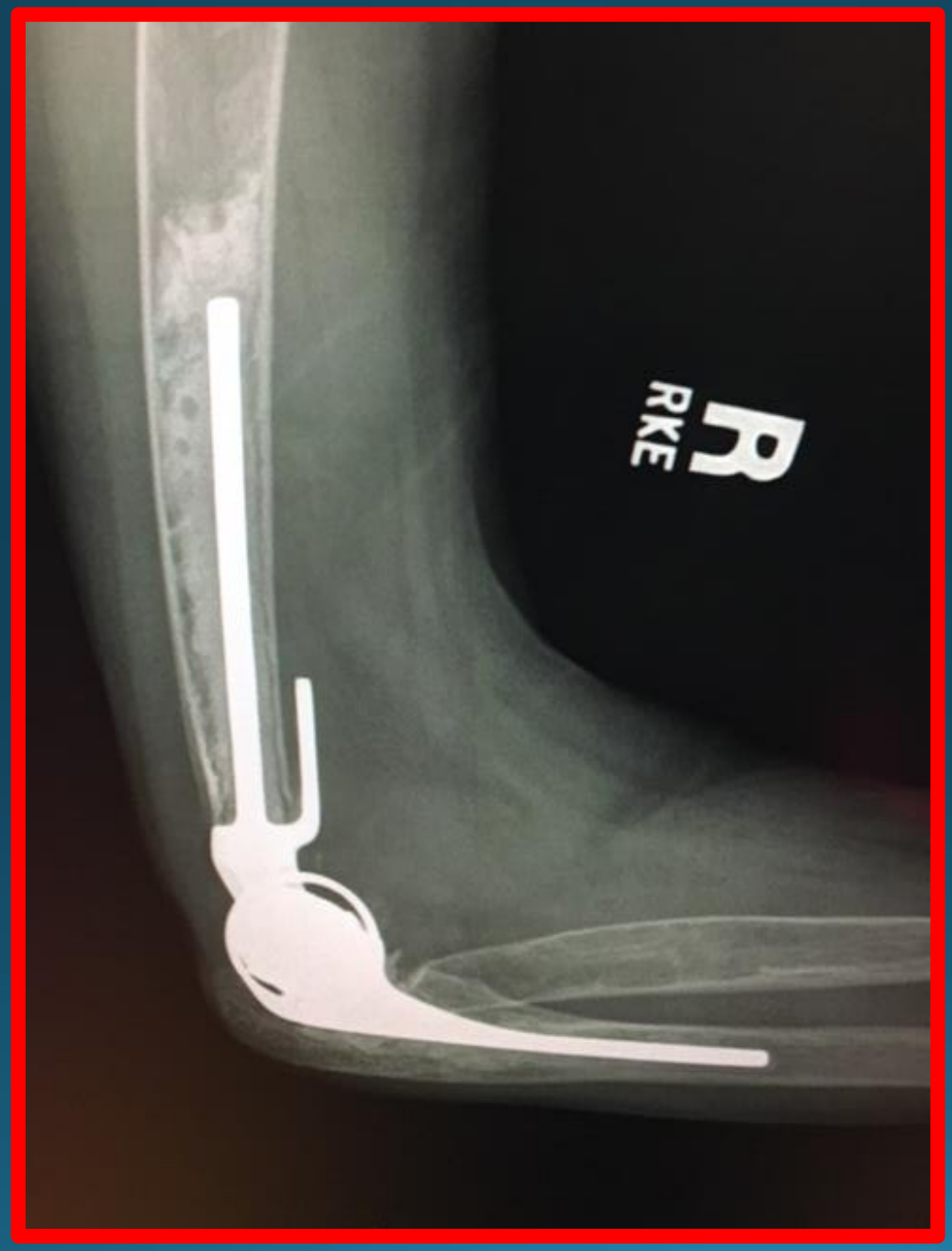


- 68 YO Female
- Severe RA
- Dominant Extremity
- Congenital longitudinal deficiency on ipsilateral side and phocomelia on contralateral side
- Lives alone
- No longer able to perform ADLs






R
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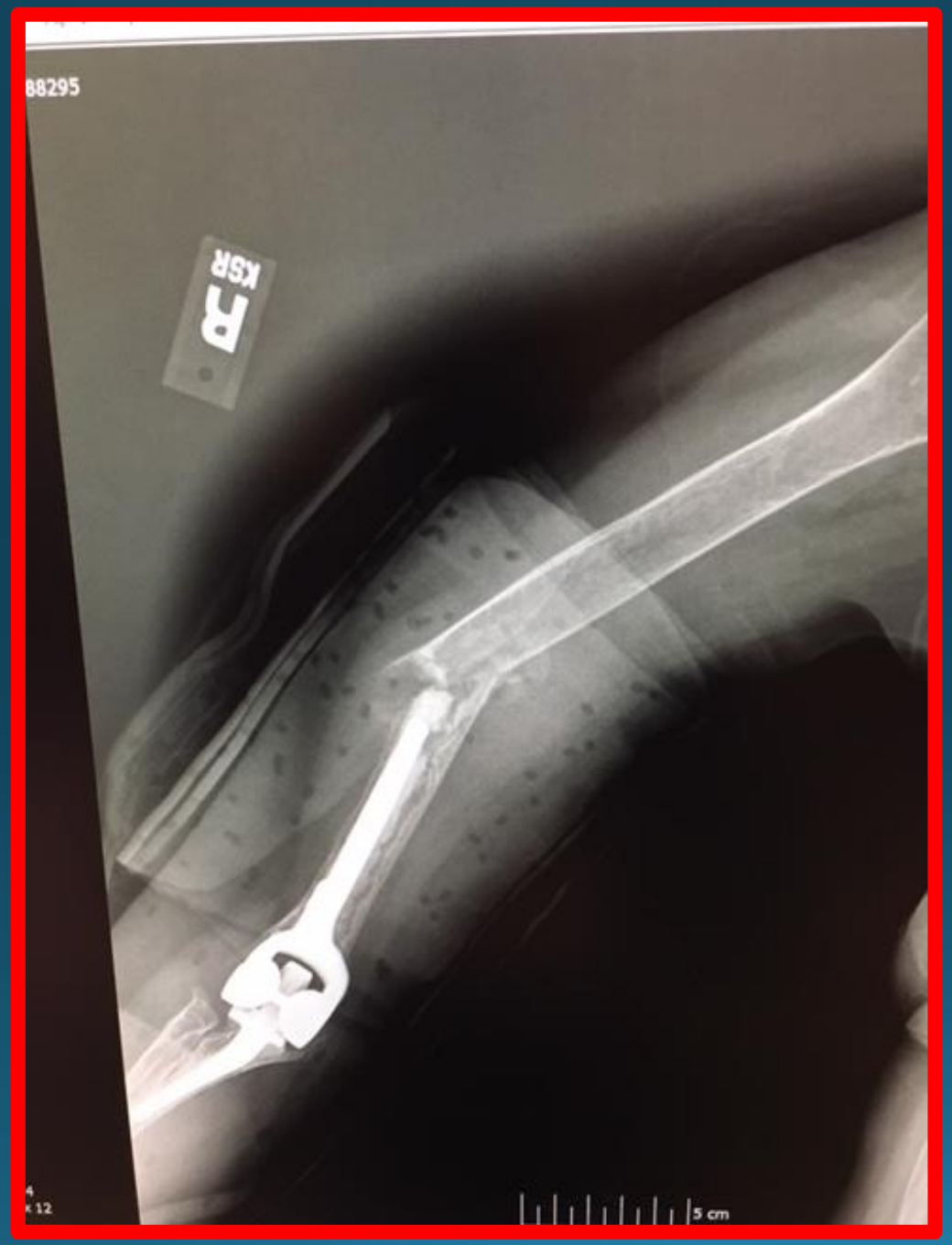
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R
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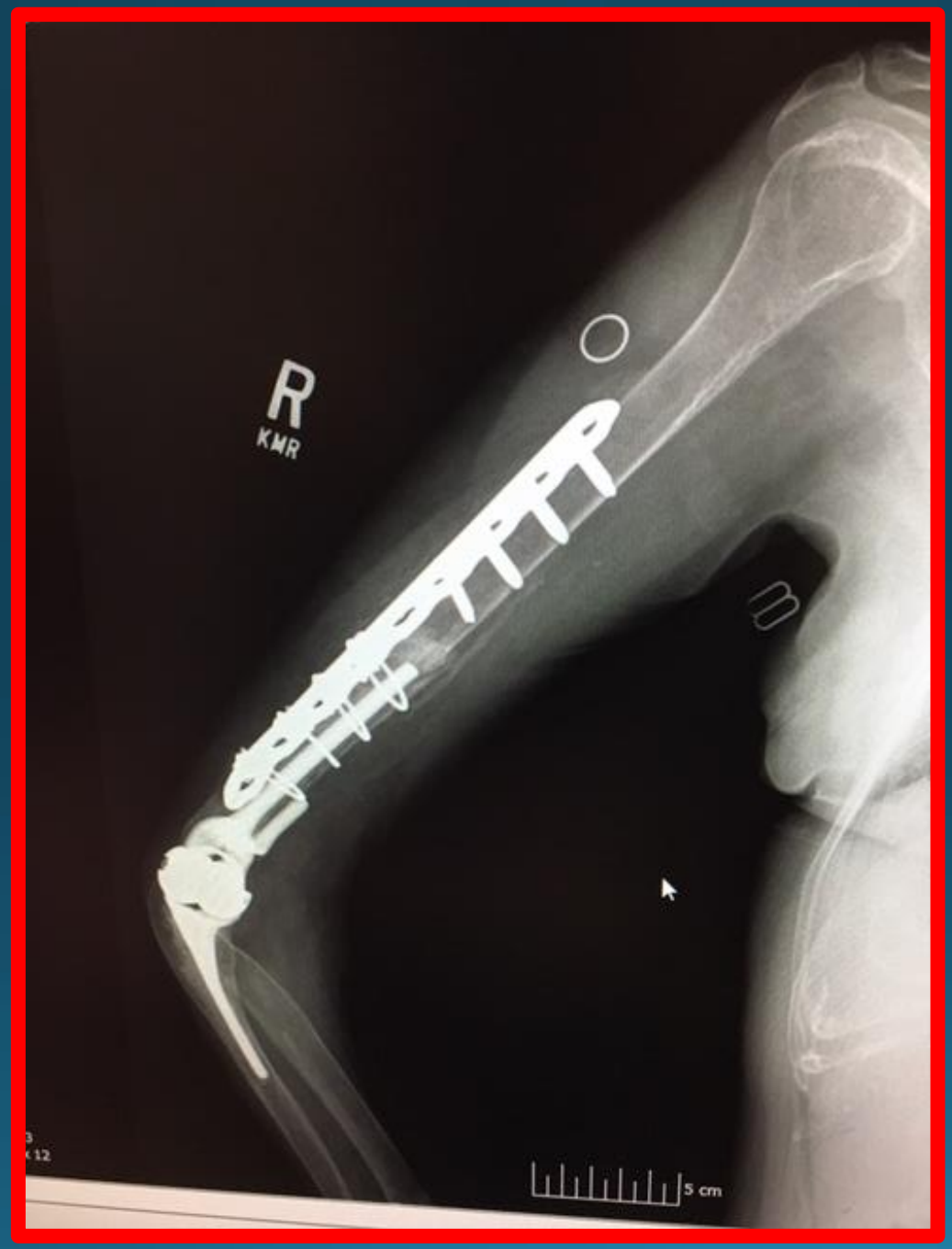
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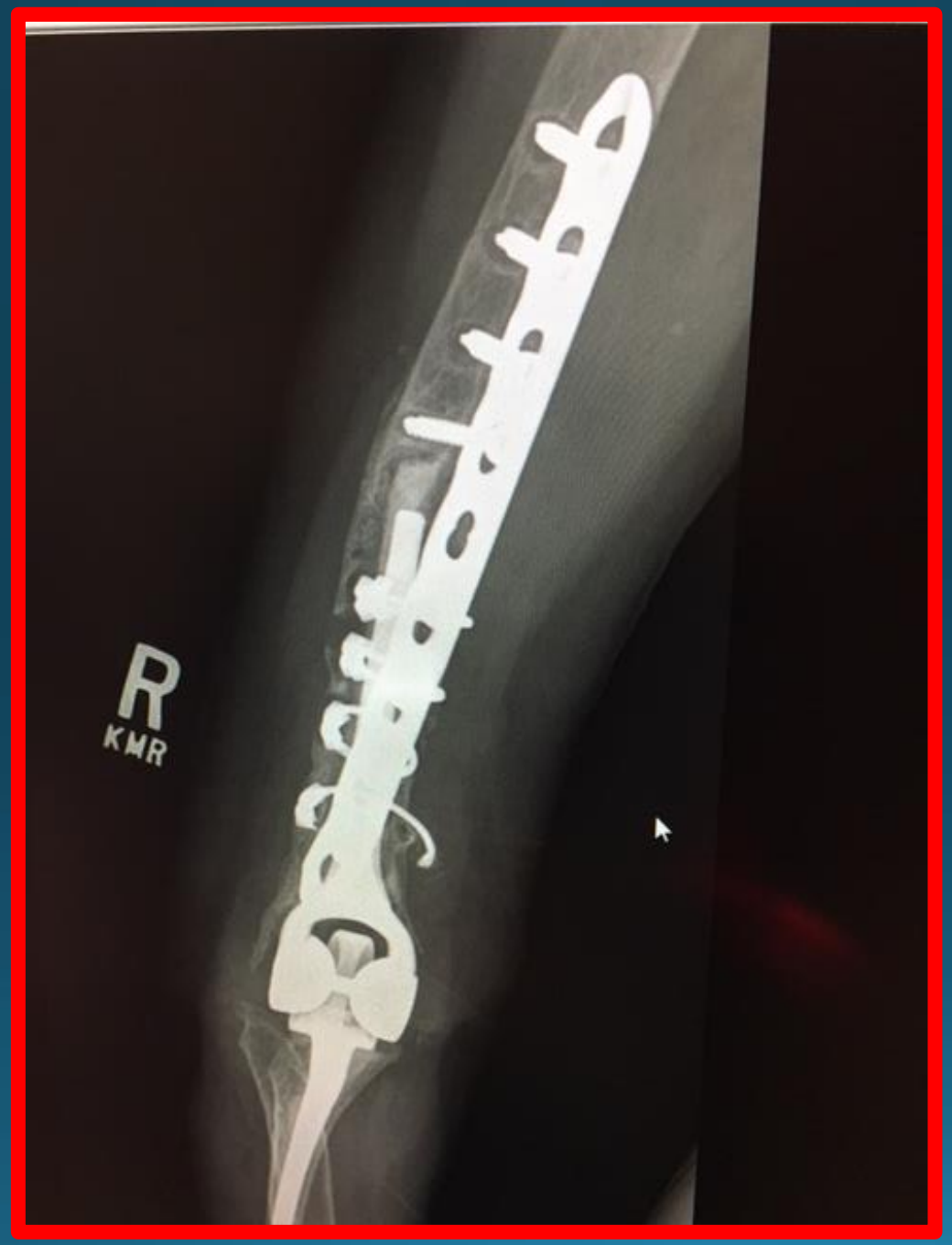
5 cm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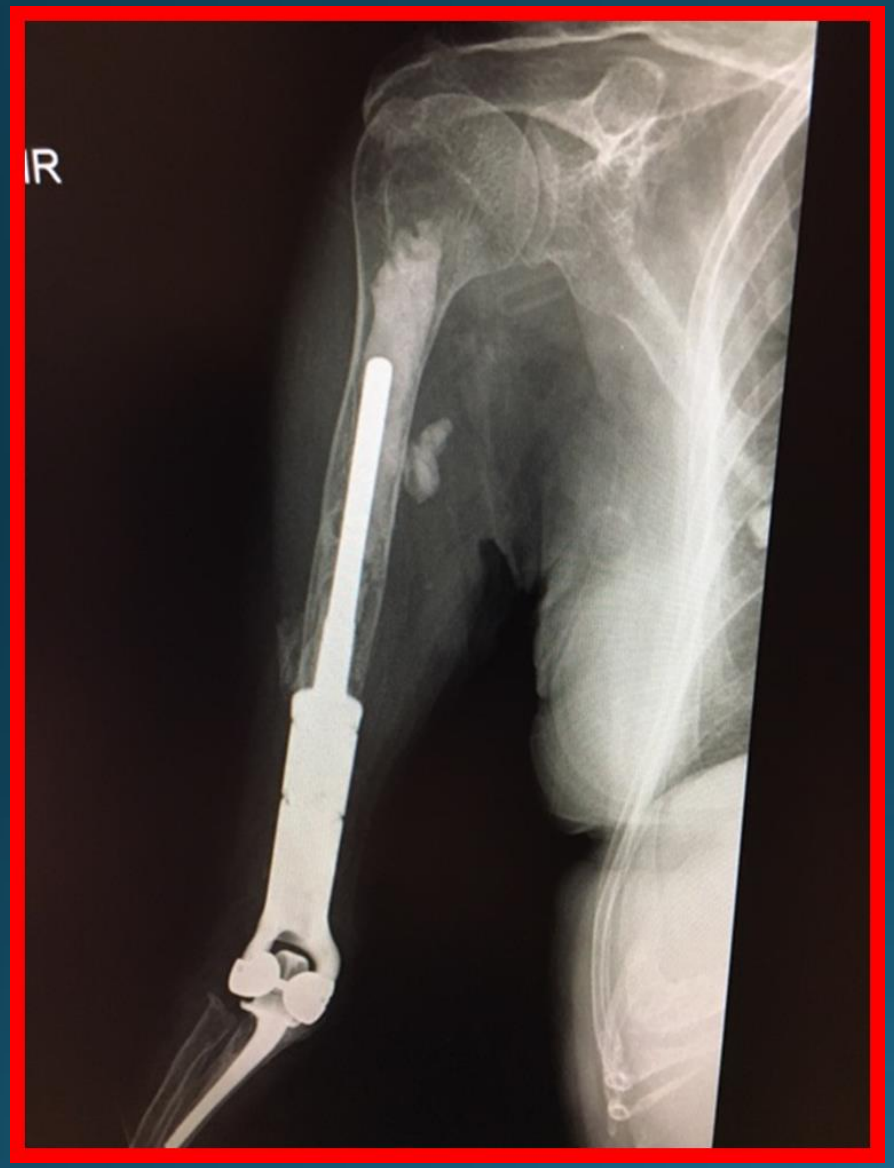
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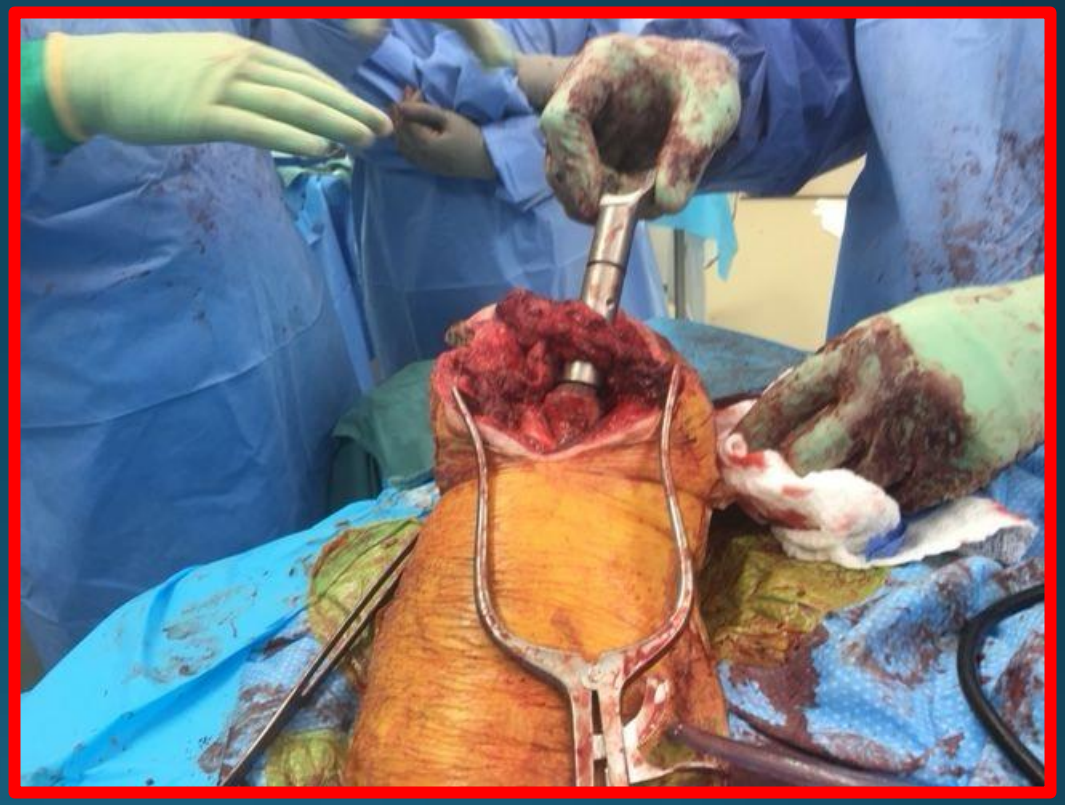

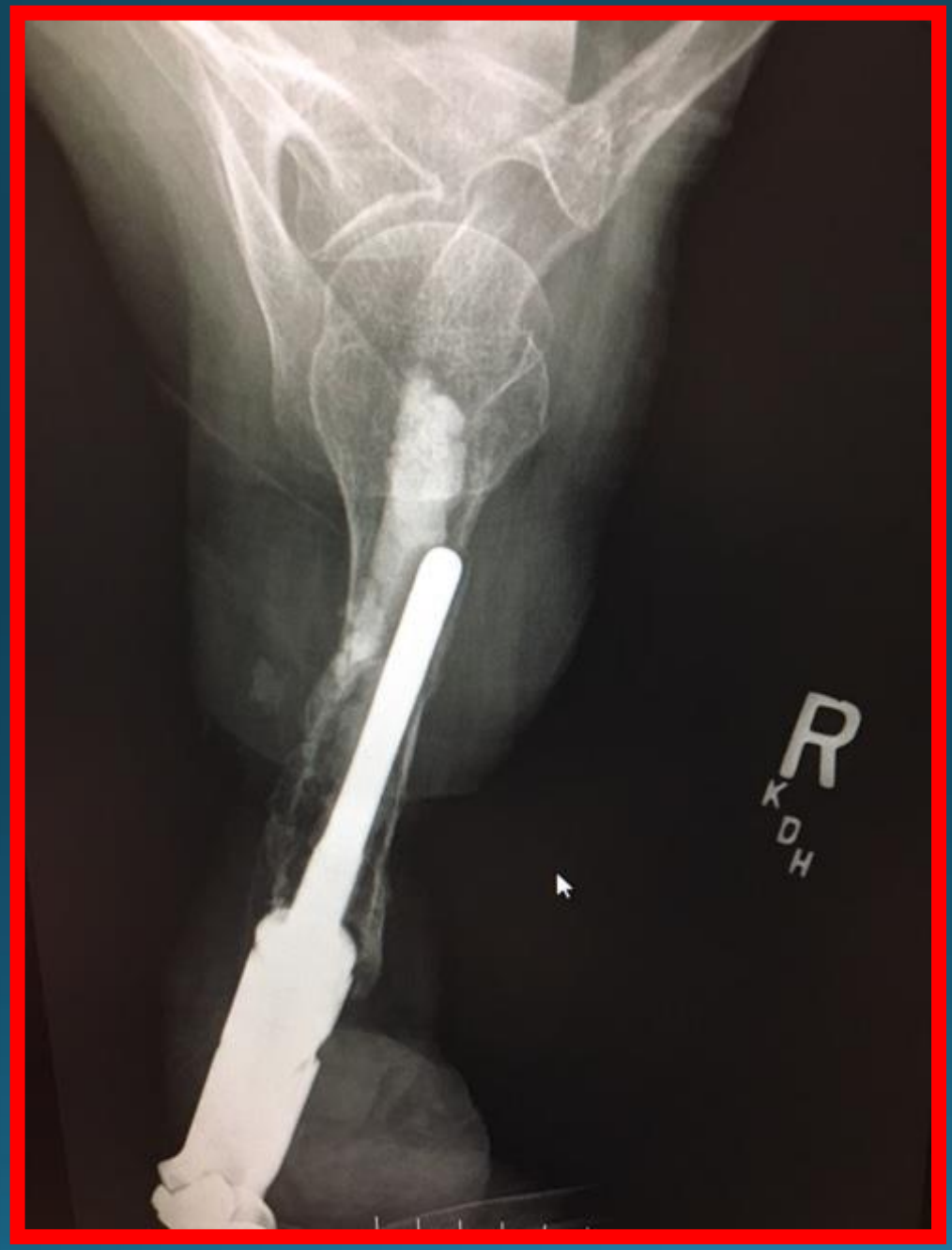
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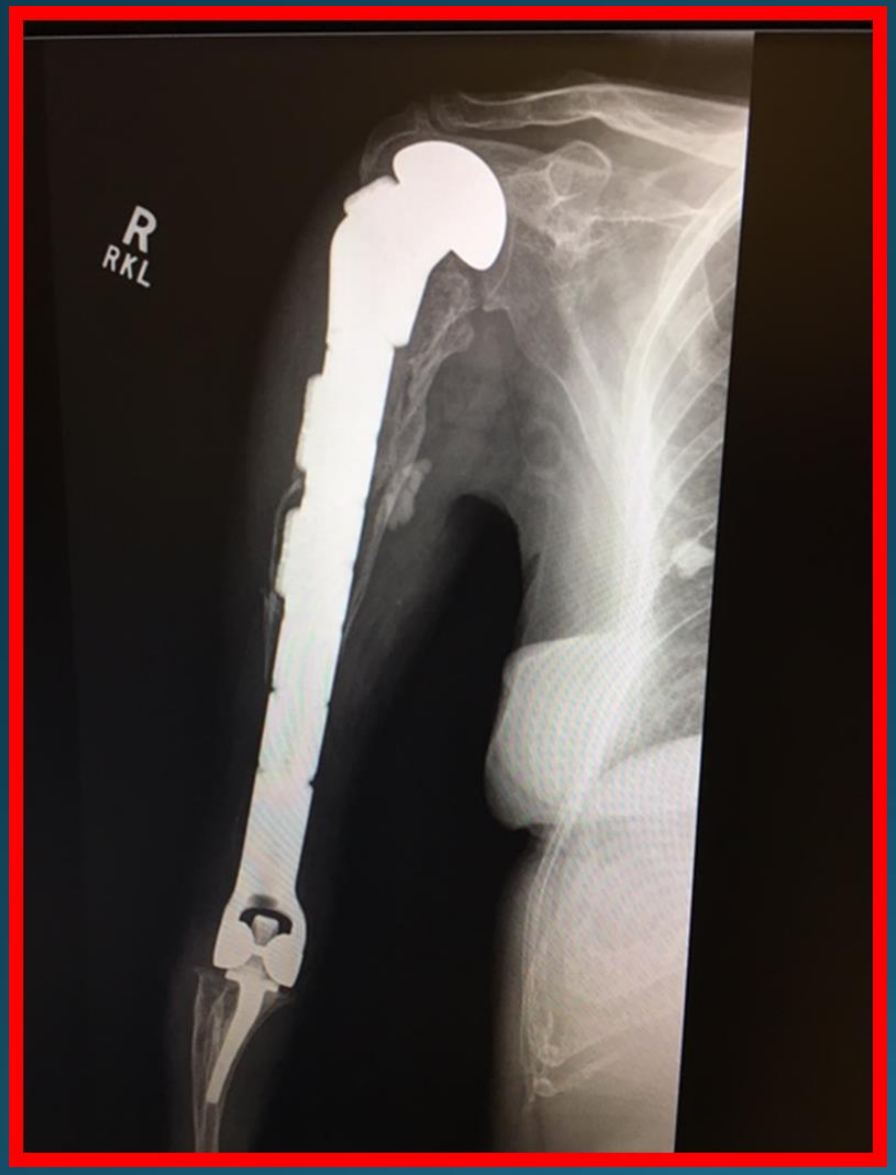
R
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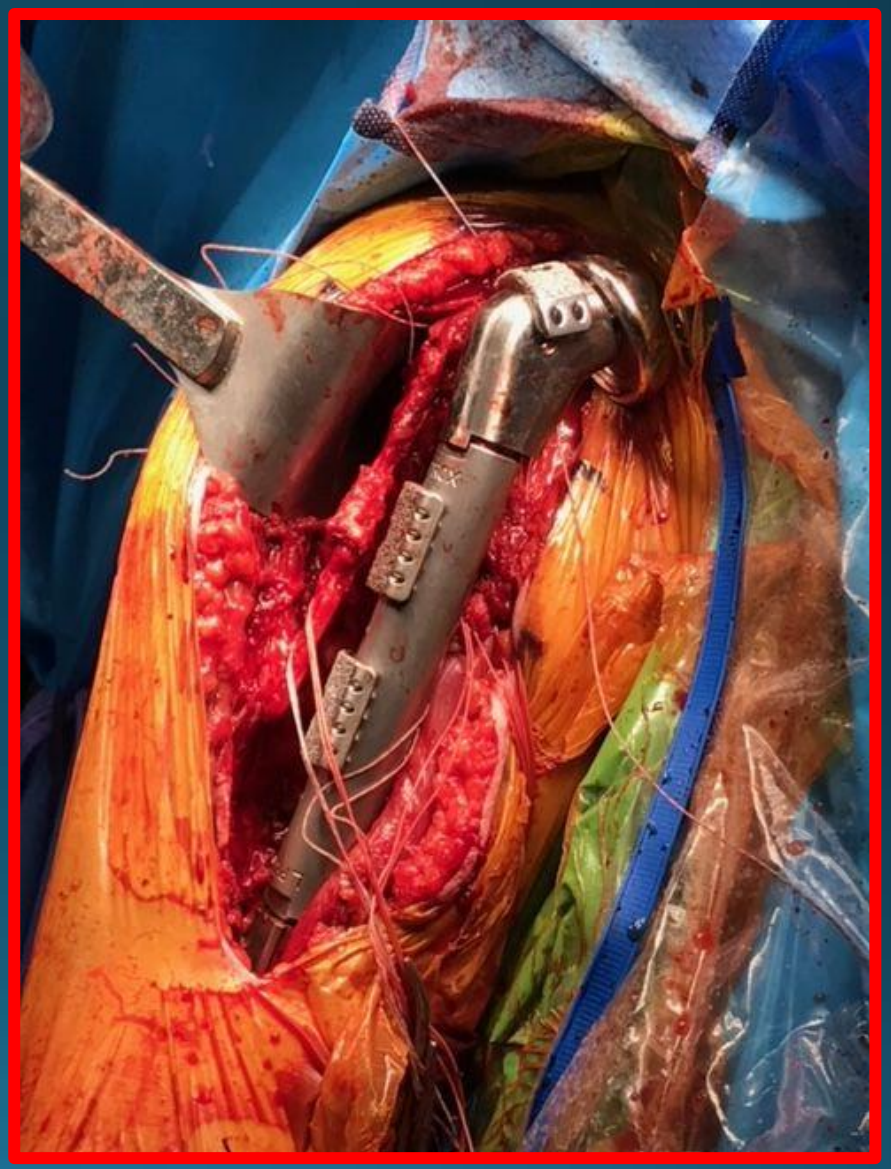


BONE AND JOINT
INSTITUTE