Shoulder Injuries

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Role of the Emergency Department

- Need to be mindful of WHAT IS IMPORTANT TODAY and hence what needs to be done right now:
  - Rule OUT significant pathology which might require immediate or prompt attention
    - Know your population, including what injuries are likely and which significant injuries need to be ruled out
  - Appropriately manage identified pathology and refer on to most appropriate service

Role of Imaging

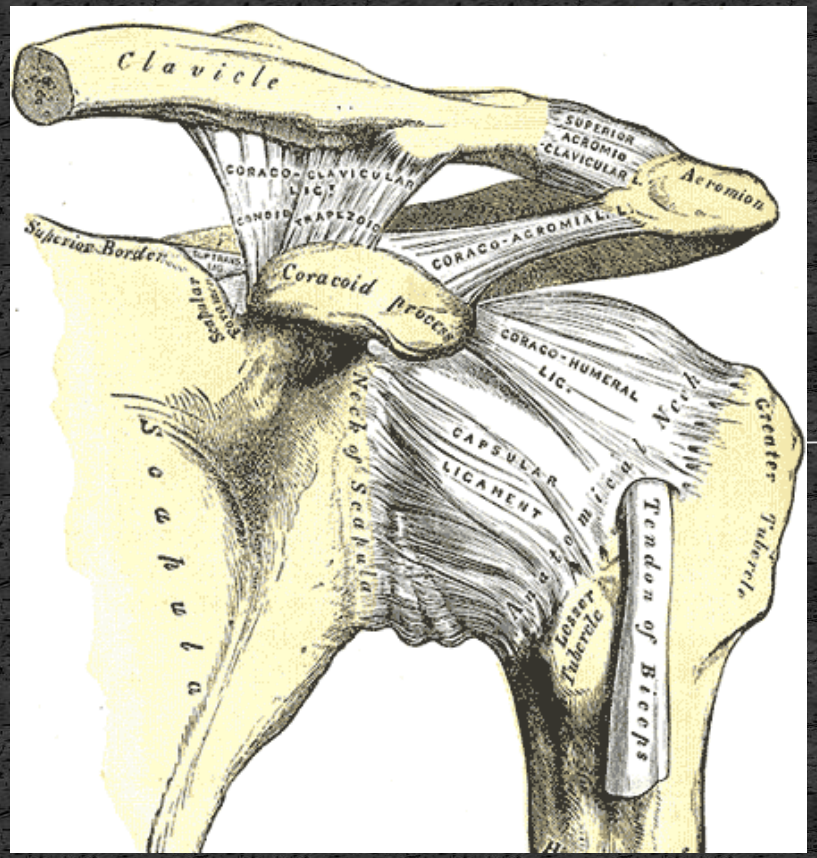
- X-rays and other diagnostic imaging modalities may form a PART of the assessment of a limb injury, but they are not the FULL assessment
- The patient should be examined as thoroughly as possible and a decision made as to whether imaging might be indicated and what the most appropriate modality might be
- It is not always possible to perform a complete examination using all available tests on someone with an acute injury, due to pain / swelling. It is therefore important to realise the tests which are going to help rule out the most significant pathology

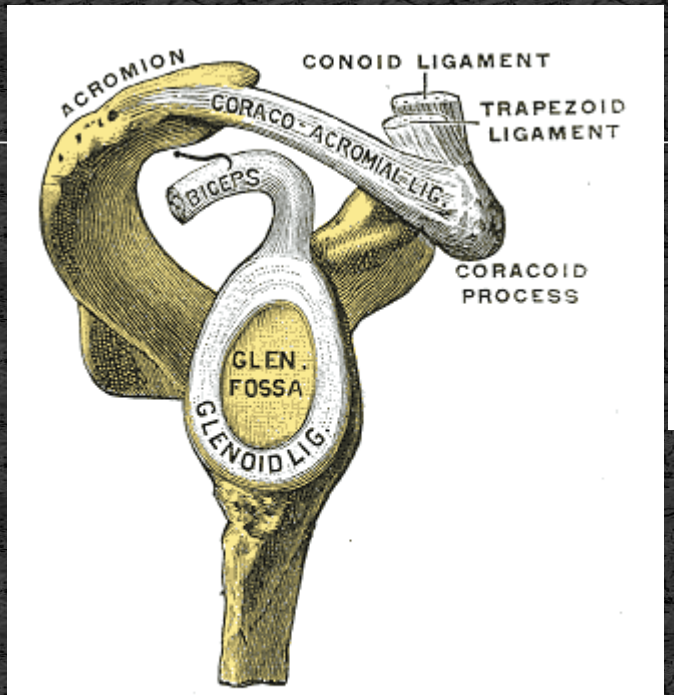
Shoulder Complex

Shoulder Complex

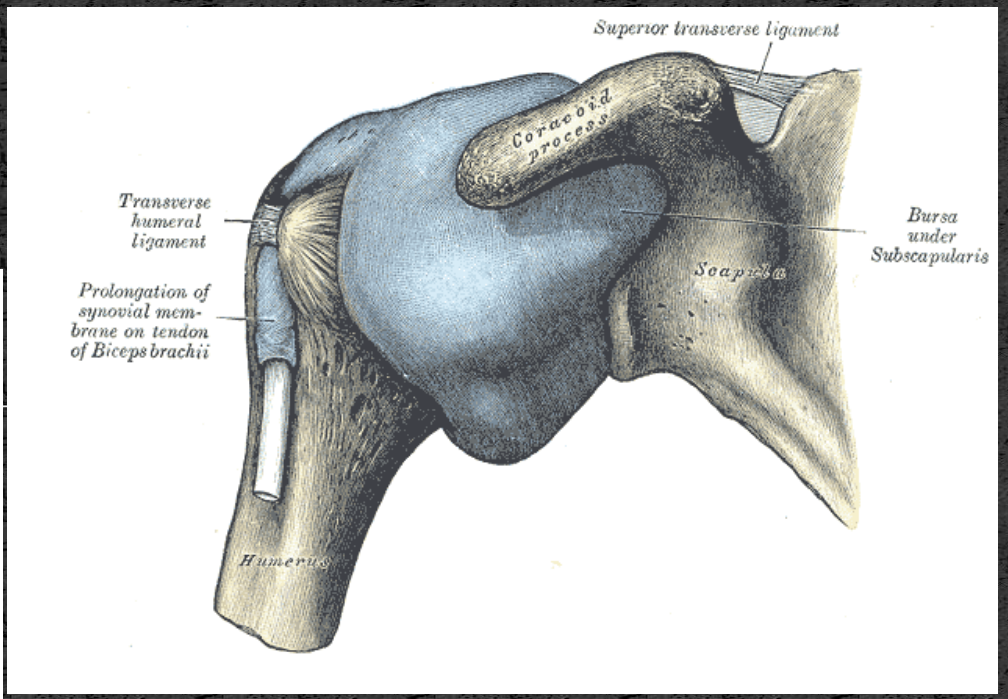
- The shoulder complex consists of the:
  - Glenohumeral Joint
    - A ball and socket joint with a relatively shallow cup, which is very mobile and inherently unstable
    - Supported by series of ligaments, a labrum (which deepens the cup) and the rotator cuff to provide passive and dynamic stability
  - Scapulothoracic Joint
  - Acromioclavicular Joint
  - Sternoclavicular Joints
- Particular muscles will have a designated function on specific joints
- Dysfunction in any joint or the muscles and stabilising structures will affect the ability to move the shoulder complex

Shoulder Complex

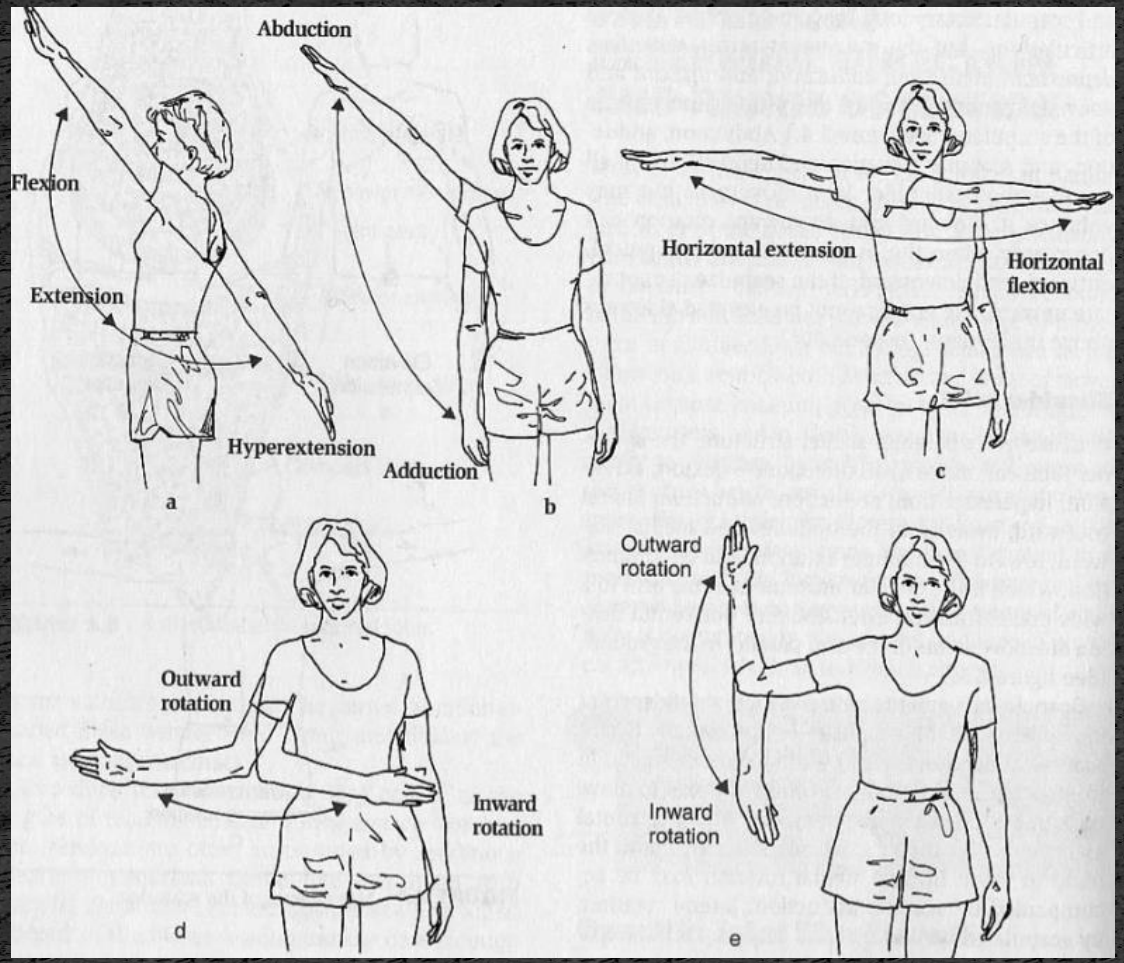




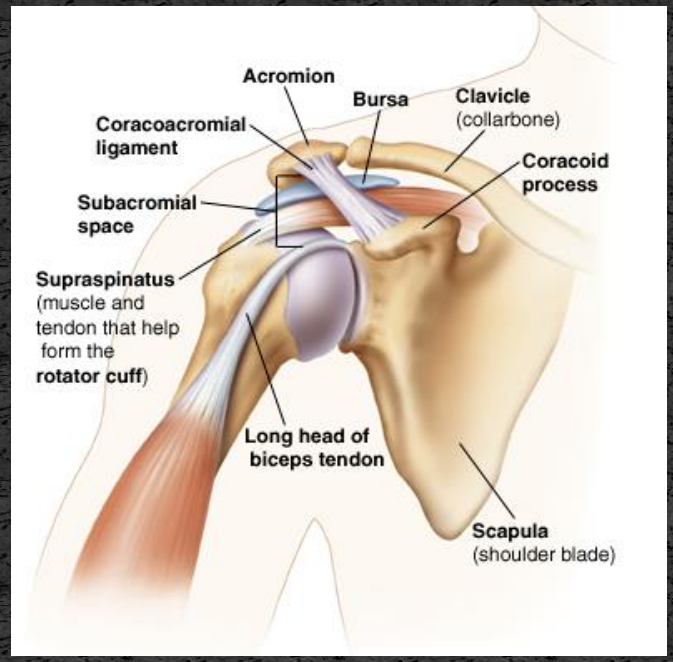
Glenoid fossa of right side.



Shoulder Movement

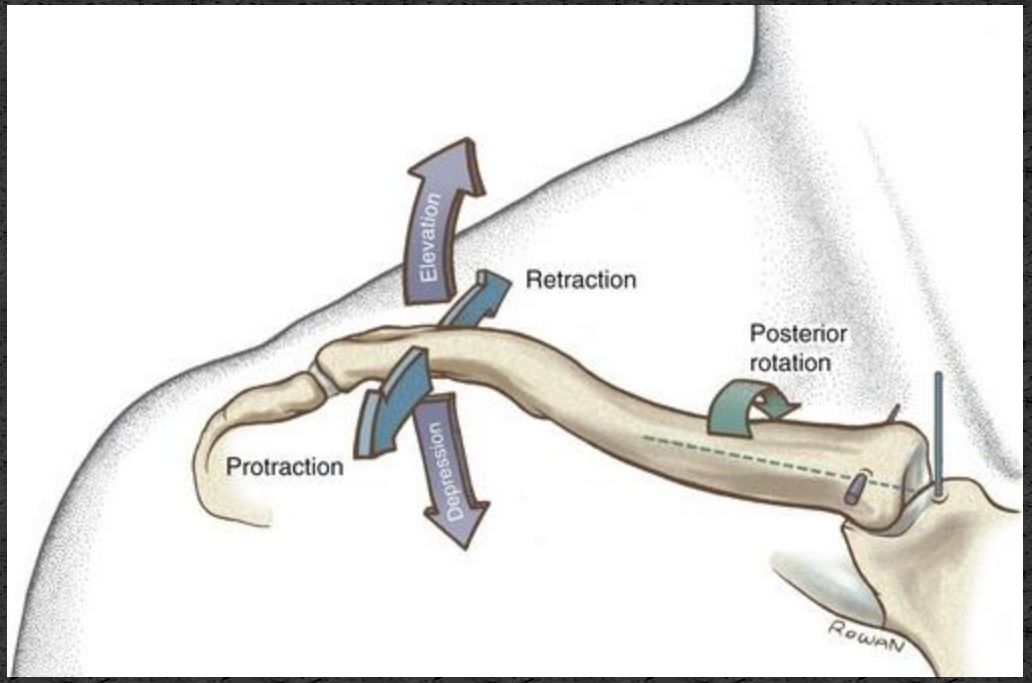


- For shoulder abduction, which has about 180 degrees of movement:
  - Only 120 degrees are from the glenohumeral joint
    - Need 90 degrees of external rotation for the greater tubercle to clear the coracoacromial arch; if cannot ER, then cannot abduct > 90



Shoulder Movement

- For shoulder abduction, which has about 180 degrees of movement:
  - Only 120 degrees are from the glenohumeral joint
  - 60 degrees from the scapulothoracic joint
    - In the first 90 degrees of abduction, there is clavicular elevation
    - In the last 90 degrees, there is clavicular posterior rotation

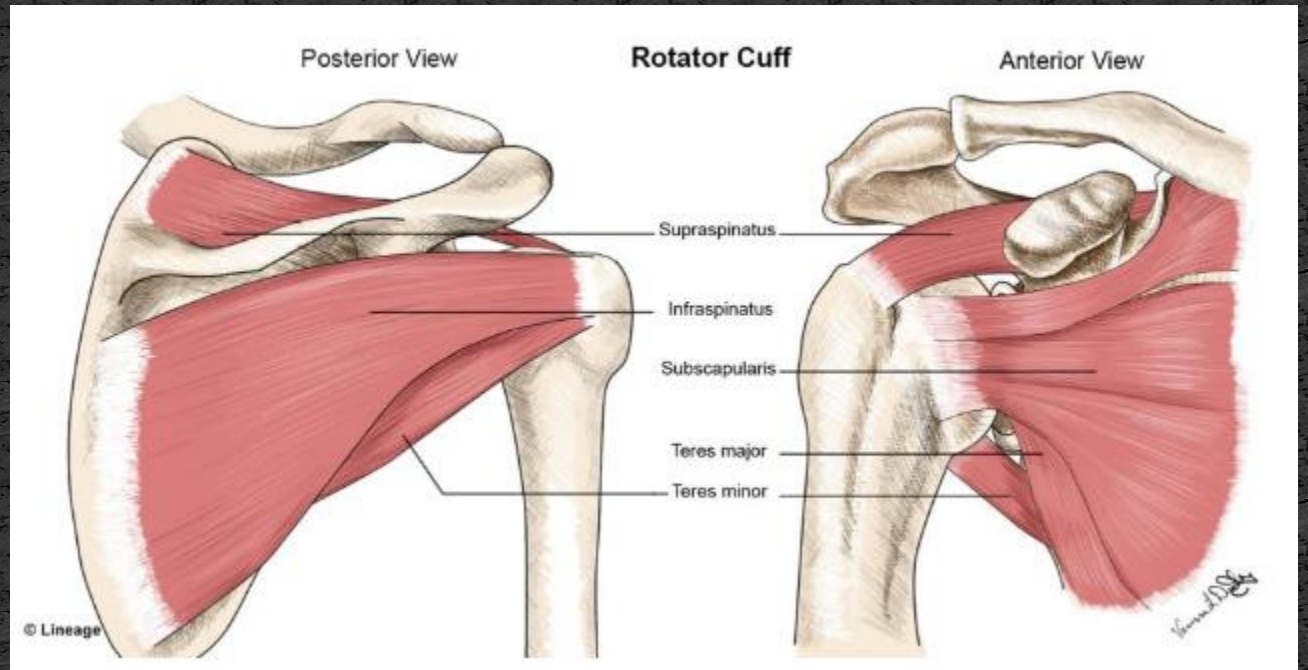


Shoulder Muscles

- Due to the complexity of the joint, there are many muscles involved in shoulder movements:
  - Rotator Cuff
    - Stabilise the shoulder joint (all)

    - External rotators (and assist in shoulder elevation)
      - Supraspinatus
      - Infraspinatus
      - Teres Minor

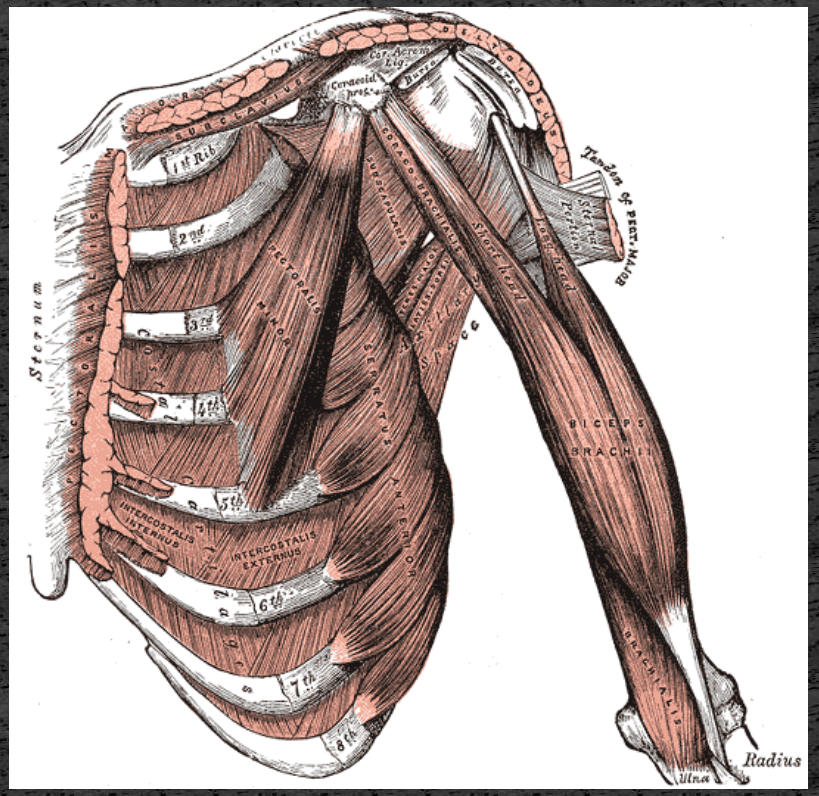
    - Internal rotators
      - Subscapularis

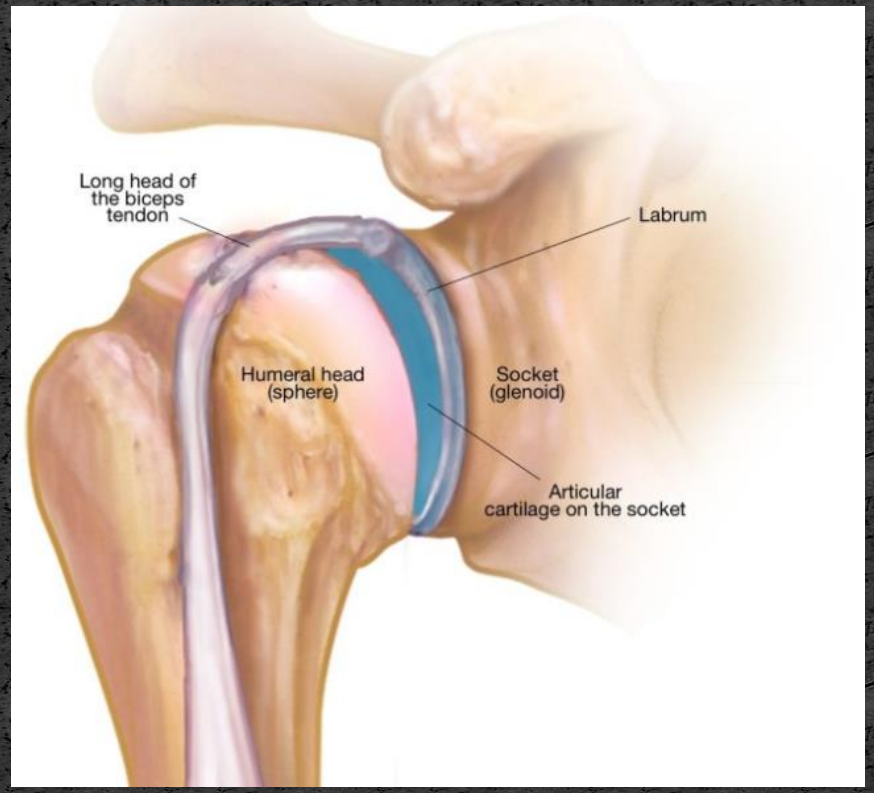


Shoulder Muscles

- Due to the complexity of the joint, there are many muscles involved in shoulder movements:

- Biceps Mechanism
  - Long head biceps
  - Labrum

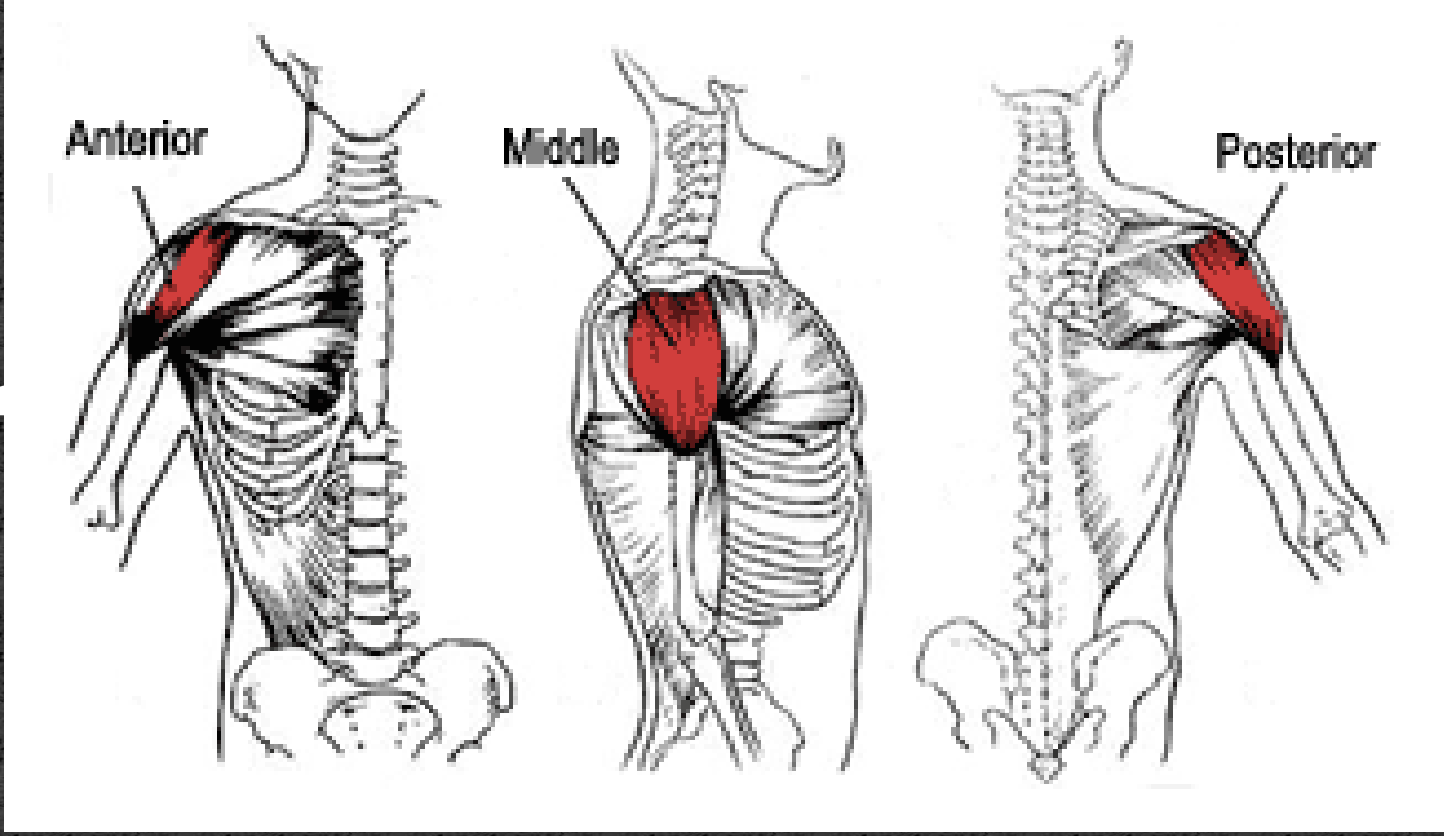




Shoulder Muscles

- Due to the complexity of the joint, there are many muscles involved in shoulder movements:

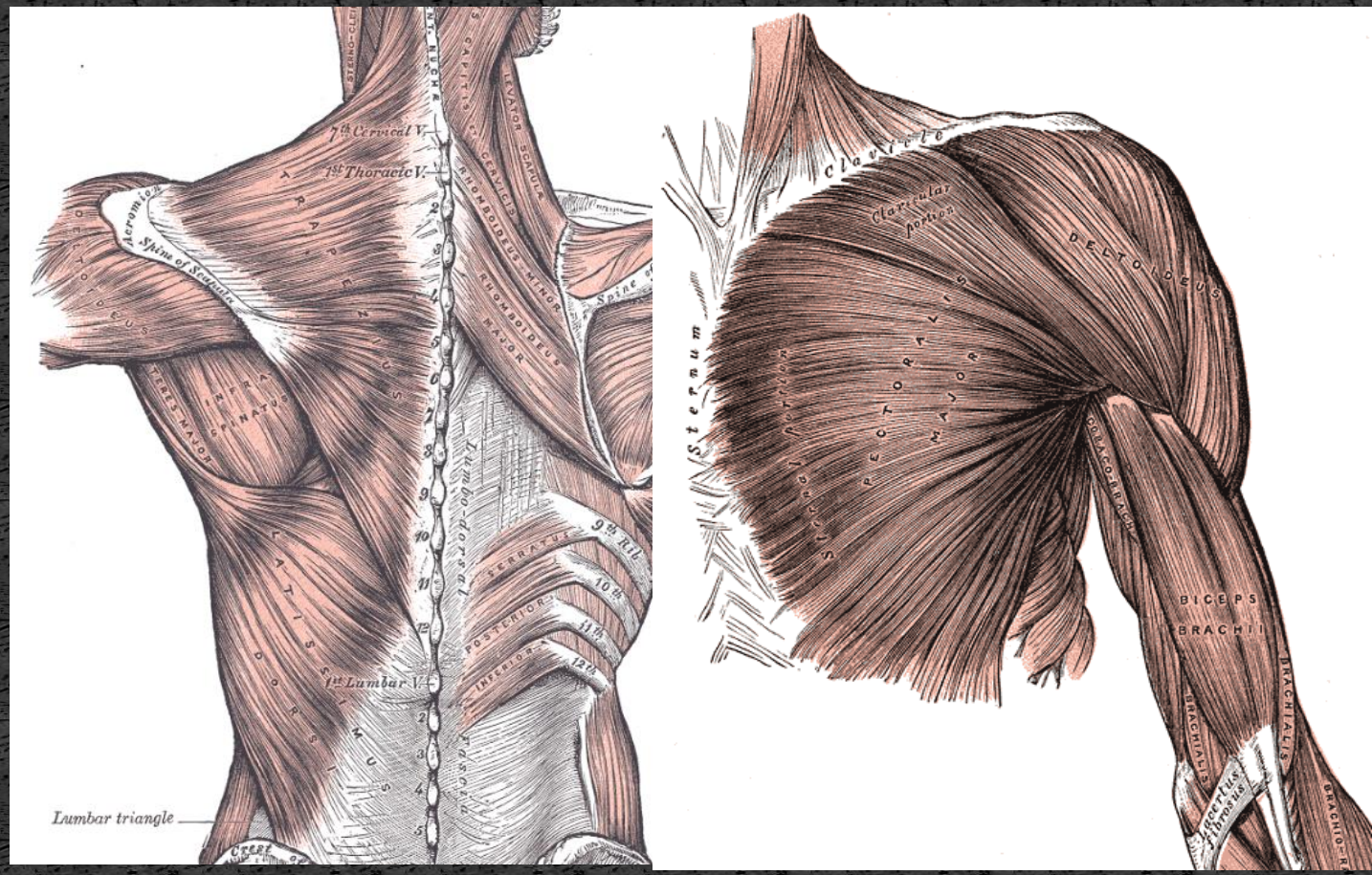
- Deltoid (power muscle)
  - 3 parts
    - Anterior – flexes shoulder
    - Middle – abducts shoulder
    - Posterior – extends shoulder



Shoulder Movement

- Scapular Stabilisers
  - Trapezius
  - Serratus Anterior
  - Rhomboids

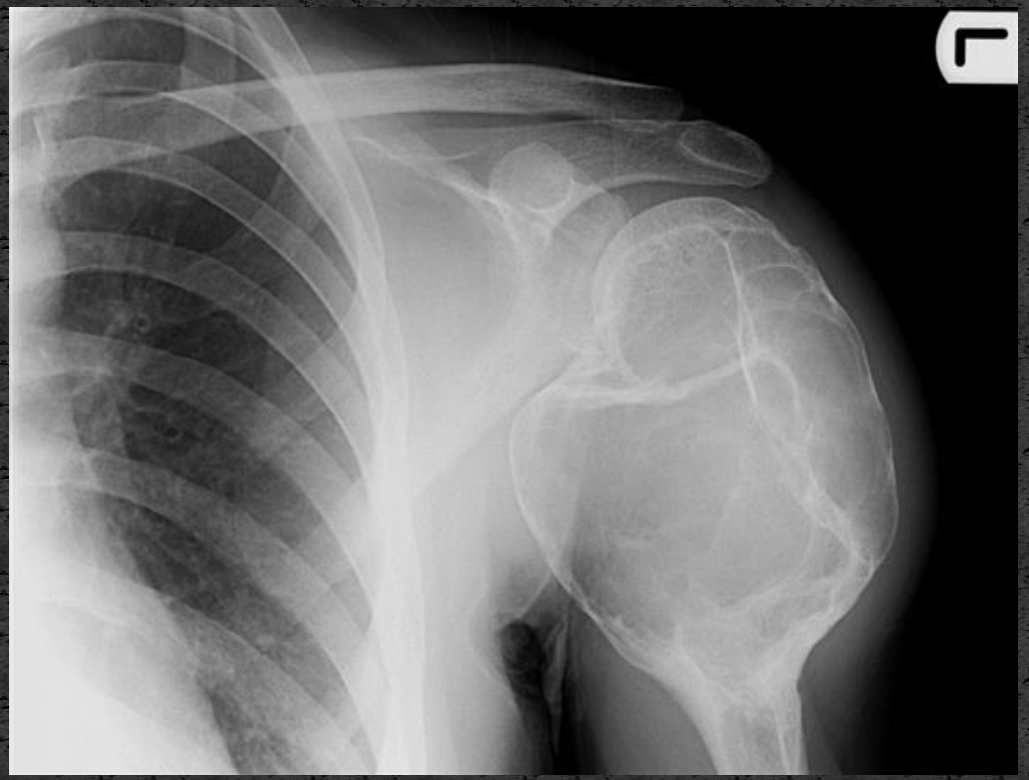
- Other Power muscles
  - Pectorals
    - Adduction / horizontal flexion / internal rotation
  - Latissimus Dorsi / Teres Major
    - Adduction / internal rotation



SHOULDER ASSESSMENT

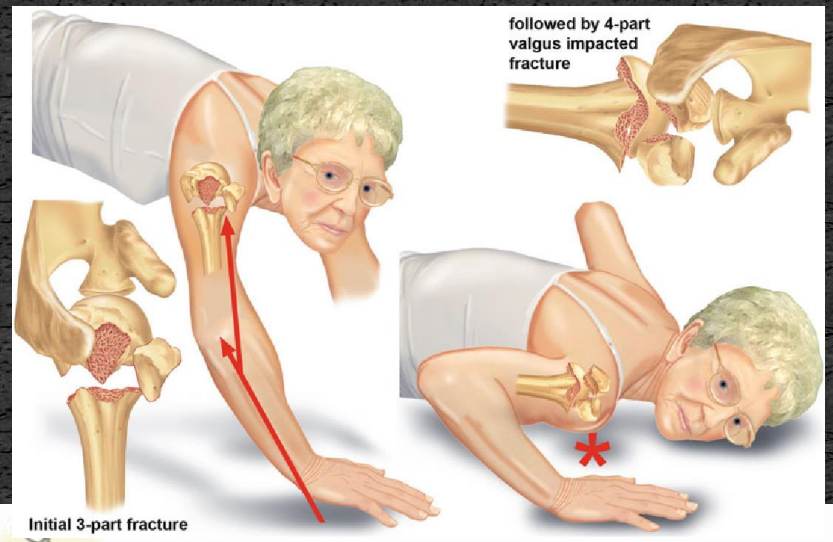
Shoulder

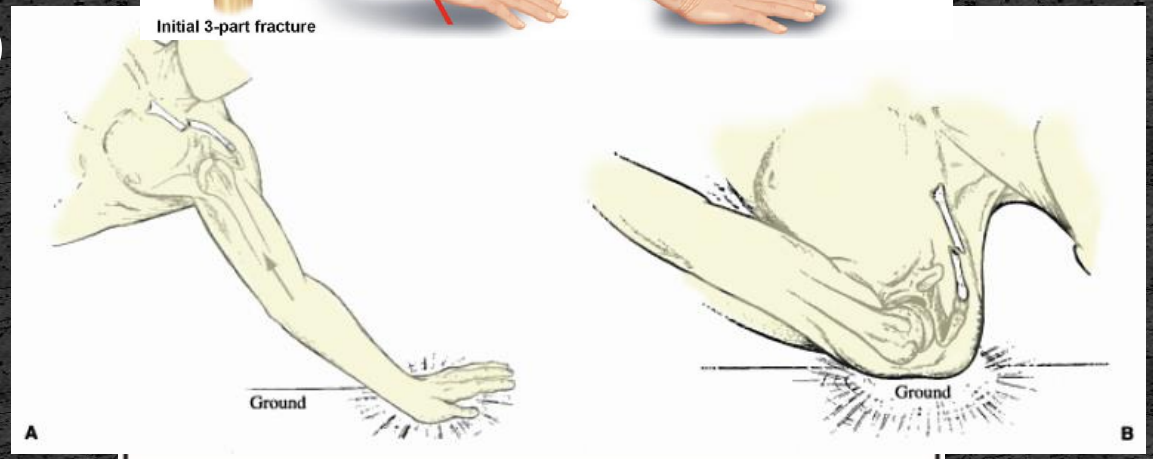
- What do we want to rule out?
  - Neurovascular compromise
  - Fracture
  - Dislocation
  - Significant soft tissue injury that requires prompt attention
    - Distal Biceps
    - Triceps
    - Massive Rotator Cuff tear in the younger person
  - Infection
  - Foreign bodies
  - Weird bony problems
    - Cysts
    - Tumours
    - Pagets, etc

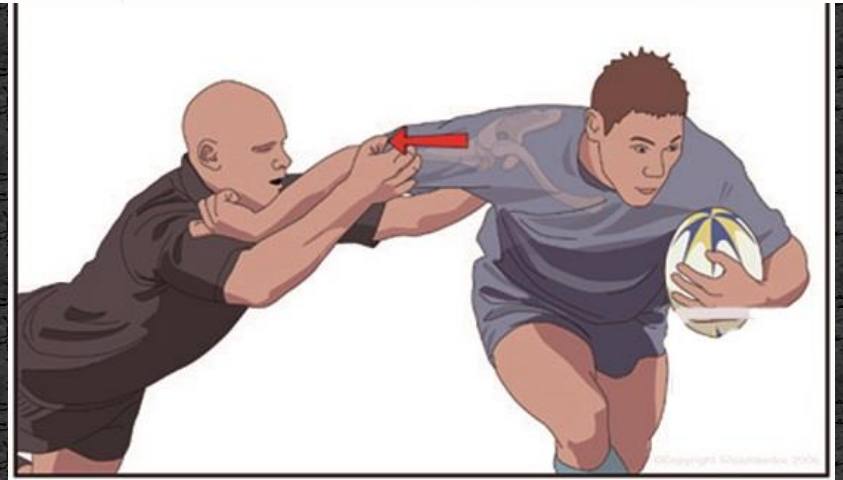


Shoulder Assessment

- Subjective
  - If acute injury, get an idea:
    - Mechanism (understand the forces involved)
      - Longitudinal force
      - Abduction / ER
      - Lifting (traction)
    - Ability to continue
    - Management so far







Shoulder Assessment

- Subjective
  - Ask if any problems in that area before
    - How long has it been there?
    - What tends to stir it up?
    - What helps?
    - How long does it take to settle after activity?
    - How is it the next day? (especially in the morning)
    - Investigations / management
  - Handedness
  - Enquire about activity level (including occupation, sports)
    - Type
    - Duration
    - Frequency

Shoulder Assessment

- Observation
  - Expose the part!

Shoulder Assessment

- Observation

Shoulder Assessment

- Observation
  - Deformity, Swelling
  - Redness, heat

Shoulder Assessment

Shoulder Assessment

Shoulder Assessment

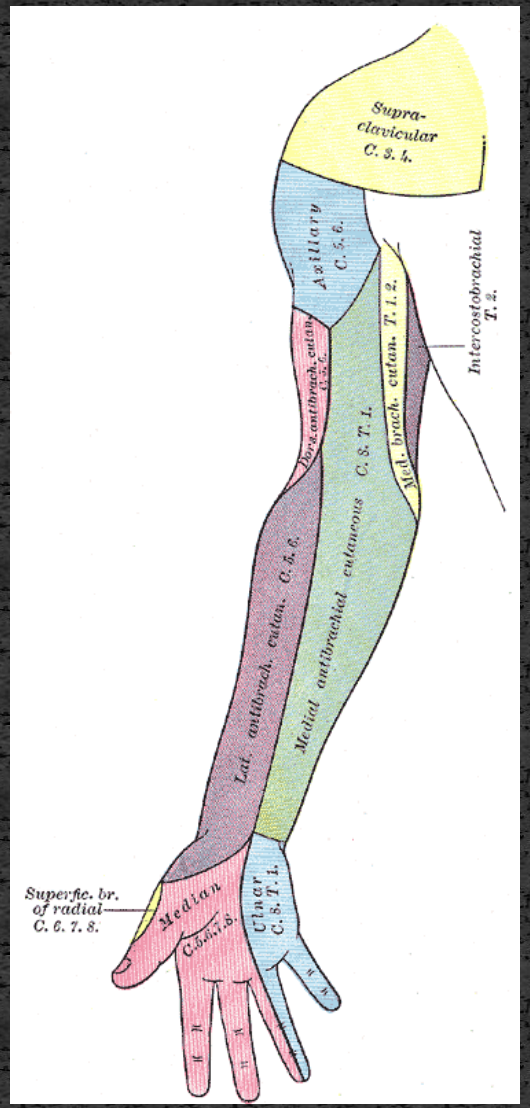
- Observation
  - Distal neurovascular function
    - Colour, Movement, Warmth, Sensation
    - Capillary Return
    - Peripheral Pulses
    - Nerve function
      - Radial
      - Median
        - Anterior Interosseus Nerve
      - Ulnar
      - Axillary nerve

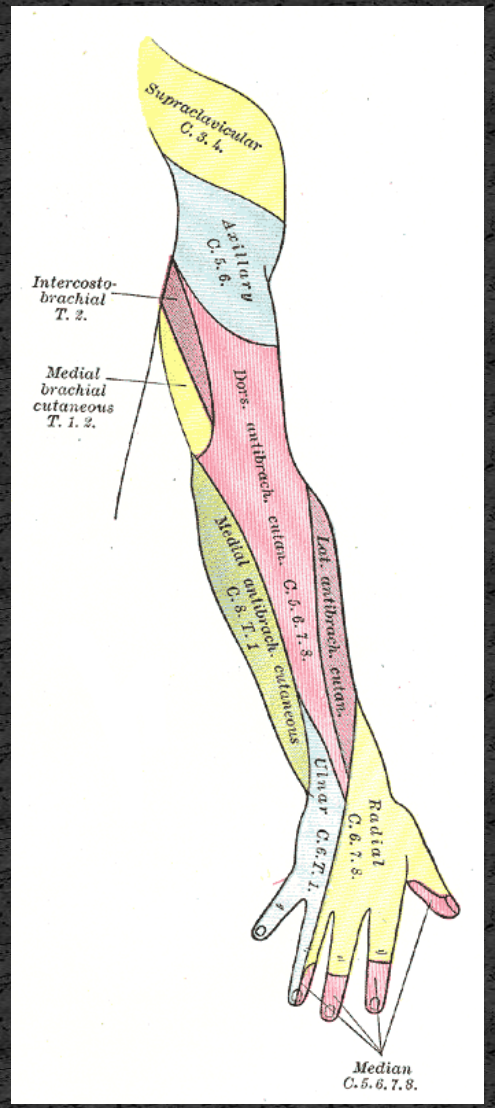
- 8% of children with upper limb fractures have a nerve injury[1]
- Nerve injuries in shoulder dislocations[2]:
  - 37% Axillary nerve
  - 29% Suprascapular nerve
  - 22% Radial nerve

1. ROCK, PAPER, SCISSORS, OK': INTRODUCTION OF A SIMPLE GUIDELINE TO IMPROVE NEUROLOGICAL ASSESSMENT IN PAEDIATRIC PATIENTS PRESENTING WITH UPPER LIMB FRACTURES
A.G. Marsh, J. Robertson, A. Godman, J. Boyle, J. Huntley

2. *Malik, S; Chiampas, G; Leonard, H (November 2010). "Emergent evaluation of injuries to the shoulder, clavicle, and humerus". Emerg Med Clin North Am.* ***28*** *(4): 739–63. doi : 10.1016/j.emc.2010.06.006. PMID 20971300.*

Distal Neurovascular function





Shoulder Assessment

- AROM of shoulder
  - Flexion / Extension
  - Abduction / Adduction
  - HBB
  - ER / IR
  - Horizontal flexion
- Also need to consider joints above and below
  - Elbow – flexion / extension / supination / pronation
  - Chest wall

Objective Assessment

- Range of motion
  - Disregarding pain as a cause, where there is loss of ROM (for a non-fracture), discrepancy between ACTIVE and PASSIVE ROM may help to differentiate the problem
    - If there is less active ROM than passive ROM, this can indicate a muscular deficiency (eg rotator cuff tear)
    - If is no difference between active and passive ROM, then it is likely that joint stiffness is limiting the ROM (eg Frozen Shoulder)

Shoulder Assessment

- Palpation
  - From medial of clavicle to at least elbow

- Special Tests
  - 30+ shoulder tests – most relatively useless in isolation
  - Murrell – Combined Tests:
    - Combined tests:
      - A positive impingement sign (internal or external rotation)
      - Weakness in external rotation
      - Weakness in supraspinatus (empty or open can)
    - Drop arm –ve
      - 98% chance of no rotator cuff tear

Clinical Tests Positive	Age	Chance of Rotator Cuff Tear
All 3	Any	98%
Any 2	>60	98%
None	Any	5%

Deciding to Image

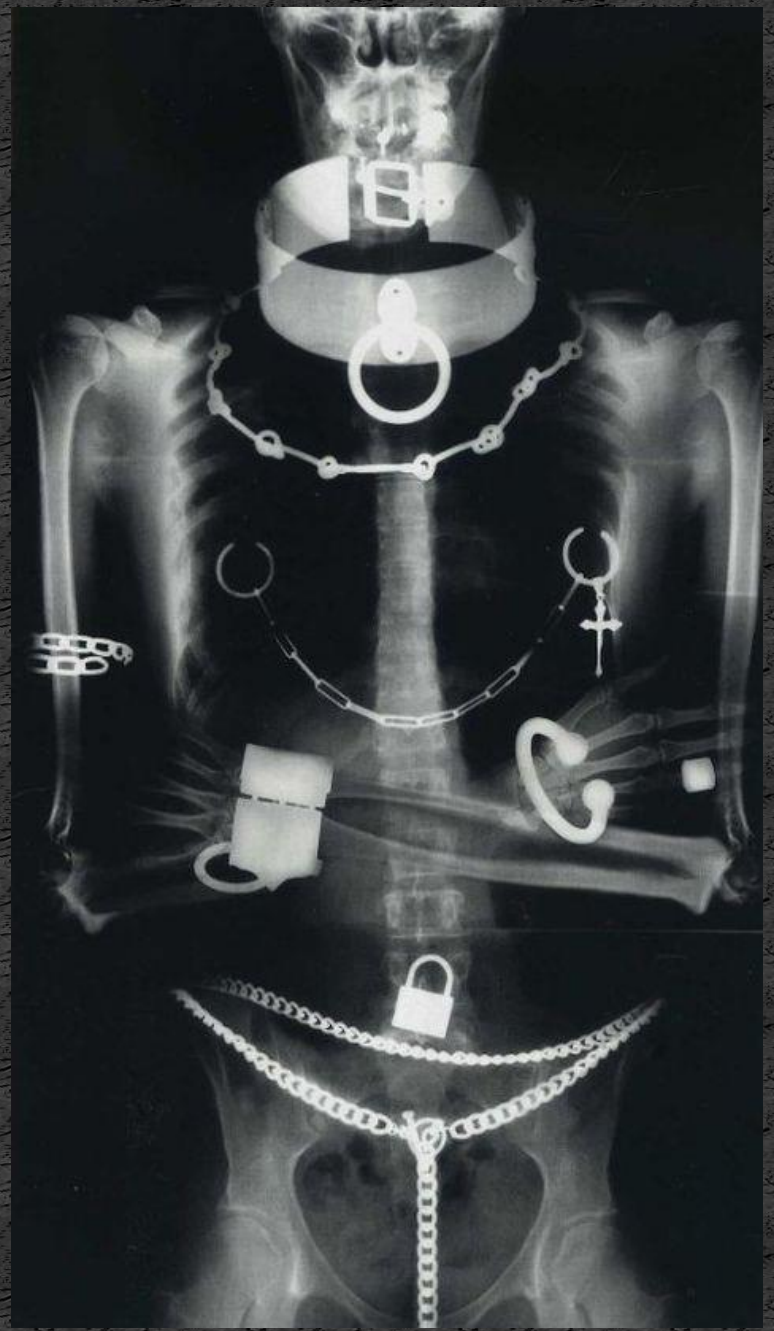
- X-rays expose the patient to radiation, so we want to minimise the risk
  - Does it need to be done at all?
    - No commonly used decision making tools for shoulder imaging
    - Given importance of upper limb function, generally have a low threshold for imaging
      - Deformity
      - Swelling
      - Reduced ROM
      - Bony tenderness
  - Have they had images taken prior to coming here that they do not have with them?
    - Can we view them online?
    - Can we get them transferred across from another site SHOW ME!
  - Are they (or could they be) pregnant? (on Symphony asks from 12-60)
    - If could be – urine pregnancy test

Imaging Modalities

Modality	Use	Radiation Dose (mSv)	Equivalent Normal Background Radiation	Increased risk of Ca from Ix
X-ray	Bony pathology, foreign bodies	0.005	< 1 day	1 in 11,000,000
CT	Clarification and classification of fracture	0.15	1 month	1 in 76,000
Bone Scan	Suspicion of malignancy; was previously used for potential stress injury but out of favour now with MRI	6.3	1.8 years	1 in 1,800
Ultrasound	Identification of soft tissue problems (ambiguous tendon pathology, ? UCL rupture) or foreign bodies not visible on x-ray	Nil	N/A	N/A
MRI	Soft tissue injuries where diagnosis is unclear; can show bone marrow oedema / fractures as well (although CT better for just bone)	Nil	N/A	N/A

Deciding to Image

- Remove clothing, jewellery where possible
  - Creates a shadow



Principles of X-rays

Importance of AP and lateral view in X-ray

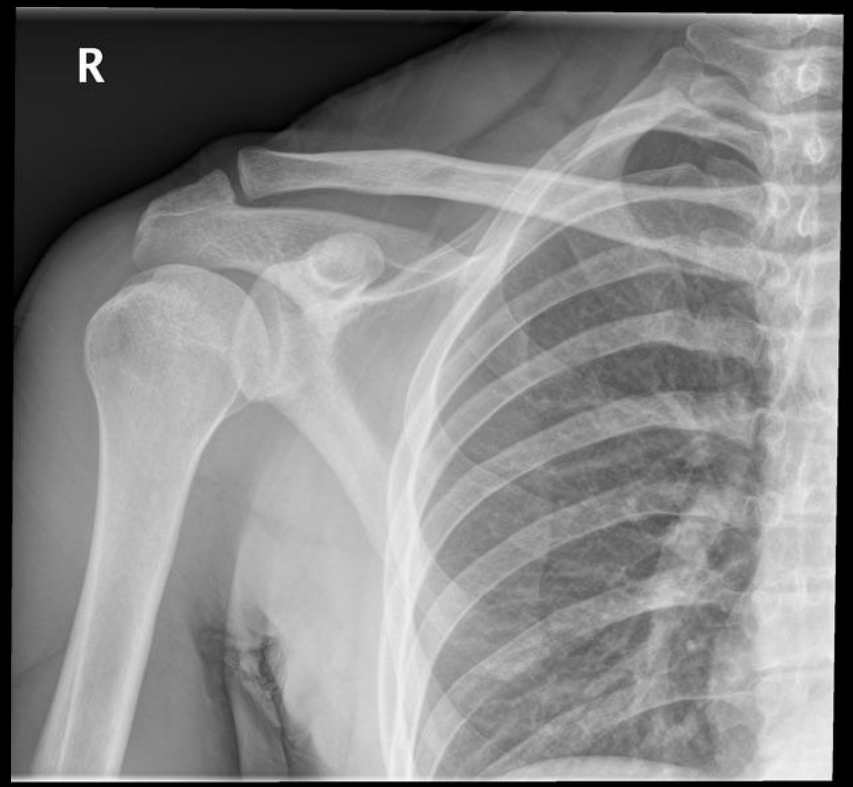
Principles of X-rays

- X-rays are a 2-dimensional representation of a 3-dimensional structure

- As such, we ALWAYS need AT LEAST 2 orthogonal views (ie at 90 degrees to each other – usually at least an AP or PA and a lateral)
  - There are also special views for particular areas or when looking for particular pathologies

- Each of the views are relative to the part requested
  - For the shoulder, the images are AP and lateral to the SHOULDER
  - For the humerus / Clavicle / AC jt views, although the shoulder is included, the images are AP and lateral to the those bones / joints.

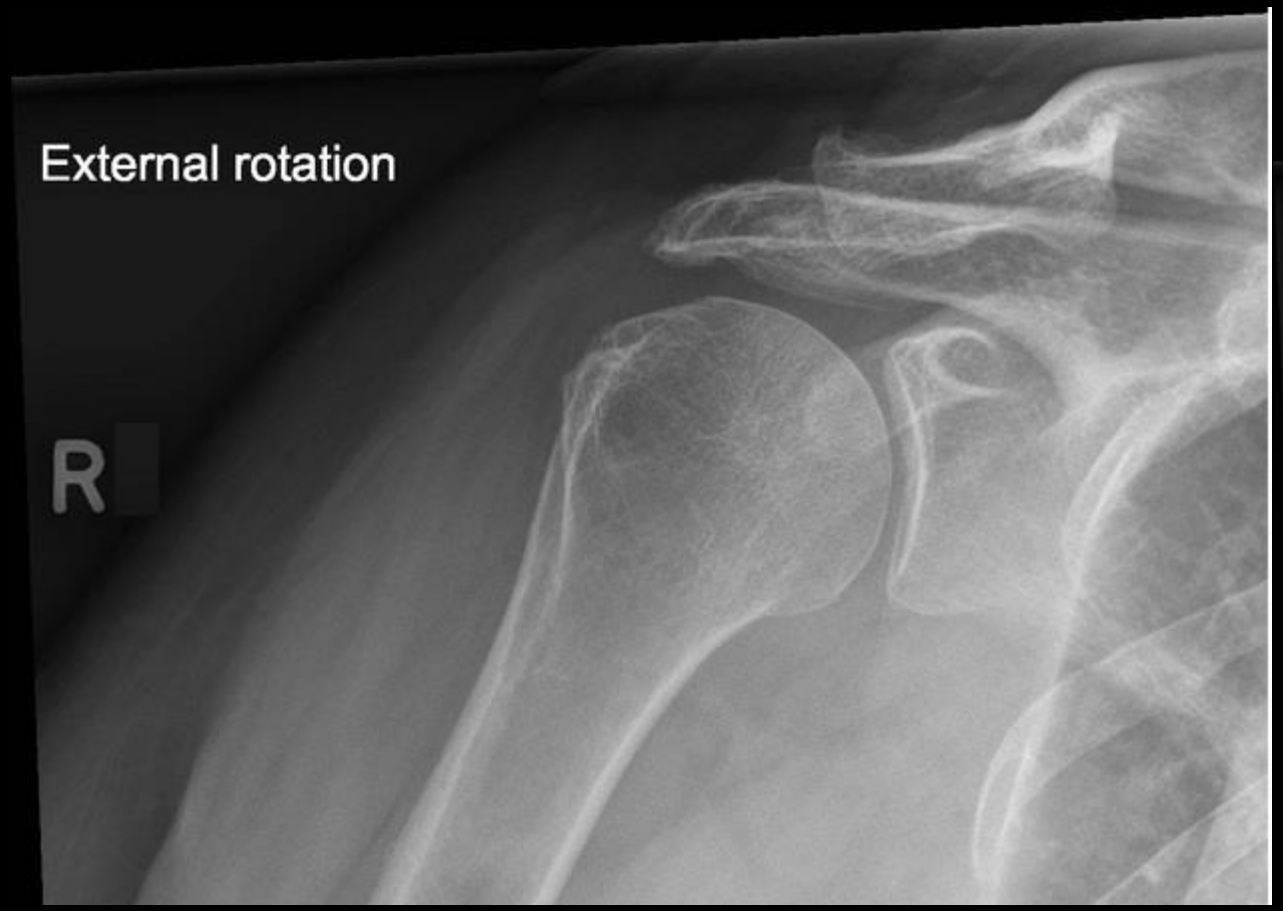
Standard Shoulder Views



Shoulder - AP

Shoulder – Y view Lateral

Other Shoulder Views



Shoulder – External Rotation

Shoulder – Internal Rotation

AC Joint

Clavicle

Clavicle AP

Clavicle AP 20 degrees cephalad

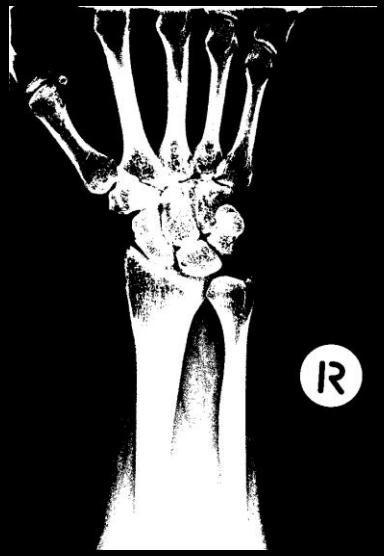
Humerus

Humerus - AP

Humerus – Lateral

Principles of X-rays

- SYSTEMATIC APPROACH TO INTERPRETATION
  - First Impression
    - Anything obvious?
  - A
    - Adequacy
      - Neither under (too light) or over exposed (too dark)
      - Joints above and below the area of concern are visualised
    - Alignment
      - The type of x-ray views taken and the anatomical site visualised



Principles of X-rays

- B
  - Bones
    - Outline
      - The contours of the bone should be followed and any abnormality commented on
    - Density
      - Look at each bone in sequence and comment on whether it is:
        - Radiolucent = thinner bone (eg osteopenic)
        - Radioopaque = thicker than surrounding bone (eg Paget's disease, chronic osteomyelitis, osteochondritis)
      - Check for trabecular interruption

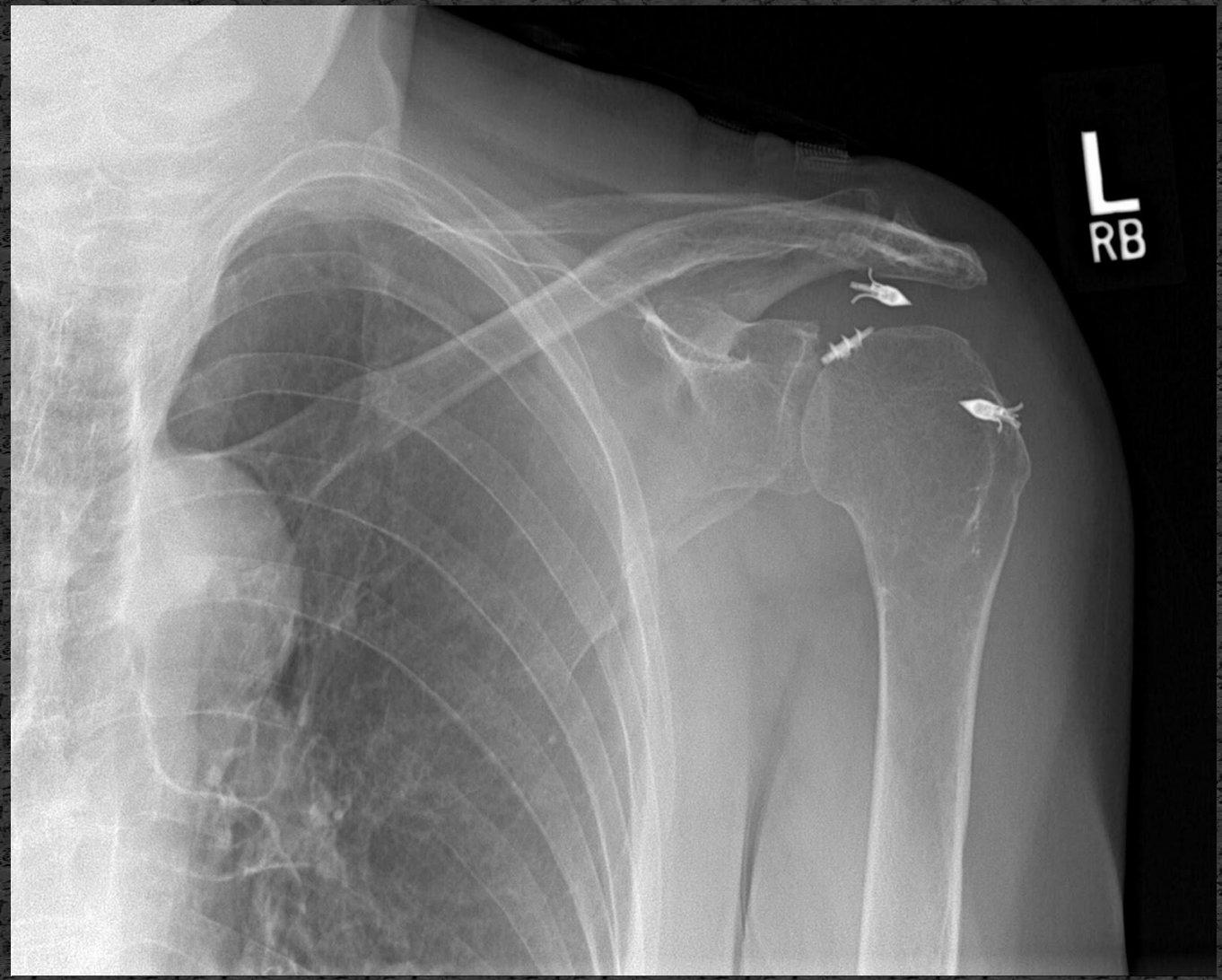
Principles of X-rays

- C
  - Cartilage
    - Outline
    - Joint space
    - Loose bodies
- D
  - Don’t stop
    - Complete a full assessment of the entire image – don’t just stop when you find something!

Describing Findings

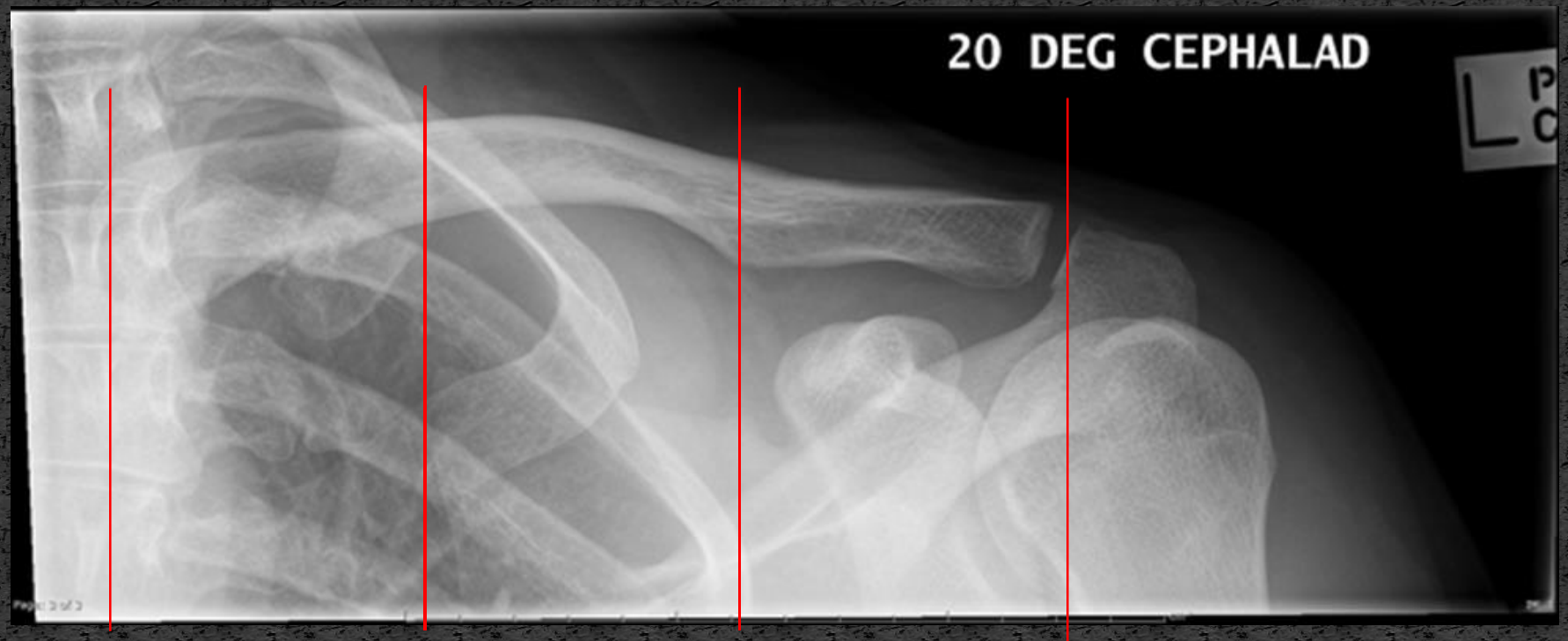
- Describe
  - Swelling
  - Foreign objects
  - Wounds
  - Fractures
  - Dislocations
  - Other bony findings eg ossicles

- Know your ANATOMY!

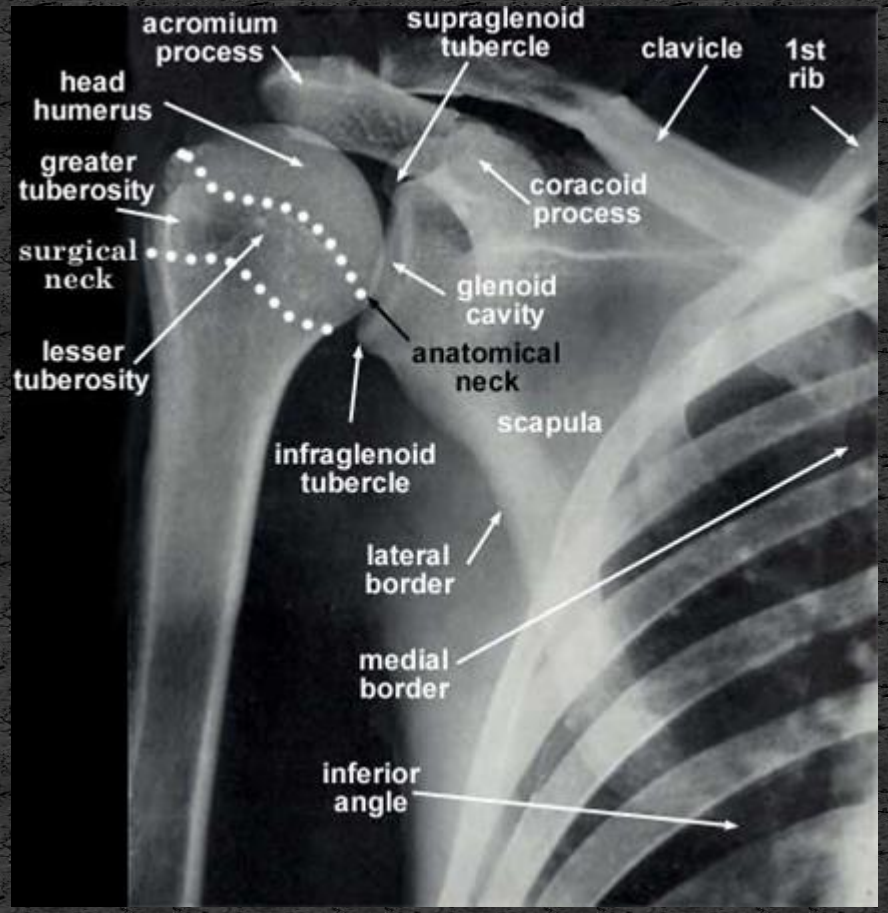


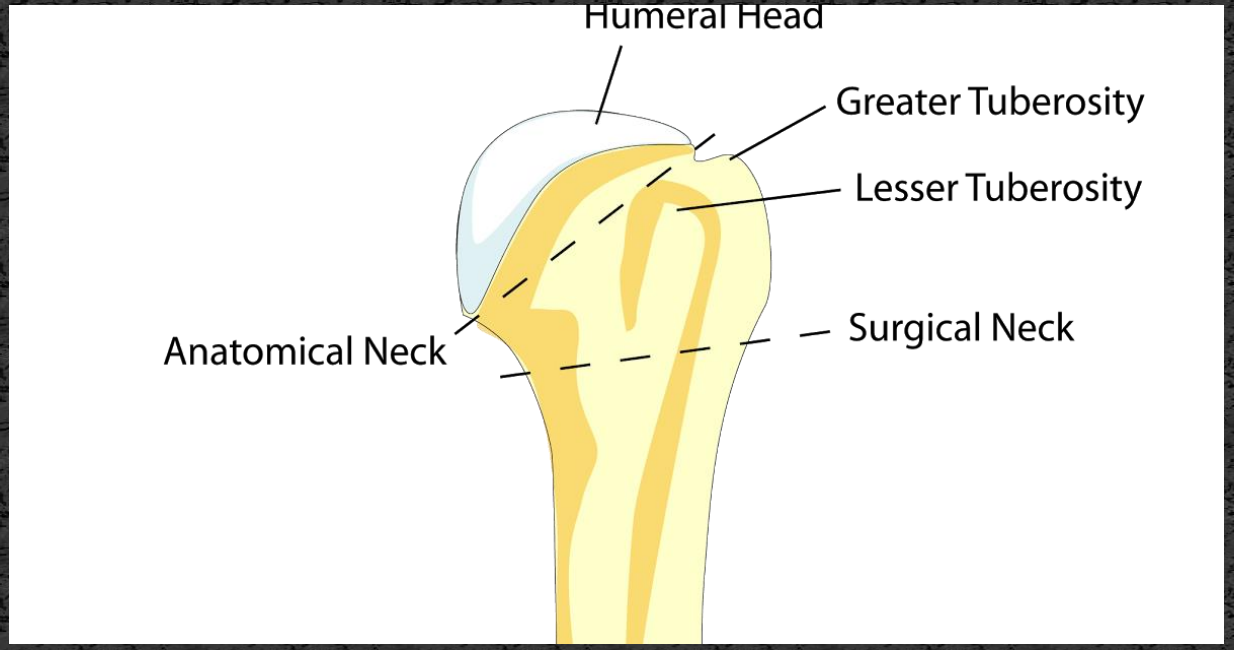
Describing Findings

- Location
  - Anatomical
    - Clavicle divided into medial, middle and lateral thirds



Describing Findings





Describing Findings

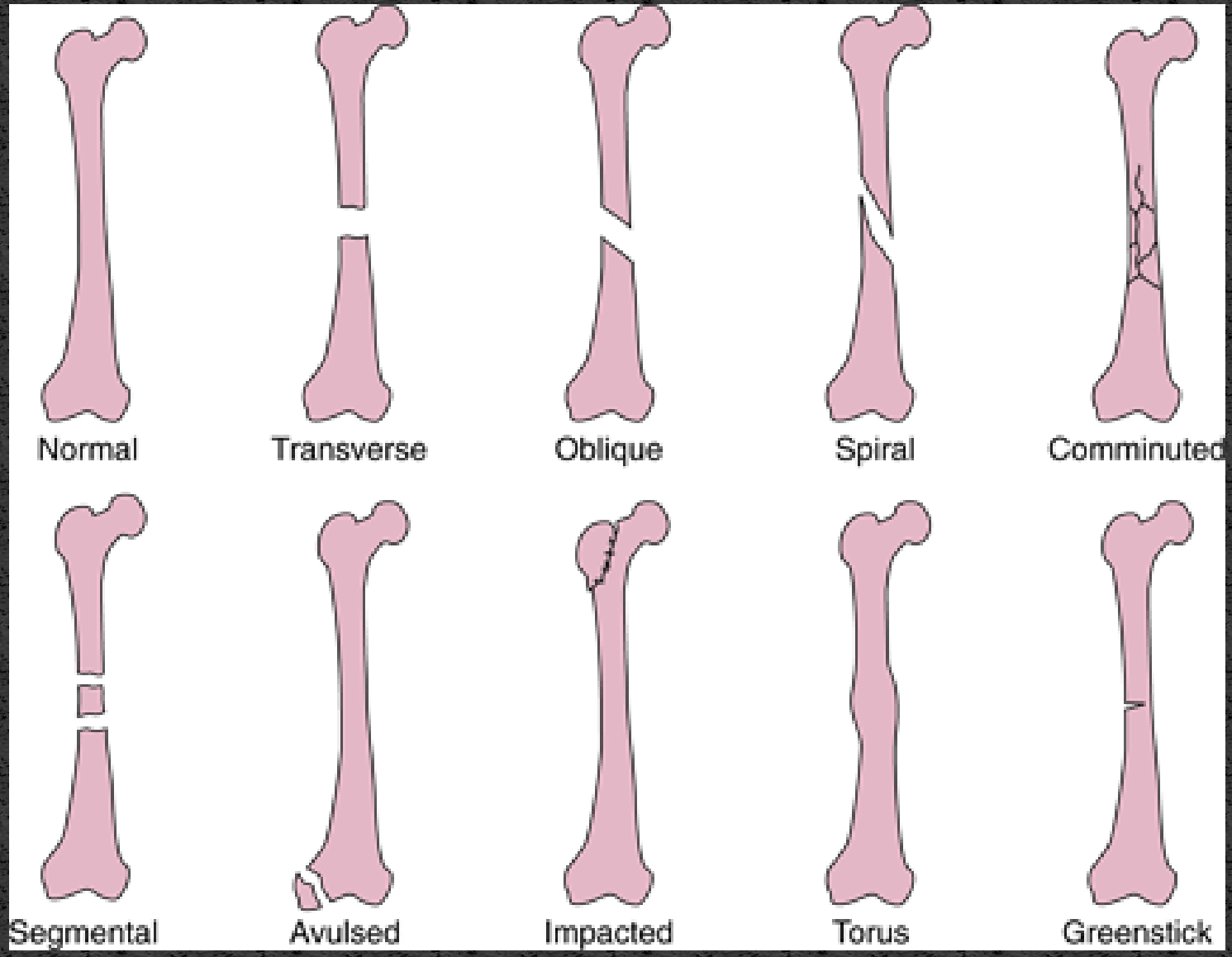
Describing Findings

- Radiolucent / Radiodense
  - Allows radiation to pass freely = transparent (more dark)
  - Eg fracture line

- Radio-opaque
  - Obstructs passage of radiant energy (more white)
  - Eg metal

Describing Fractures

- Pattern
  - Transverse / Horizontal
  - Vertical / Longitudinal
  - Oblique
  - Spiral
  - Comminuted
  - Stellate
  - Depressed



Describing Fractures

- Displacement
  - Undisplaced
  - Displaced
    - Describe the distal segment relative to the proximal segment, in the anatomical position

- Articular
  - Extra-articular
  - Intra-articular
    - Step / defect

- Angulation
  - Discuss in terms of the distal segment relative to the proximal segment in the anatomical position

Describing Subluxations and Dislocations

- Location
  - Which joint
    - Eg Glenohumeral joint or AC joint

- Subluxation / Dislocation
  - Subluxation = Partial loss of joint congruency
  - Dislocation = Complete loss of joint congruency

- Pattern
  - Which direction (relative to the anatomical position)
    - Posterior / Anterior

- Other injury
  - Is there associated bony injury (see previous slide)

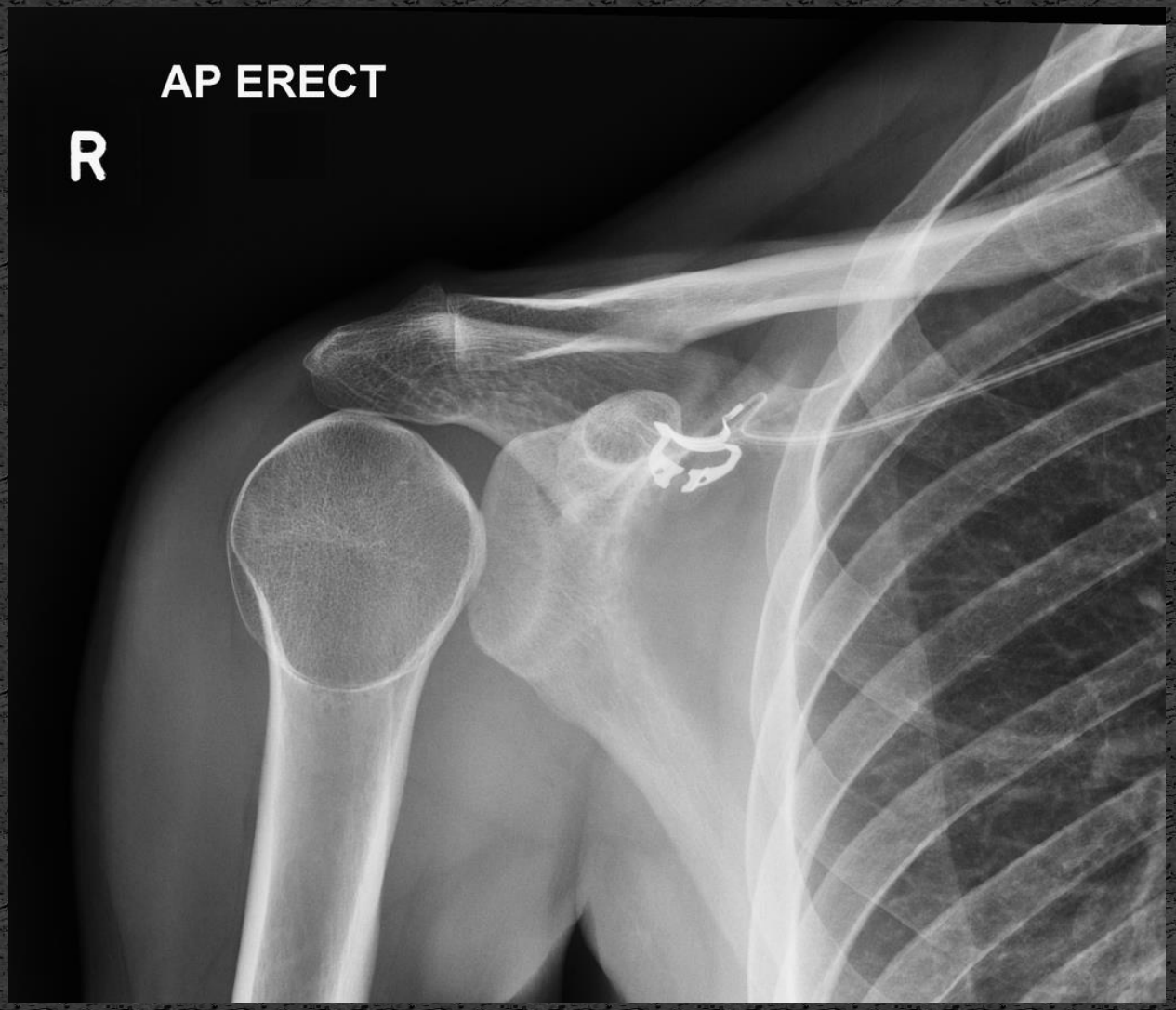
Anterior Dislocation

Hill Sach's Lesion

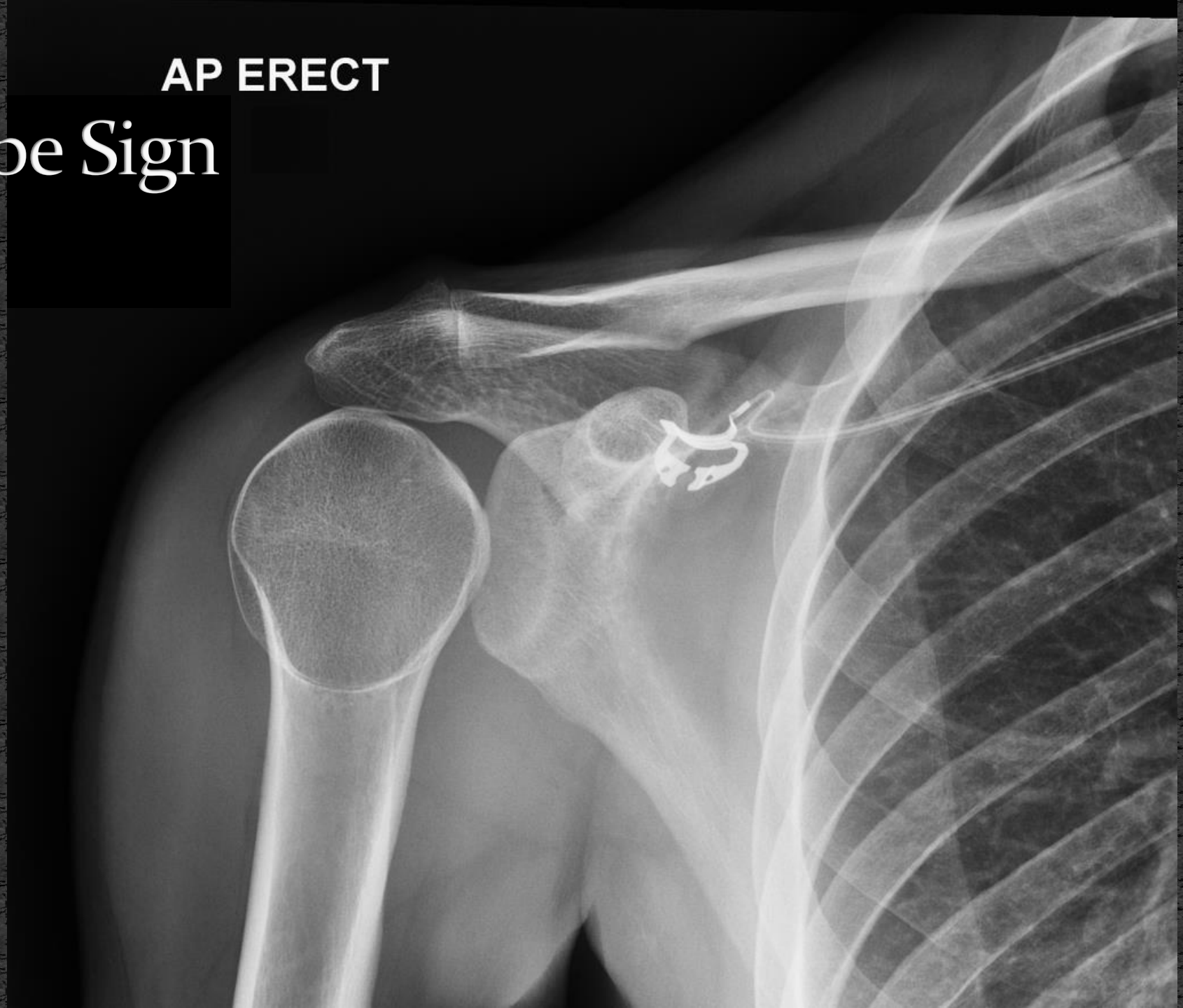
Bankart Fracture

Luxation Erecta

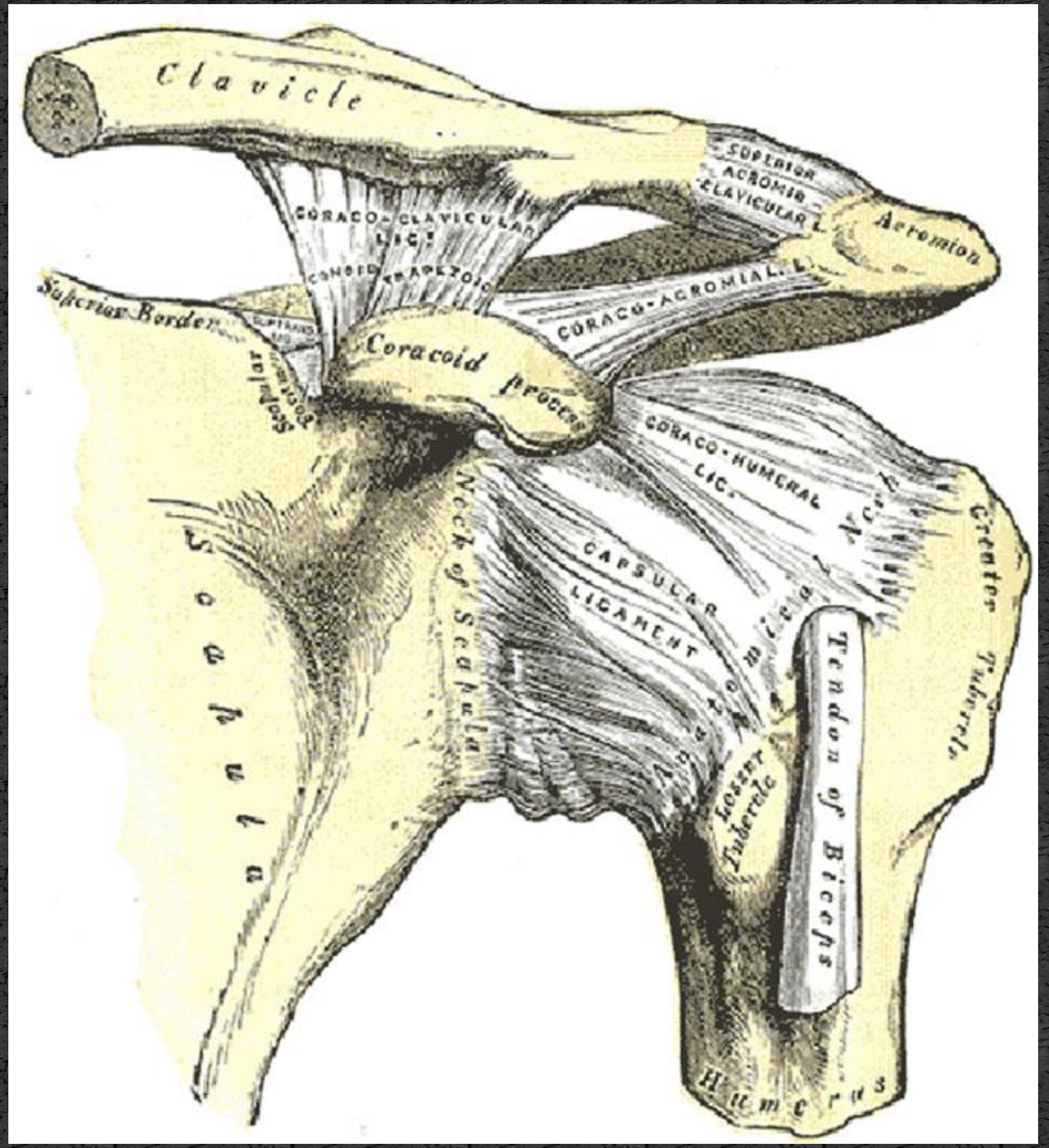
Posterior Dislocation



Lightbulb / Globe Sign

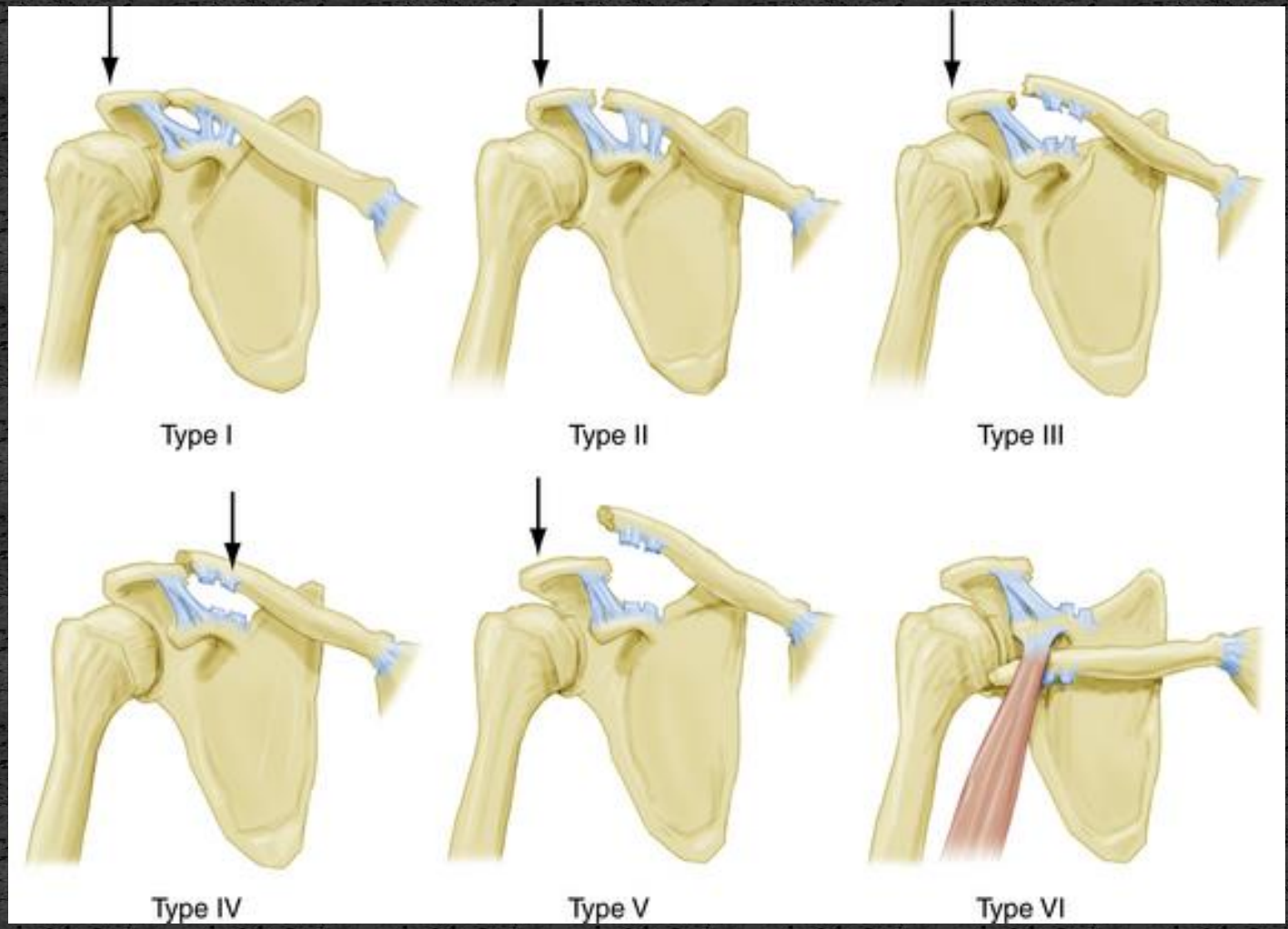


AC Joint


Clavicle
SUPERIOR ACROMIO-CLAVICULAR L.
CORACO-CLAVICULAR LIG.
CONOID
TRAPEZOID
Acromion
CORACO-ACROMIAL L.
Superior Border
Coracoid process
Scapula
CORACO-HUMERAL LIG.
Neck of Scapula
CAPSULAR LIGAMENT
Greater Tubercle
Lesser Tubercle
Tendon of Biceps
Humerus

AC Joint Injury – Rockwood Classification

Classification	Description	Notes
Type 1	AC Joint strain	Normal radiograph
Type 2	AC disrupted, CC strain	Mild vertical separation (normal AC interval 5-8 mm)
Type 3	AC and CC disrupted	CC distance 25-100% of contralateral side
Type 4	Distal clavicle positioned posterior to acromion	
Type 5	Subcutaneous distal clavicle	CC distance >100% contralateral side
Type 6	Distal clavicle positioned inferior to coracoid	Rare: Deep to conjoined tendon (coracobracialis, short head biceps)



AC Joint Injuries

Substantial Rotator Cuff Tear

- Exceptionally rare in children (more likely to fracture something)

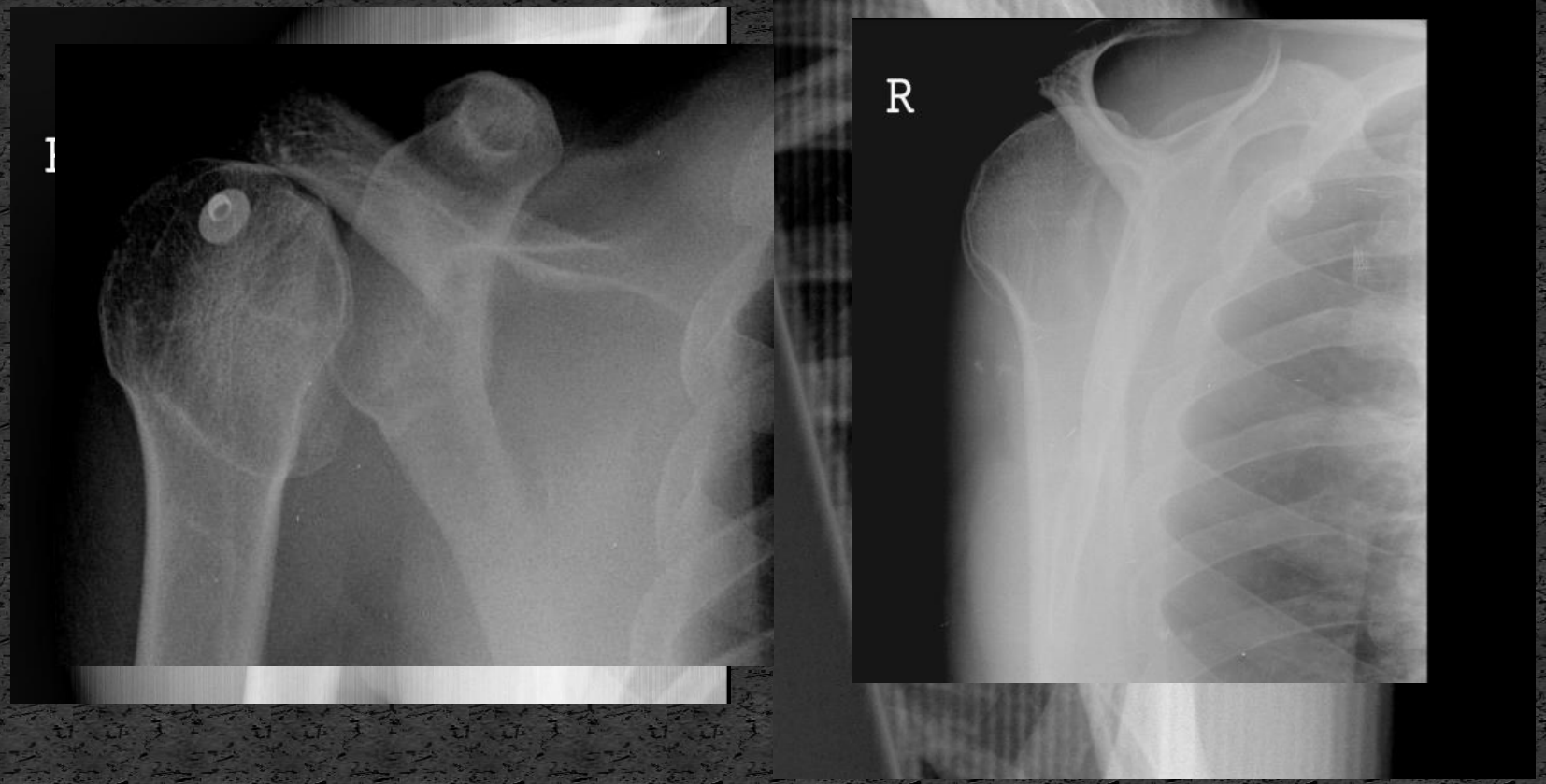
- Younger adults, particularly involved in sport, or physical activities more likely to benefit from operative management

= if suspicious of same, consider early US (via GP)

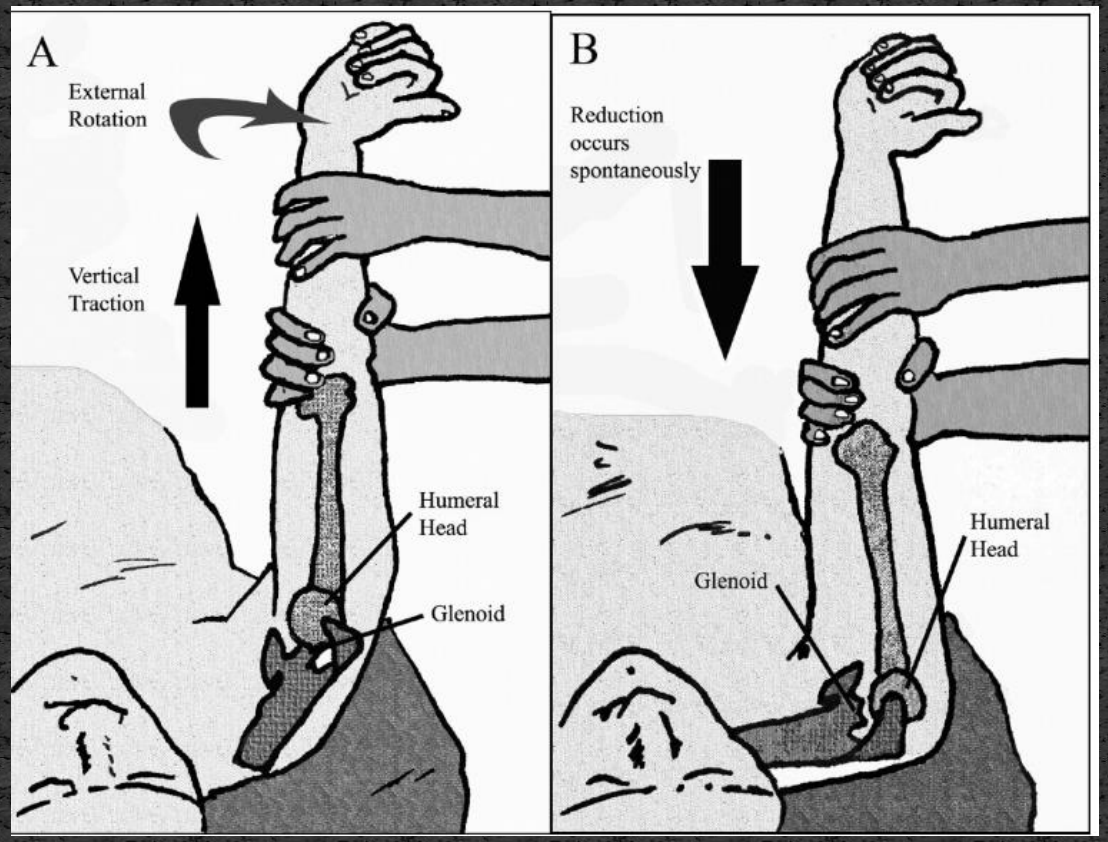
- Older adults (with less physical requirements) often do quite well with conservative management

Proximal Humeral Fractures

Glenohumeral Joint Dislocation



Glenohumeral Joint Dislocation



https://dislocation.com.au/

Shoulder Dislocation

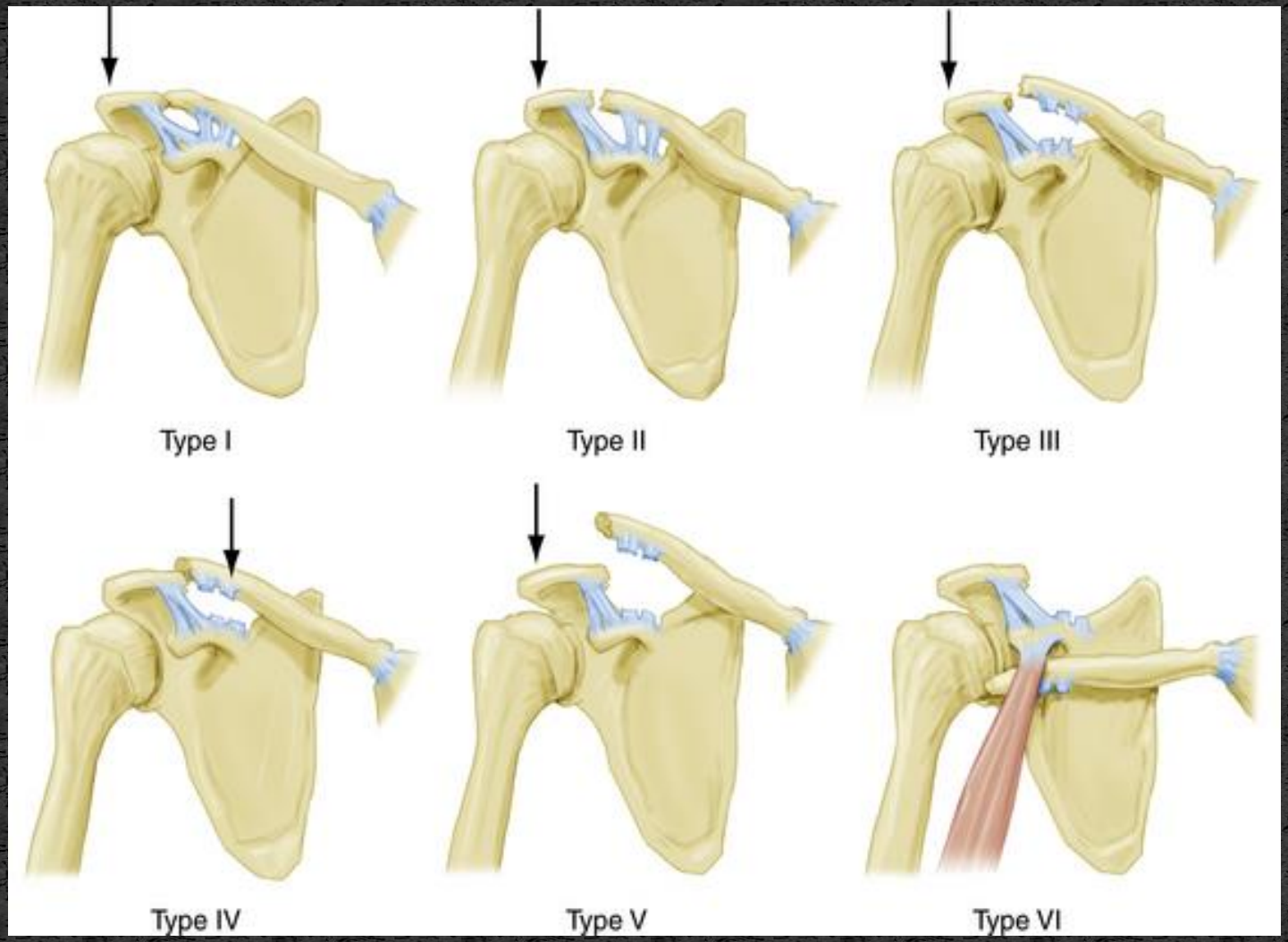
- 90% of first time shoulder dislocations will involve tearing of the labrum (as well as tearing of the ligaments)
  - In recurrent dislocators, this usually hasn't healed
- Most vulnerable position for the shoulder is abduction / external rotation = need to avoid for 6/52
- Need to strengthen shoulder muscles up
- Rx
  - Sling for comfort only
  - Avoid Abd / ER for 6/52
  - Physio once pain settles to start rehab (in non-threatening positions initially, but eventually into the vulnerable position)

Acromioclavicular Joint Injury

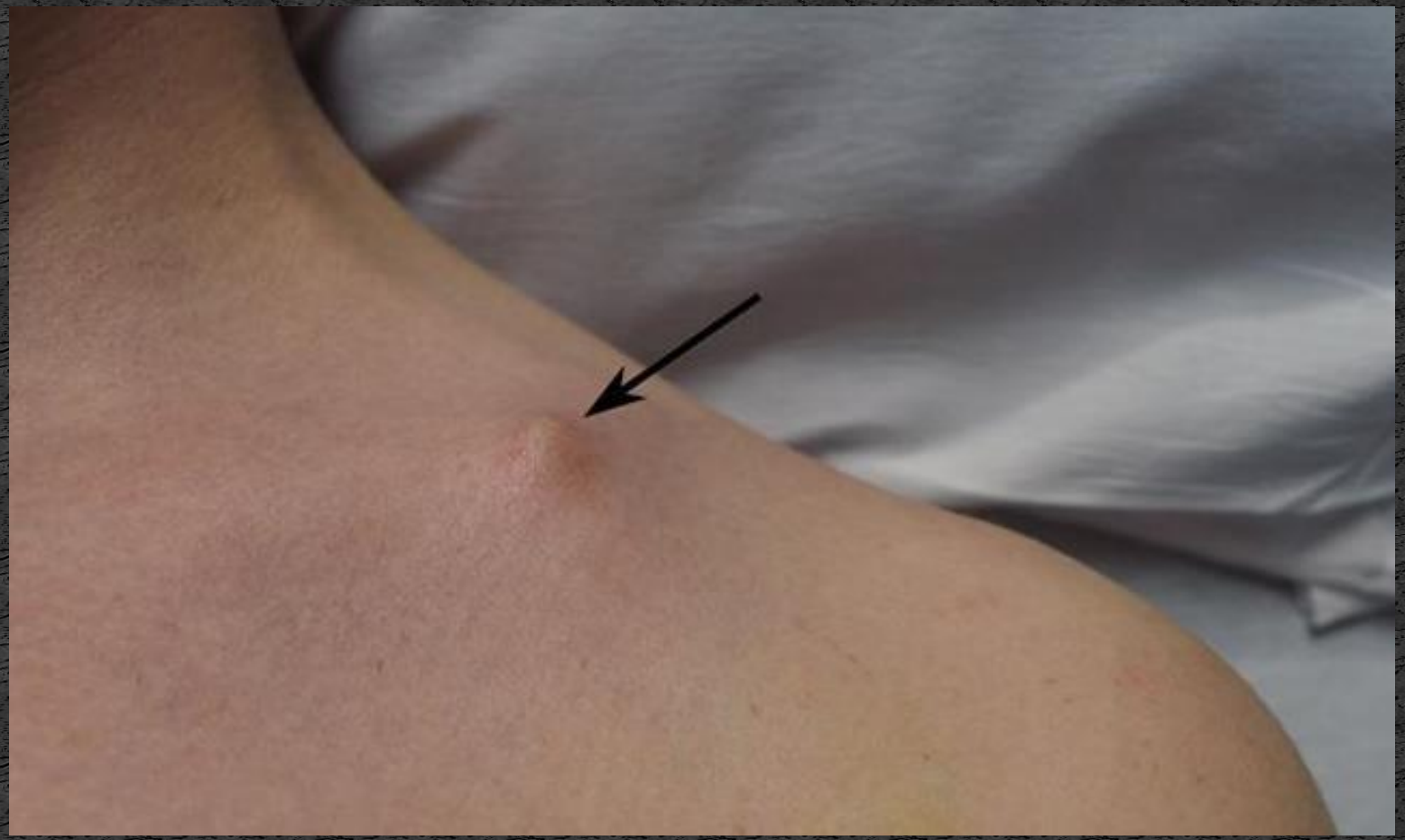
Acromioclavicular Joint Injury

- Paediatric and younger patients (older more likely to # NOH)
- FOOSH / Hip and shoulder / Fall onto point of shoulder

Acromioclavicular Joint Injury



Clavicle Fractures



Clavicle Fractures

- Paediatric and younger patients (older more likely to # NOH)
- FOOSH / Hip and shoulder / Fall onto point of shoulder

Clavicle Fractures

Clavicle Fractures

- Operative Intervention
  - Lateral clavicle fractures
  - Medial clavicle fractures potentially
  - Shortened midshaft (heals <2cm shorter)

Shoulder Assessment

Shoulder Assessment

Shoulder Assessment

SHOULDER SHENANIGANS

CASE STUDY 1

Case Study 1

- 23 year old male
- Playing football – collided with another player = took blow to L shoulder and root of neck
- Triage:

BIBA - LJ clavicle pain and deformity post collison with another football player. NV obs - limited ROM. 3mls penthrane, 10mg morphine and now not distressed with pain at triage. BP 120/-, HR 86, SaO2 99%, RR 16, chest clear

Case Study 1

- Subjective
  - L medial clavicular pain >> neck pain
- Objective
  - Obvious lump to medial clavicle / SC jt region – appears to be protruding anteriorly
  - Midline bony tenderness to neck "C5-C7"
  - Tender+++ lump medial end of clavicle
  - Neurological exam
    - Sensation normal
    - Power normal below elbow; unable to test above due to pain
    - Could not assess reflexes on injured side

Problem

- Requires Cx imaging as per NEXUS low risk criteria:
  - Cervical spine imaging IS indicated unless ALL of the following criteria are met:
    - No midline tenderness*
    - No focal neurologic deficit
    - Normal alertness
    - No intoxication
    - No painful distracting injury*

Problem

- Needs cervical spine imaging
- Patient could not lie flat due to shoulder pain (couldn't go lower than 45 degrees)
- Collar would rest on bump on medial end of clavicle
- Luckily, patient sensible and compliant
- Clavicle, cervical spine imaging requested

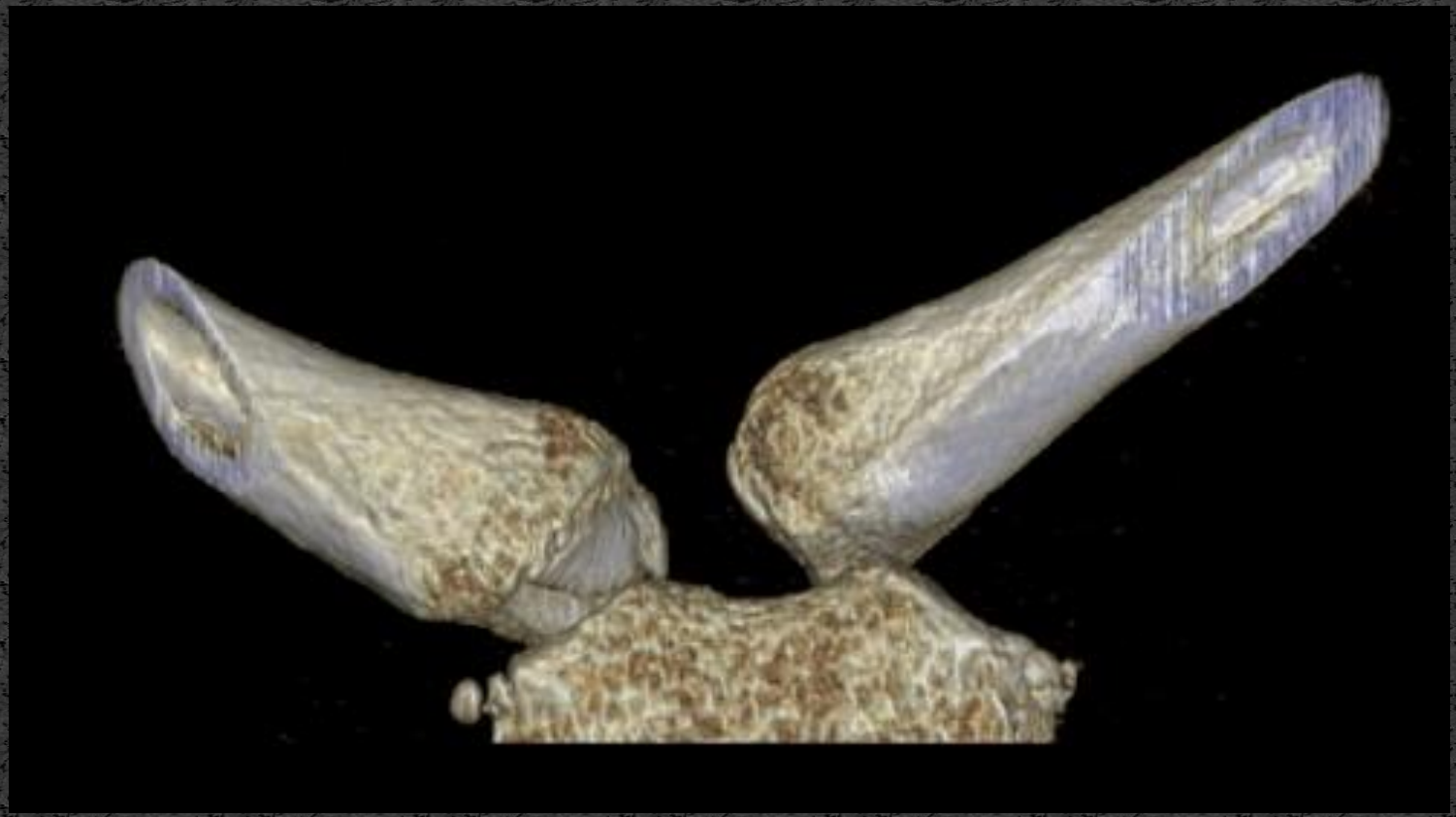
Case Study 1

Case Study 1

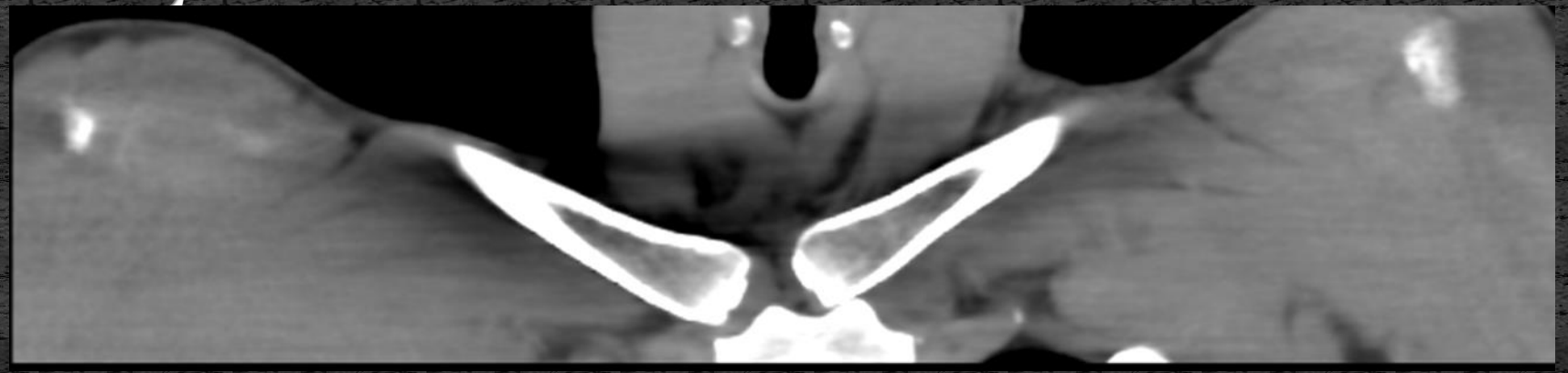
Left clavicle
Clinical
Trauma
No fracture or dislocation

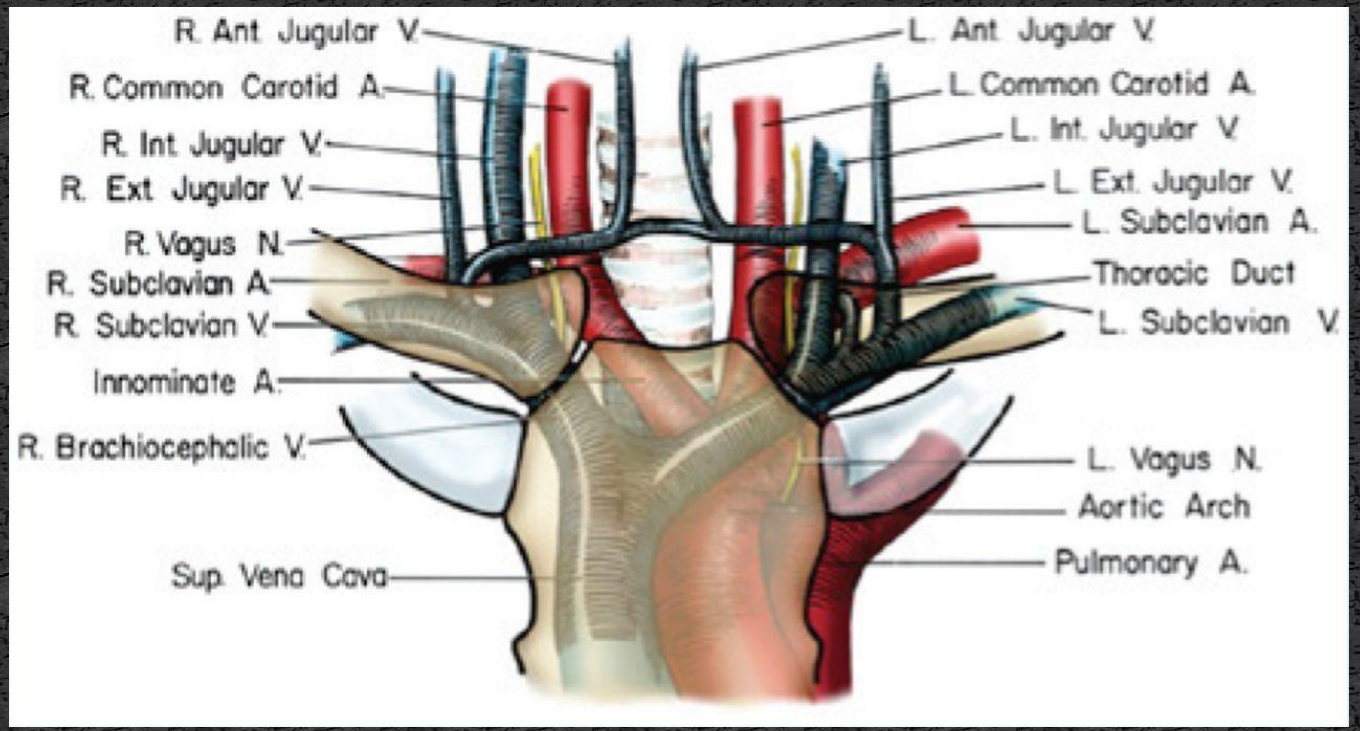
Case Study 1

Case Study 1



Case Study 1




R. Ant. Jugular V.
R. Common Carotid A.
R. Int. Jugular V.
R. Ext. Jugular V.
R. Vagus N.
R. Subclavian A.
R. Subclavian V.
Innominate A.
R. Brachiocephalic V.
Sup. Vena Cava
L. Ant. Jugular V.
L. Common Carotid A.
L. Int. Jugular V.
L. Ext. Jugular V.
L. Subclavian A.
Thoracic Duct
L. Subclavian V.
L. Vagus N.
Aortic Arch
Pulmonary A.

Case Study 2

- CT
  - Posterior dislocation SC jt
  - T1 spinous process # (no Mx)

- Patient admitted for 4/7, then discharged home and had surgery 9/7 post injury

CASE STUDY 2

Case Study 2

- 16/17 yr old male
  - Well known to department over the previous year with various dislocations / re-dislocations & fractures / re-fractures
  - Didn't attend any followup in OPs

Case Study 2

- 16/17 yr old male
  - Well known to department over the previous year:
  - Dislocated shoulder with glenoid fracture
    - Put in sling, told not to use and referred to clinic for followup
    - Did not attend clinic and subsequently attended ED 4 more times over the next 3/52 with dislocations – dirtbike riding, playing football etc
    - I attempted to reason with patient who did not want to refrain from these activities. Mother not helpful. Also stressed importance of clinic followup which patient again did not attend
  - Midshaft clavicle # with overlap
    - Reattended without sling complaining of pain
    - Failed to attend clinic
    - Fell again after 3-4 weeks motocross riding and re-fractured
    - Did not attend clinic
  - Didn't attend any followup in OPs

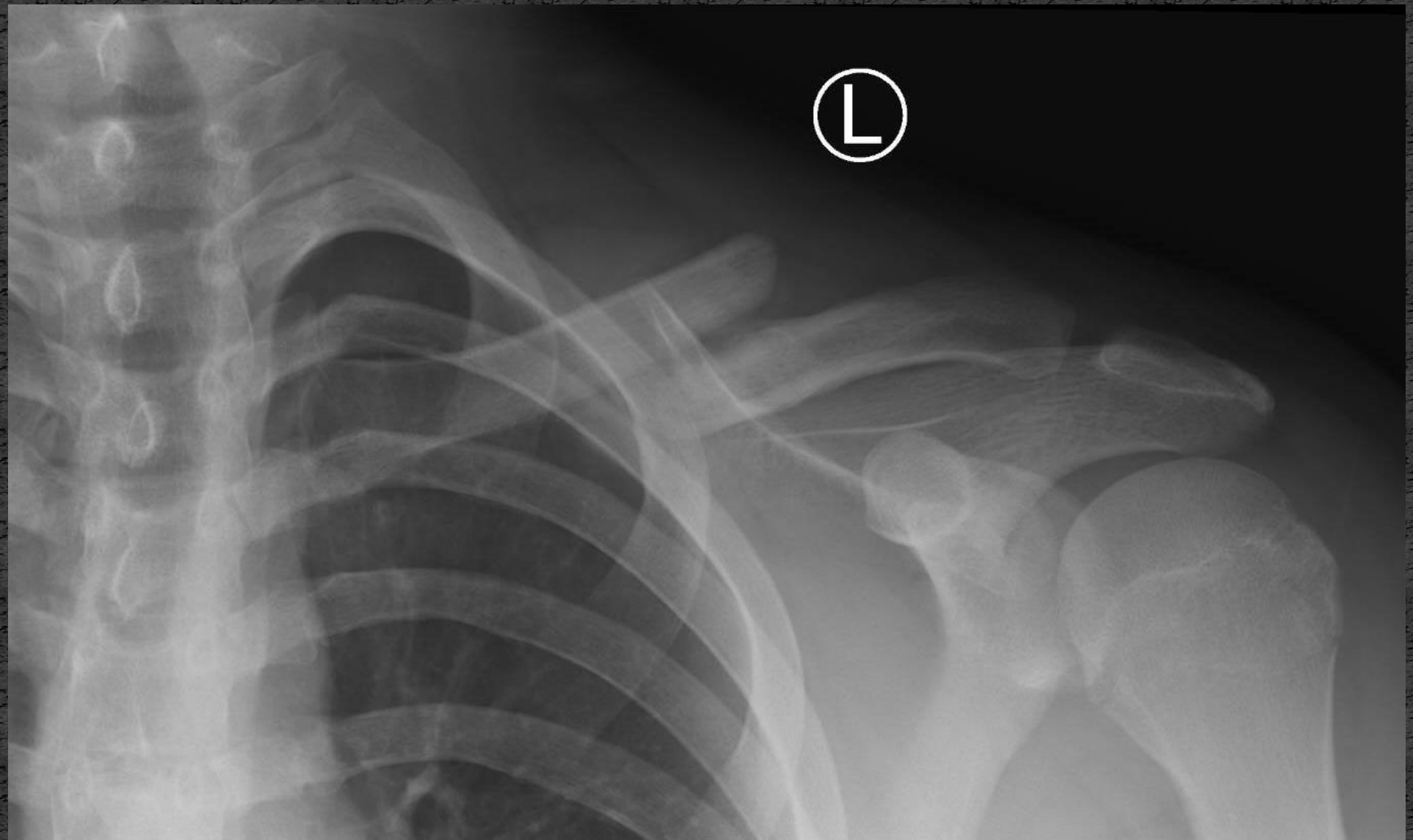
Case Study 2

- Presents about 3/12 after last clavicle re-# after a click at fracture site after elevating same to pick up something from the cupboard
- Reporting discoloured, cold L upper limb when elevating
- No symptoms at other times
- Persisting deformity

Case Study 2

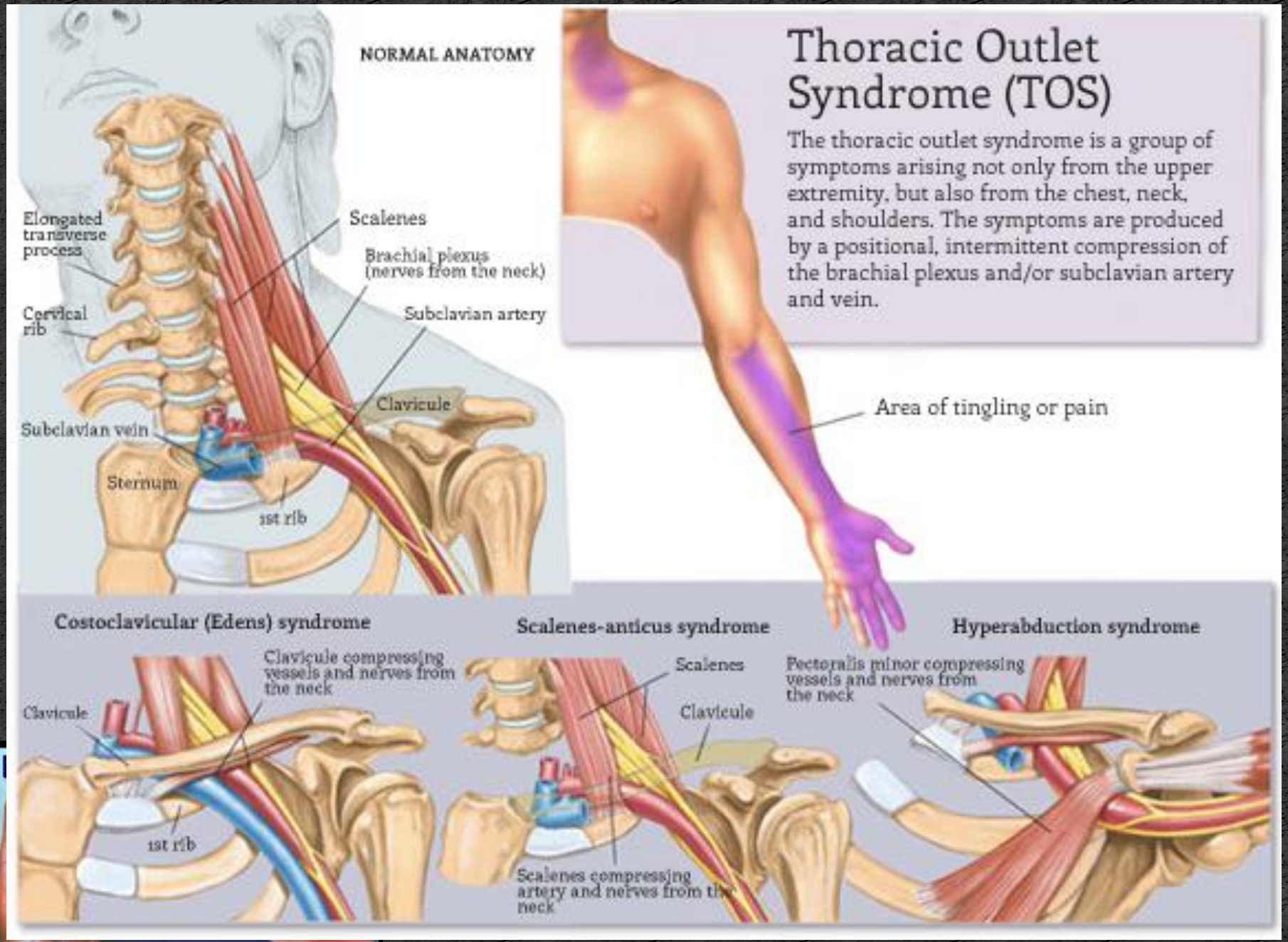
- Objective:
  - Strong radial pulse but possibly weaker than other side
  - Otherwise distal NV function normal
  - If elevates arm, upper limb appears mottled and hand becomes cool


L


L

Case Study 2

- **Ultrasound Report** (Arterial and venous ultrasound of the left upper limb)
  - The left subclavian vein is patent
  - There is an ***abdominal*** flow at rest and of abduction
  - No DVT is identified
  - There is complete loss of flow within the subclavian artery at 45 degrees of abduction.
  - **Appearances are compatible with thoracic outlet syndrome. This may be post-traumatic given previous clavicular fracture. No evidence of venous obstruction.**

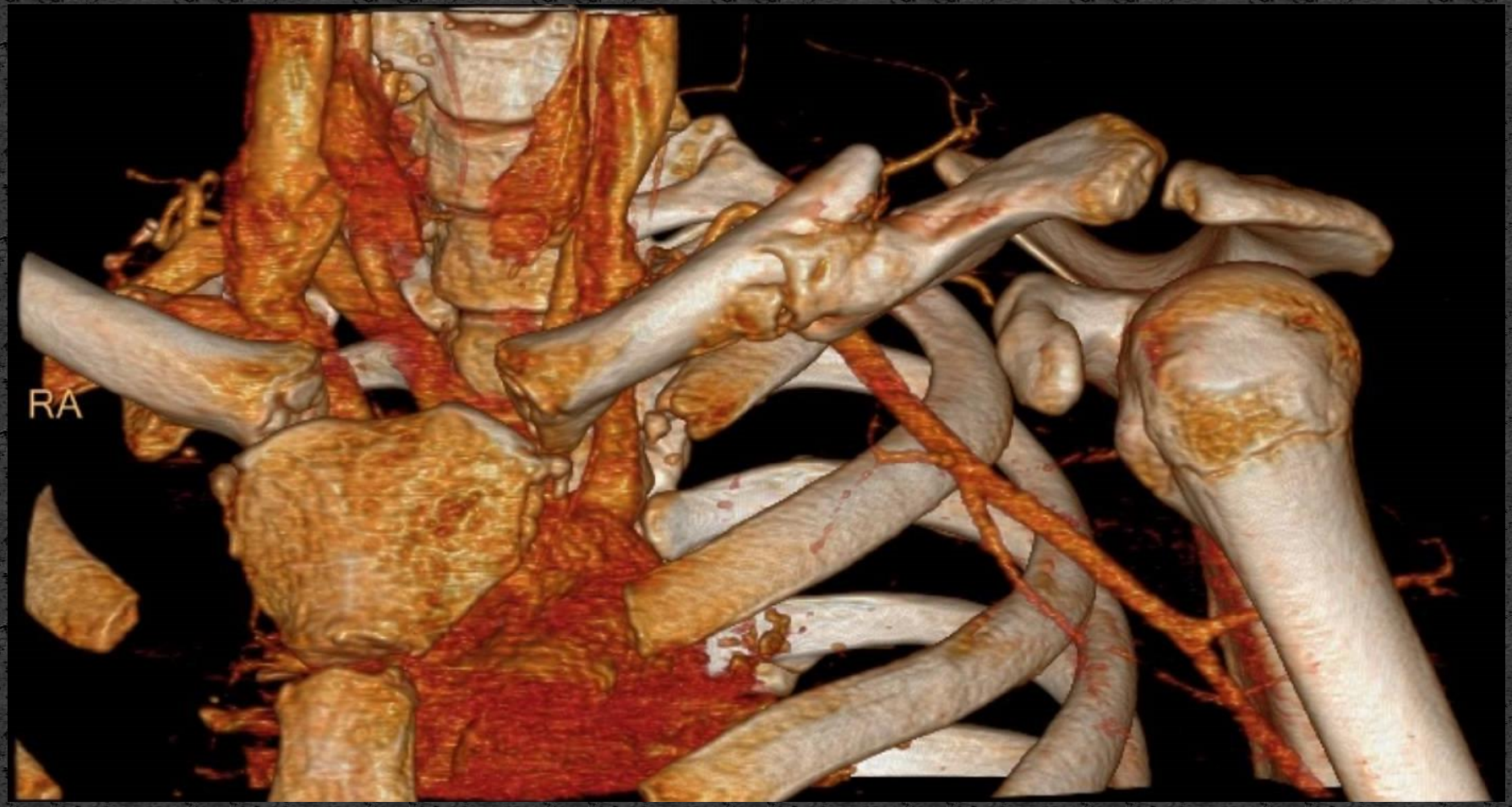

NORMAL ANATOMY
Elongated transverse process
Scalenes
Brachial plexus (nerves from the neck)
Cervical rib
Subclavian artery
Clavicule
Subclavian vein
Sternum
1st rib
Thoracic Outlet Syndrome (TOS)
The thoracic outlet syndrome is a group of symptoms arising not only from the upper extremity, but also from the chest, neck, and shoulders. The symptoms are produced by a positional, intermittent compression of the brachial plexus and/or subclavian artery and vein.
Area of tingling or pain
Costoclavicular (Edens) syndrome
Clavicule compressing vessels and nerves from the neck
Clavicule
1st rib
Scalenes-anticus syndrome
Scalenes
Clavicule
Scalenes compressing artery and nerves from the neck
Hyperabduction syndrome
Pectoralis minor compressing vessels and nerves from the neck

Case Study 2

- **CT Angiogram Report**
  - **The examination is performed with the arm in adducted position to demonstrate the normal anatomical disposition of the subclavian artery and vein.**
  - **Both the subclavian artery and vein are normal - no evidence of dissection or false aneurysm.**
  - **The anterior margin of the subclavian artery is 1 cm from the posterior aspect of the fractured clavicle/callus complex.**
  - **The subclavian vein is virtually in direct contact with the posterior aspect of the fractured clavicle/callus complex.**
  - **In the adductor position, there is no evidence of obstruction of either the vein or the artery.**
  - **The internal mammary artery and the proximal portion of the left vertebral artery and their origins from the subclavian artery are normal. The axillary artery is also normal.**

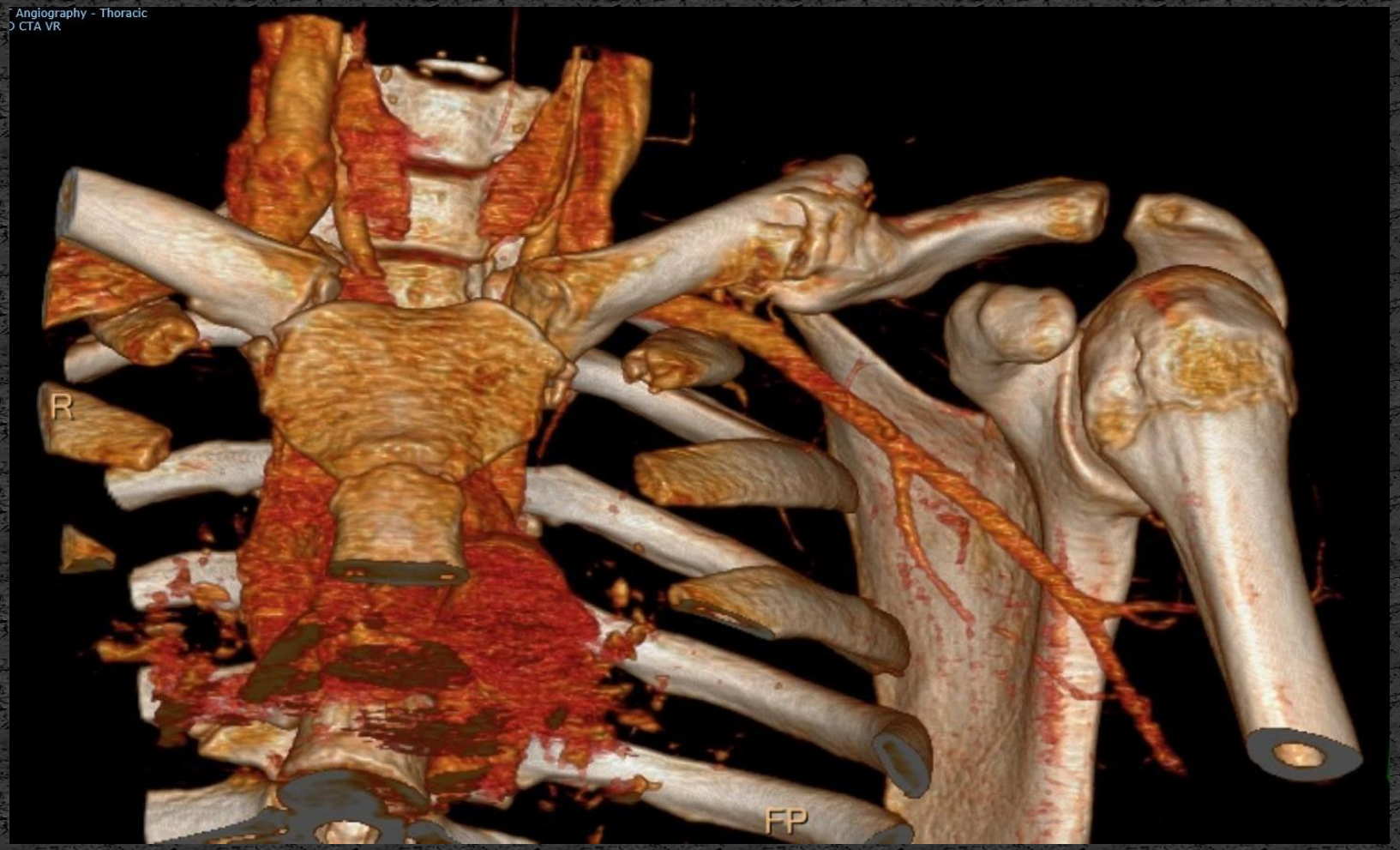
Case Study 2

- **CT Angiogram**



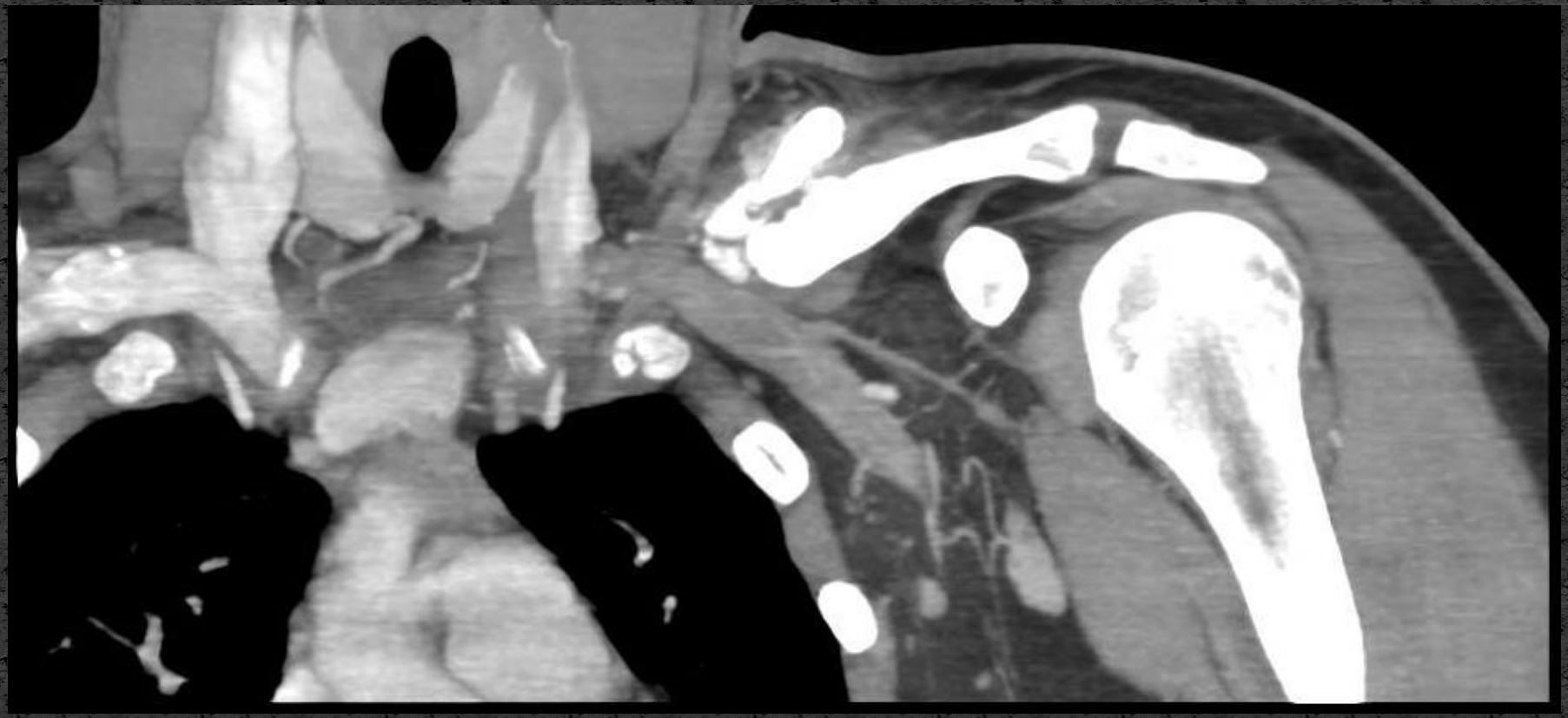
Case Study 2

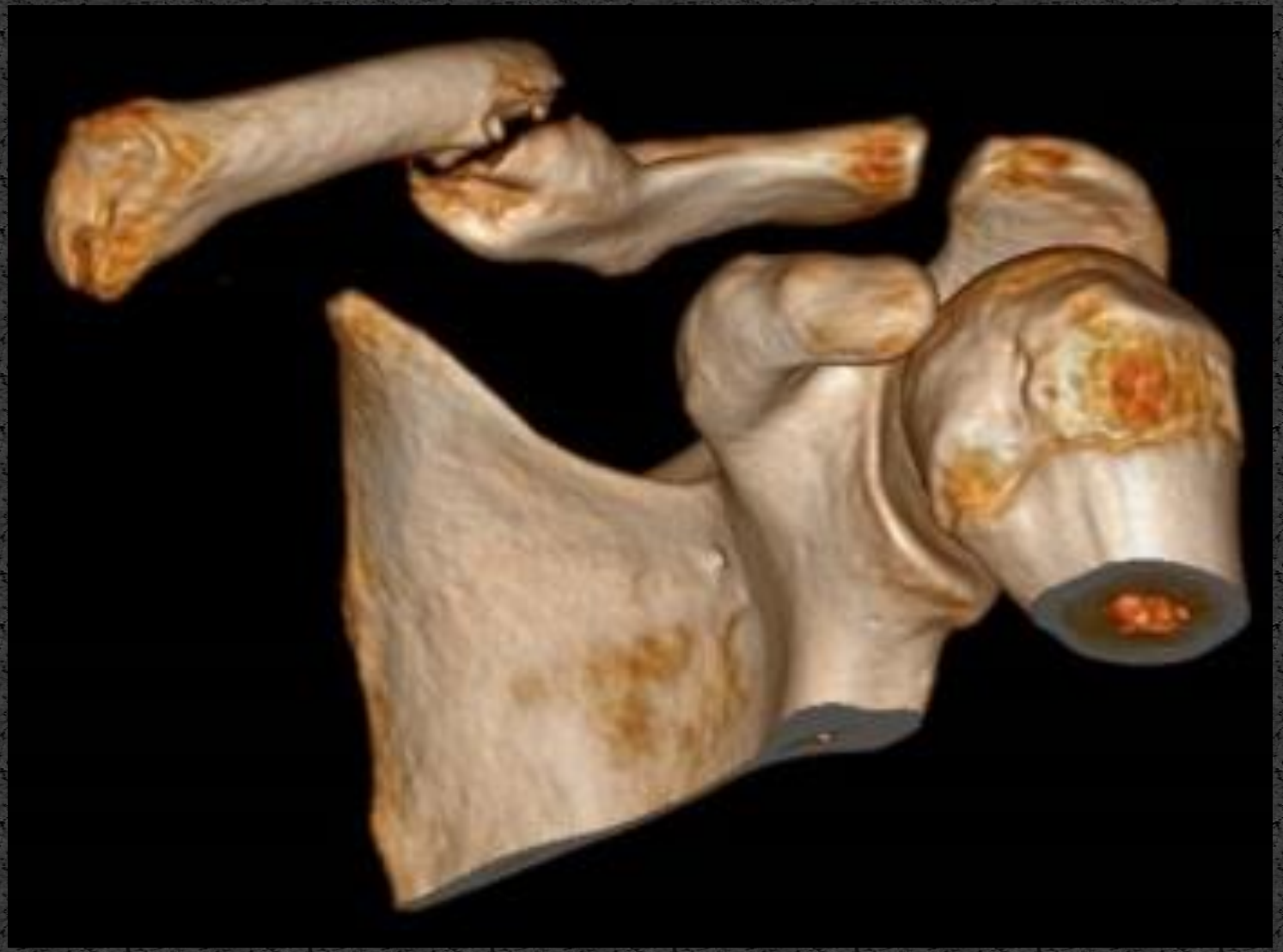
- **CT Angiogram**



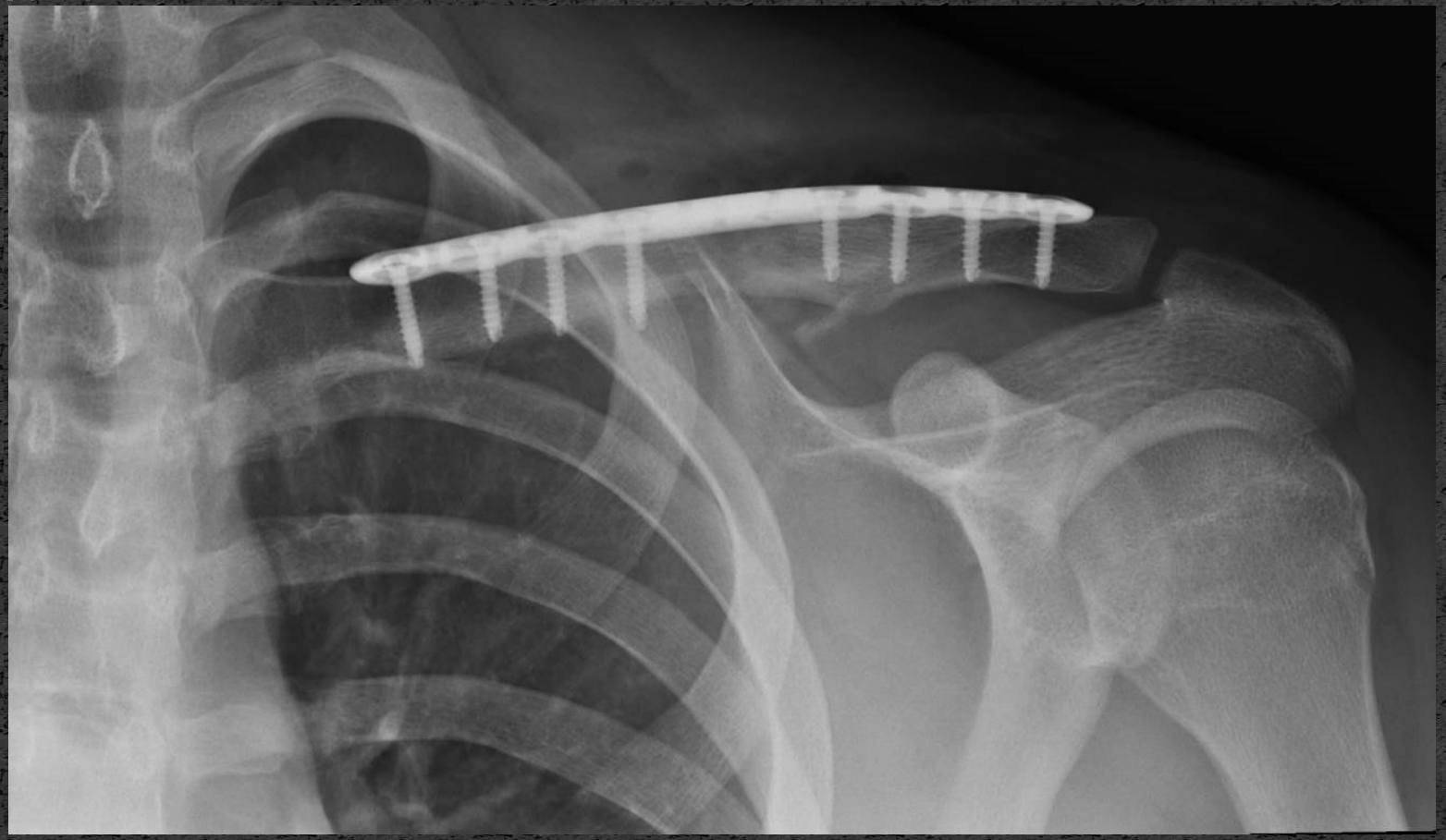
Case Study 2

- **CT Angiogram**





End Result



- Supposed to go to clinic for review post op this week

CASE STUDY 3

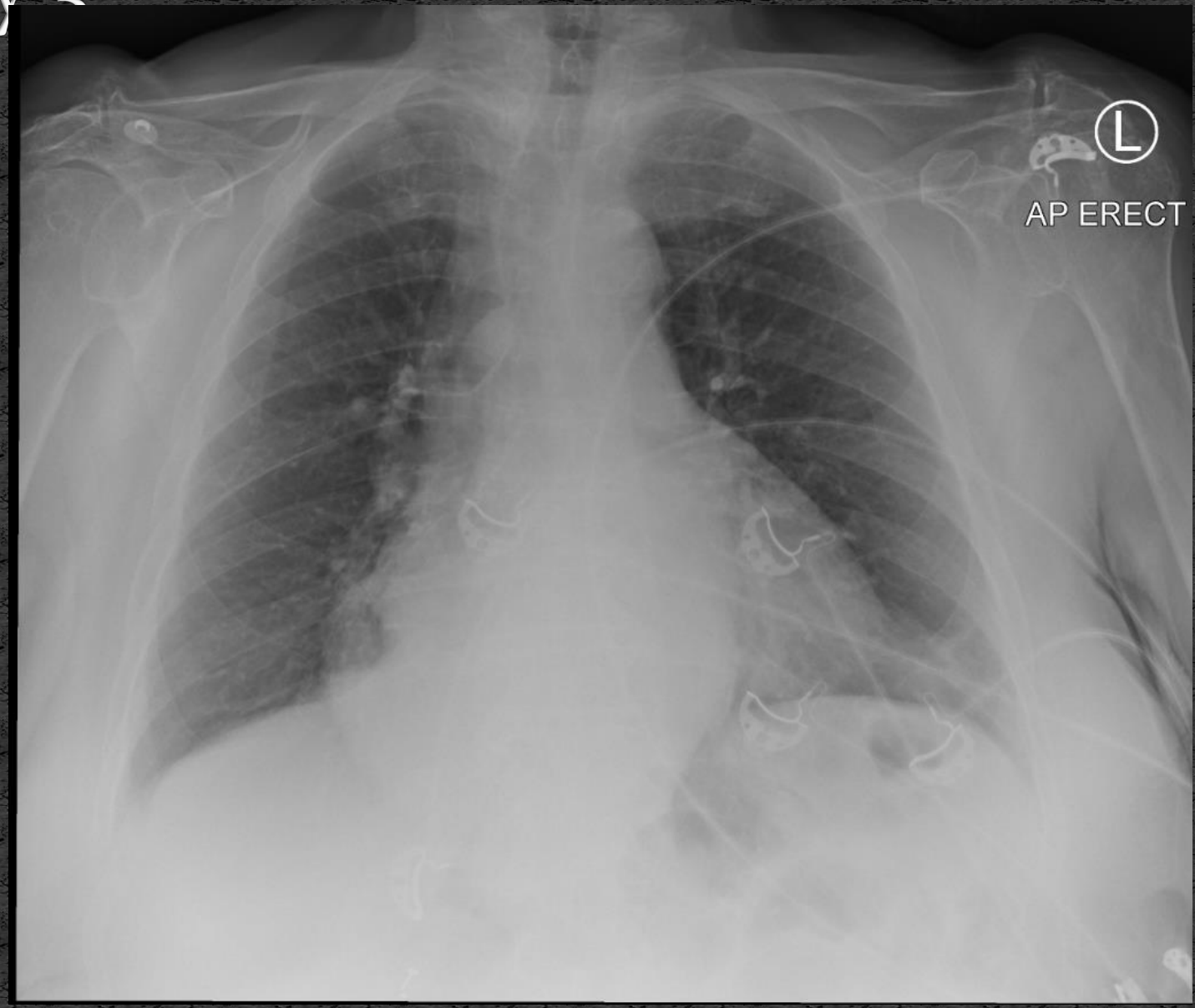
Case Study 3

- 90 year old female
- Fall in garden - ? why – landed on R side
- R shoulder pain radiating down arm

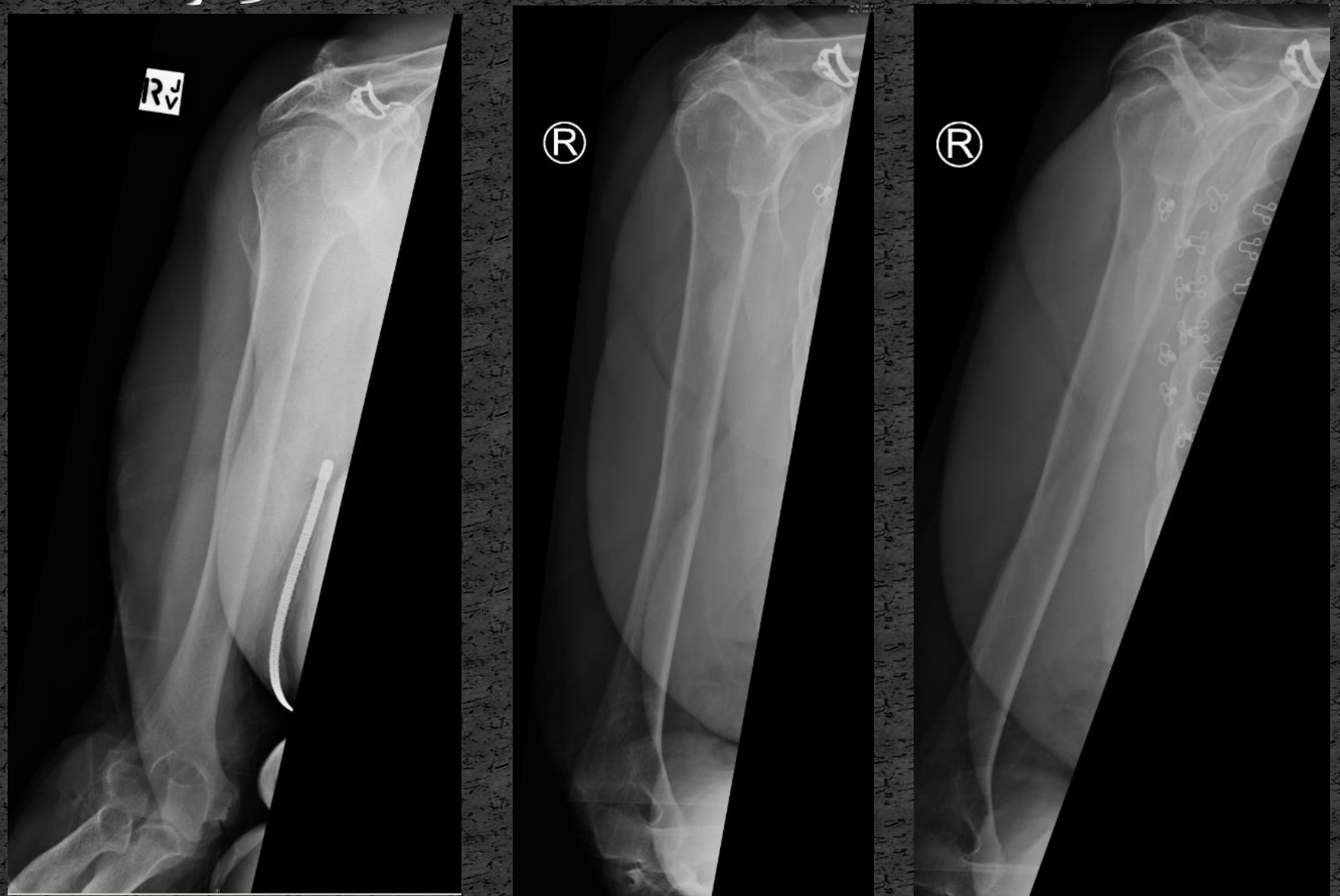
cranial nerves - normal eye movements, normal facial sensation and movements, nil tongue deviation, PEARL upper limbs - 5/5 power left side, 4/5 right side due to pain, normal tone, brisk reflexes, sensation and coordination intact lower limbs - 5/5 power, normal tone, unable to elicit knee or ankle jerk, plantars downgoing, sensation intact
soft calves, nil oedema, non tender
right shoulder joint painful and distal end of humerus painful, limited motion due to pain
? humerus fracture

xray analgesia bloods urine
right humerus and elbow xray - NAD CXR - ?blunting of right costodiaphragmatic recess

Case Study 3



Case Study 3



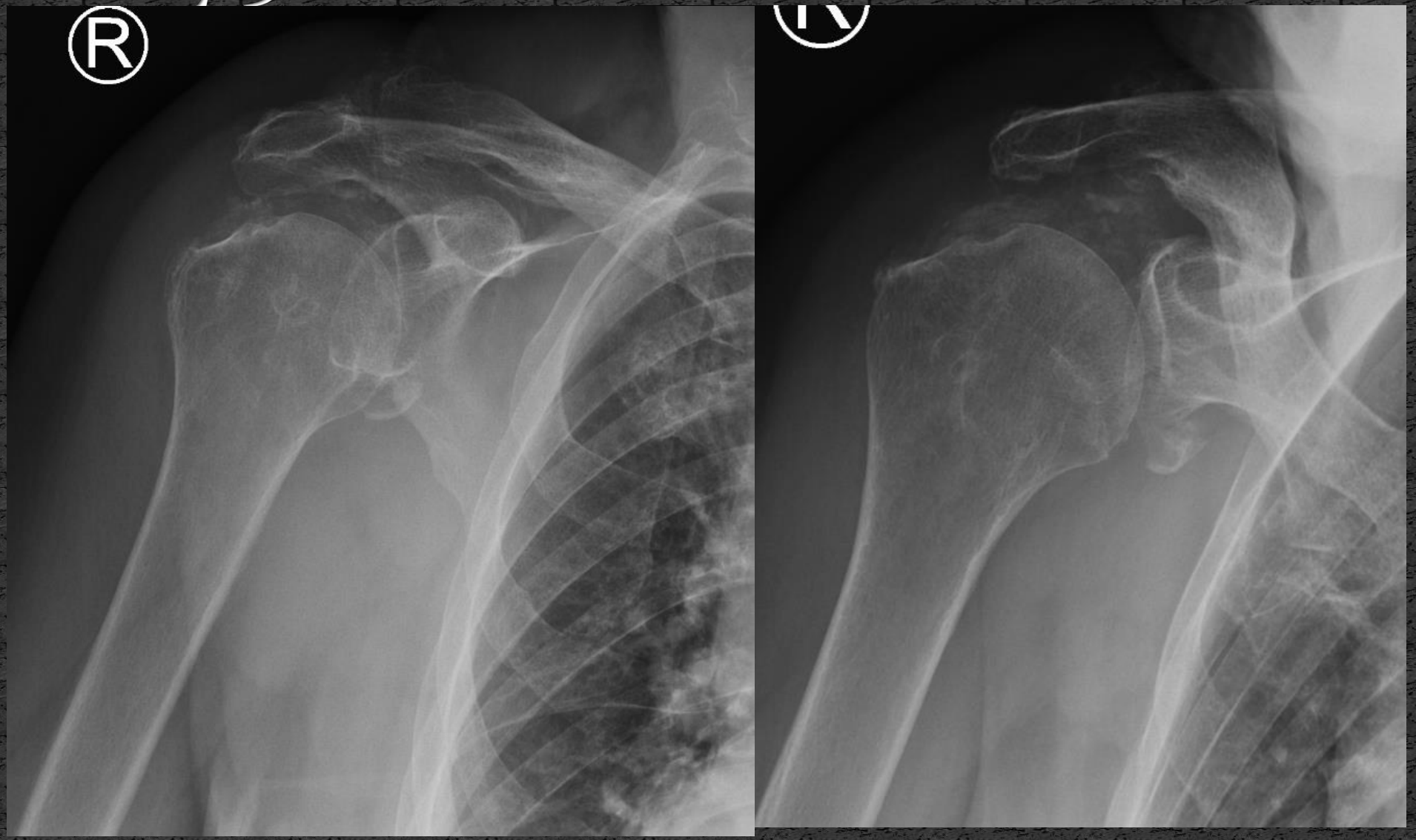
Case Study 3

- Secondary Physio referral in the AM
- Move wrist – OK
- Move elbow – OK
- Move shoulder – Problem
- Shoulder clearly dislocated

Case Study 3

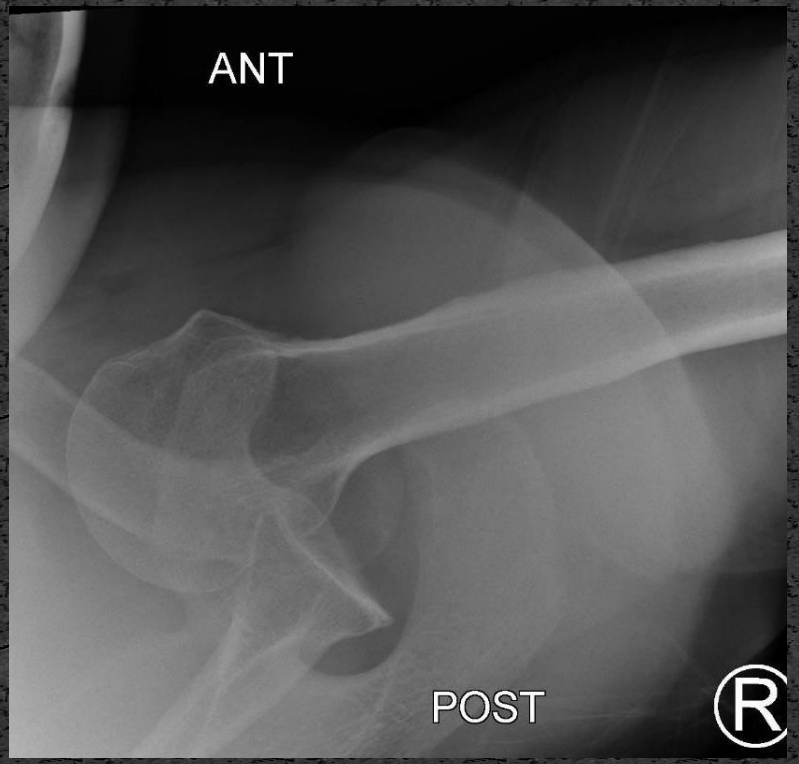
- Patient brought to Procedure Room
- Attempted without sedation = no go
- Attempted with NO_2 = no go
- With propofol = very difficult, but able to reduce

Case Study 3

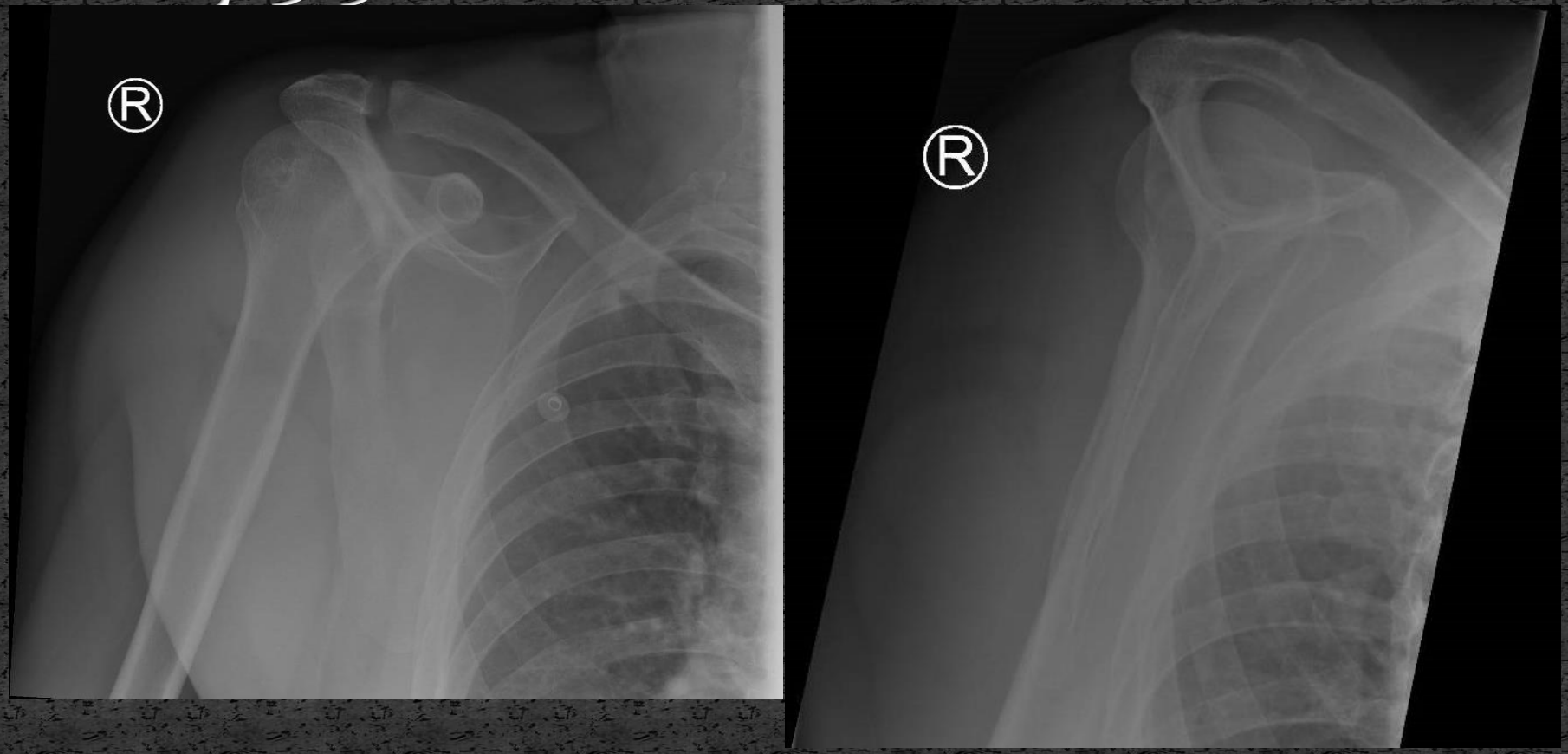


Case Study 3

Case Study 3.5



Case Study 3.5



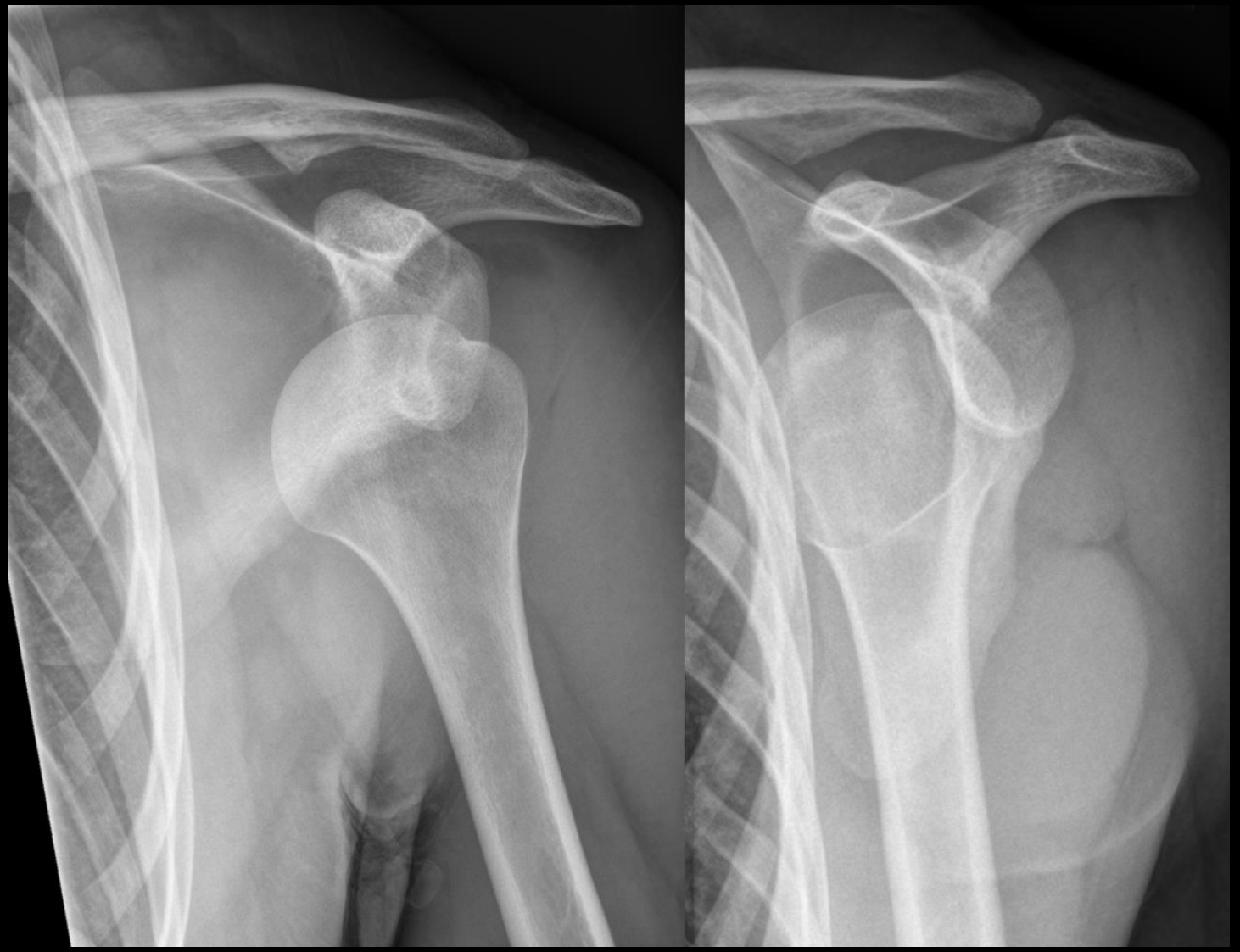
Case Study 3.5

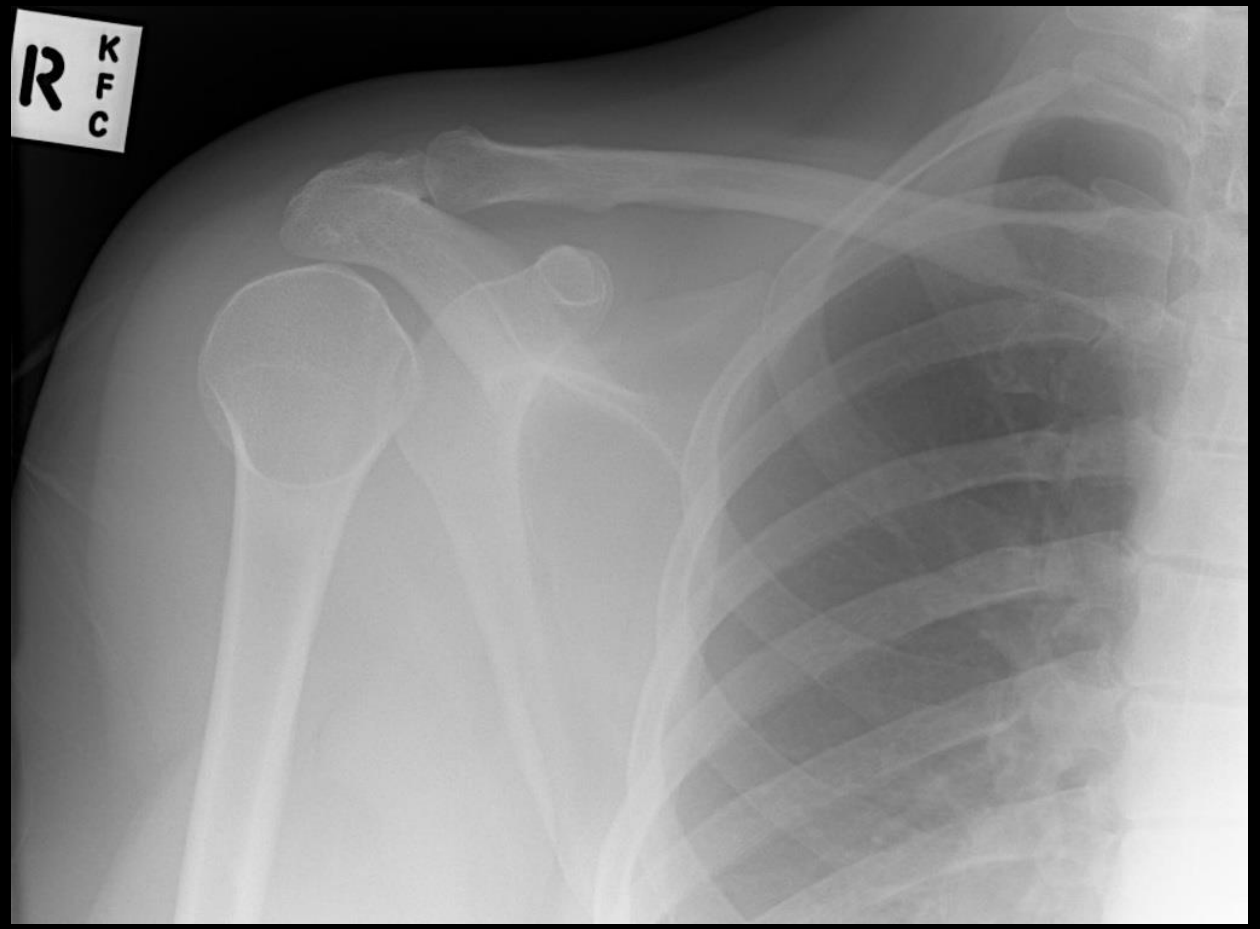
Lesson

- For shoulder problems, GET SHOULDER VIEW!!!! (not humerus)
- Could not see glenoid properly in the humerus view (is AP and lateral to HUMERUS, not SHOULDER)

TEST TIME


R

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