# Thoracic Outlet Syndrome: Relevance in Upper Limb DVT Scanning

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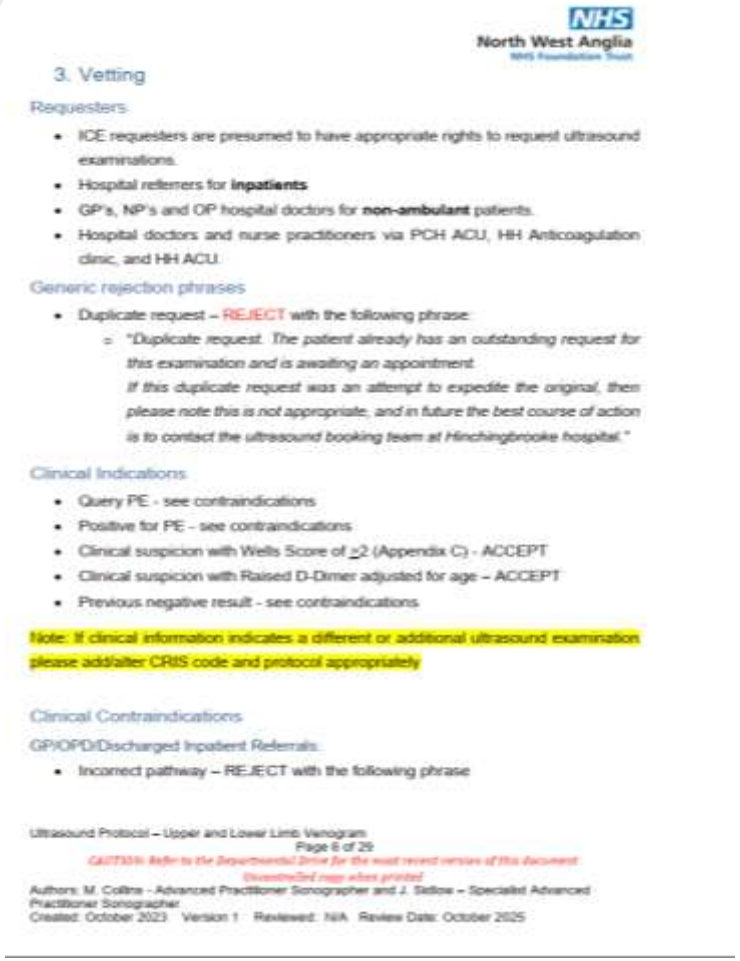
# Local protocols update

- Local protocols update
  - Comprehensive
  - Concise
  - Vetting
  - Scanning
  - Images
  - Report
  - Pathology



NHS North West Anglia

## 3. Vetting

### Requesters

- ICE requesters are presumed to have appropriate rights to request ultrasound examinations.
- Hospital referrers for **inpatients**
- GP's, NP's and OP hospital doctors for **non-ambulant** patients.
- Hospital doctors and nurse practitioners via PCH ACU, HH Anticoagulation clinic, and HH ACU.

### Generic rejection phrases

- Duplicate request – REJECT with the following phrase:
  - *"Duplicate request. The patient already has an outstanding request for this examination and is awaiting an appointment.*
    *If this duplicate request was an attempt to expedite the original, then please note this is not appropriate, and in future the best course of action is to contact the ultrasound booking team at Hinchingbrooke hospital."*

### Clinical Indications

- Query PE - see contraindications
- Positive for PE - see contraindications
- Clinical suspicion with Wells Score of ≥2 (Appendix C) - ACCEPT
- Clinical suspicion with Raised D-Dimer adjusted for age – ACCEPT
- Previous negative result - see contraindications

Note: If clinical information indicates a different or additional ultrasound examination please add/alter CRIS code and protocol appropriately

### Clinical Contraindications

GP/OPD/Discharged Inpatient Referrals

- Incorrect pathway – REJECT with the following phrase



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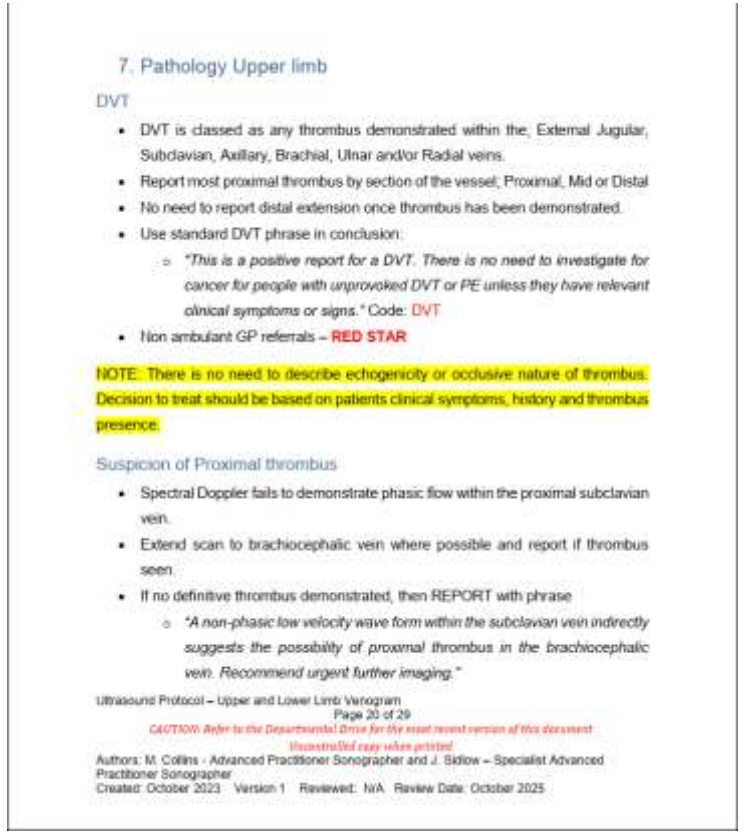

## 7. Pathology Upper limb

### DVT

- DVT is classed as any thrombus demonstrated within the; External Jugular, Subclavian, Axillary, Brachial, Ulnar and/or Radial veins.
- Report most proximal thrombus by section of the vessel; Proximal, Mid or Distal
- No need to report distal extension once thrombus has been demonstrated.
- Use standard DVT phrase in conclusion:
  - *"This is a positive report for a DVT. There is no need to investigate for cancer for people with unprovoked DVT or PE unless they have relevant clinical symptoms or signs."* Code: DVT
- Non ambulant GP referrals – **RED STAR**

NOTE: There is no need to describe echogenicity or occlusive nature of thrombus. Decision to treat should be based on patients clinical symptoms, history and thrombus presence.

### Suspicion of Proximal thrombus

- Spectral Doppler fails to demonstrate phasic flow within the proximal subclavian vein.
- Extend scan to brachiocephalic vein where possible and report if thrombus seen.
- If no definitive thrombus demonstrated, then REPORT with phrase
  - *"A non-phasic low velocity wave form within the subclavian vein indirectly suggests the possibility of proximal thrombus in the brachiocephalic vein. Recommend urgent further imaging."*



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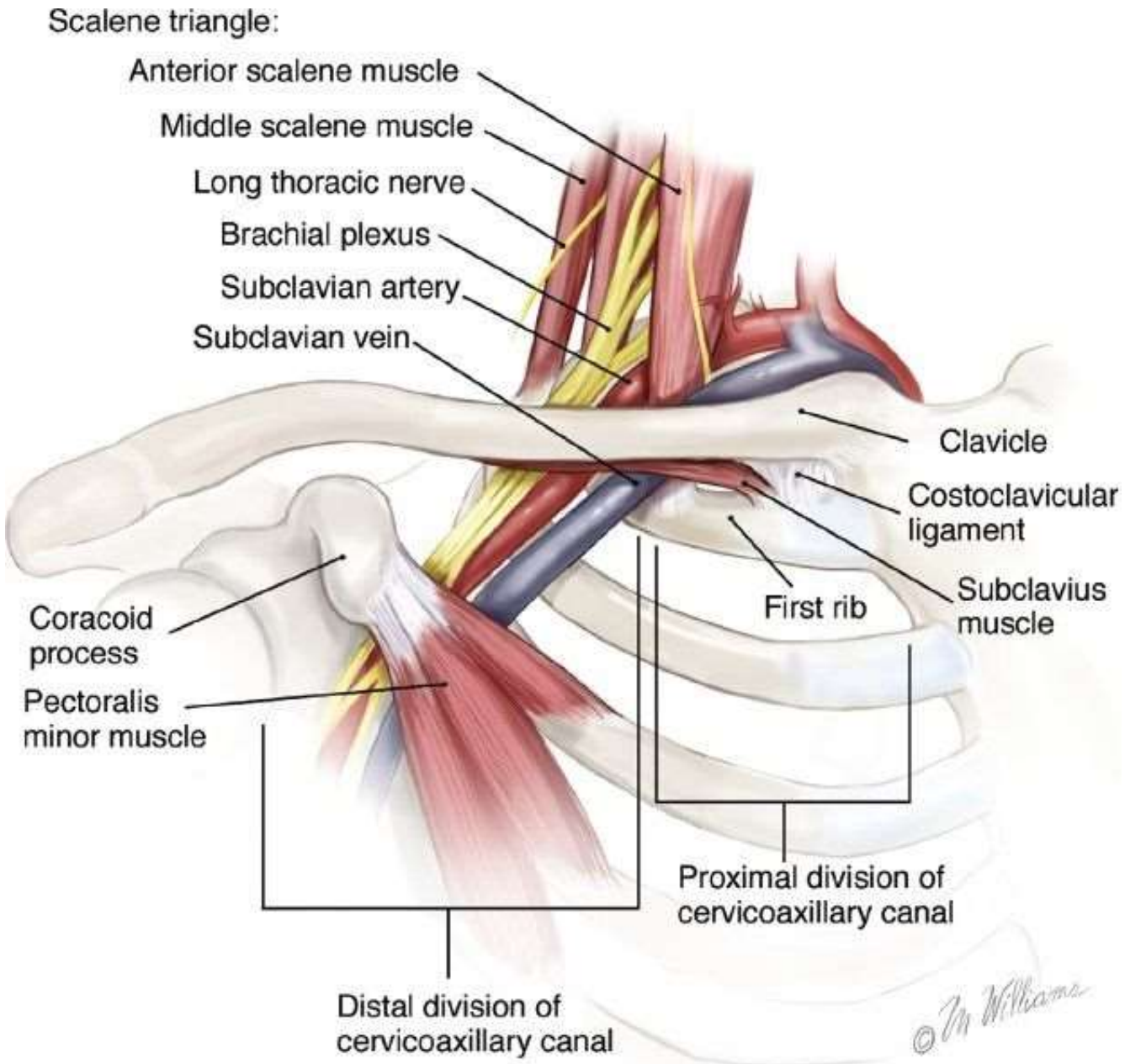
# UKAS Accreditation

- Assess imaging services
- NHS England standards
- CQC recognised
- Experts in areas
- Operating procedures
- Management structure
- Quality assurance
- Department protocols
- Peterborough City Hospital, Stamford and Rutland Hospital, City Care Centre December 2013
- Hinchingbrooke Hospital, Ely and Doddington 2024.

# Thoracic Outlet Syndrome

- 98% nerve compression / neurogenic
  - Brachial plexus
- 2% vessel compression
  - Subclavian artery
  - Subclavian Vein

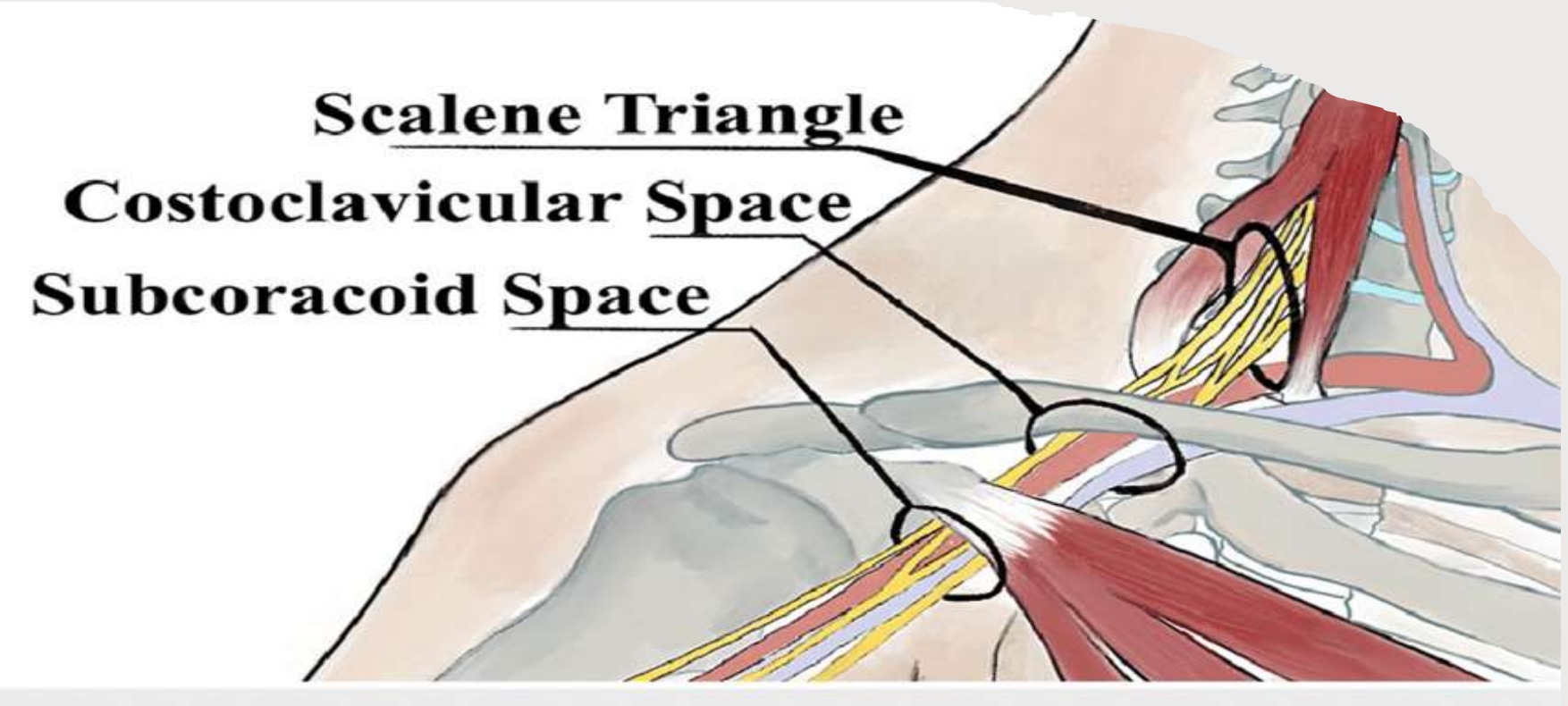


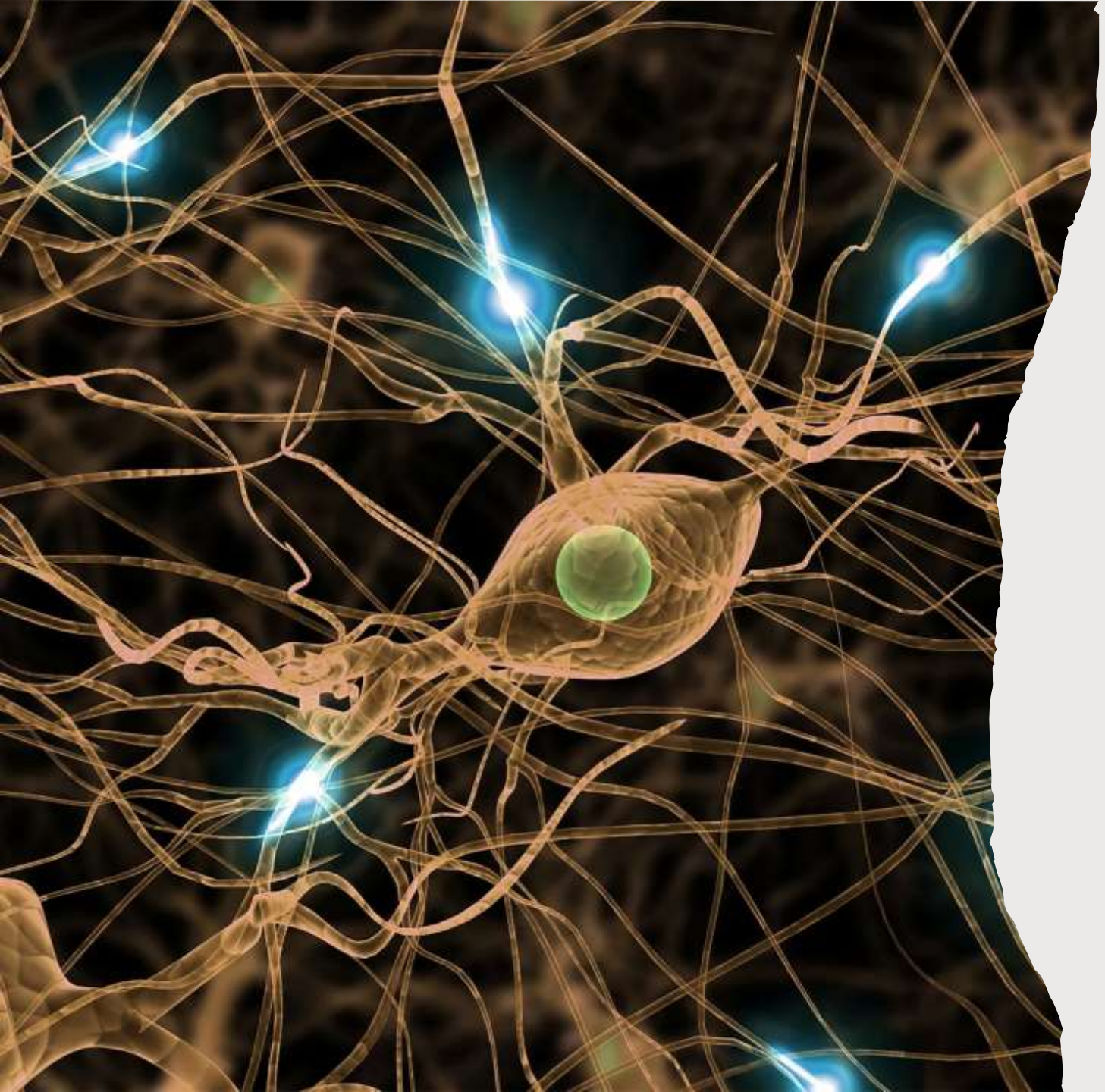
# Causes and Risk Factors

- Poor posture
  - Rounding of shoulders, head in a forward position
- Trauma
  - High impact, often delayed
- Repetitive activity
  - Typing, manual labour, and sports like weightlifting or swimming ect.
- Anatomical defects
  - Muscle thickness, vascular anatomy,, cervical rib, fibrous bands
- Extra pressure on your joints
  - Being overweight, oversized heavy backpack
- Risks : Females>Males,  >Young adults

# Compression sites

- Scalene triangle: between scalenus anterior and scalenus medius muscles
- Costoclavicular space: between the clavicle and 1st rib
- Subcoracoid / Retro or sub-pectoralis minor space: between pectoralis minor and coracoid process



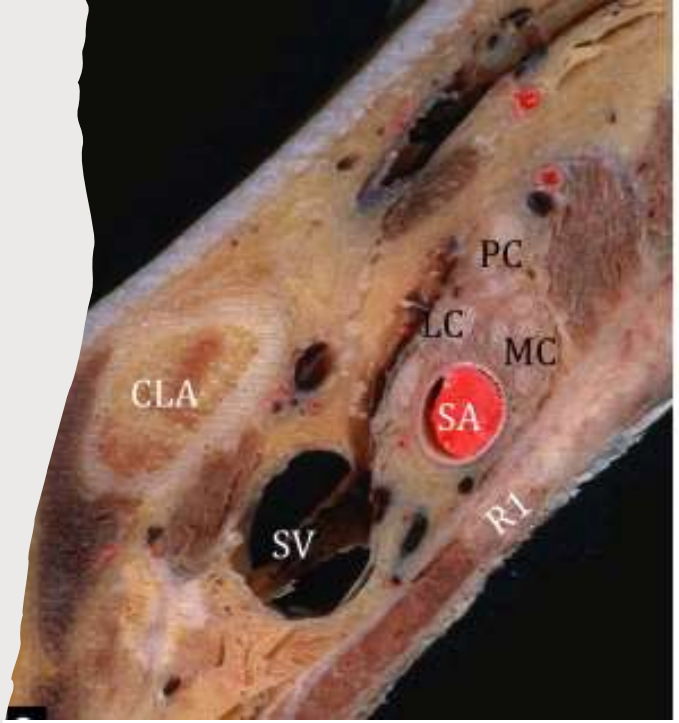


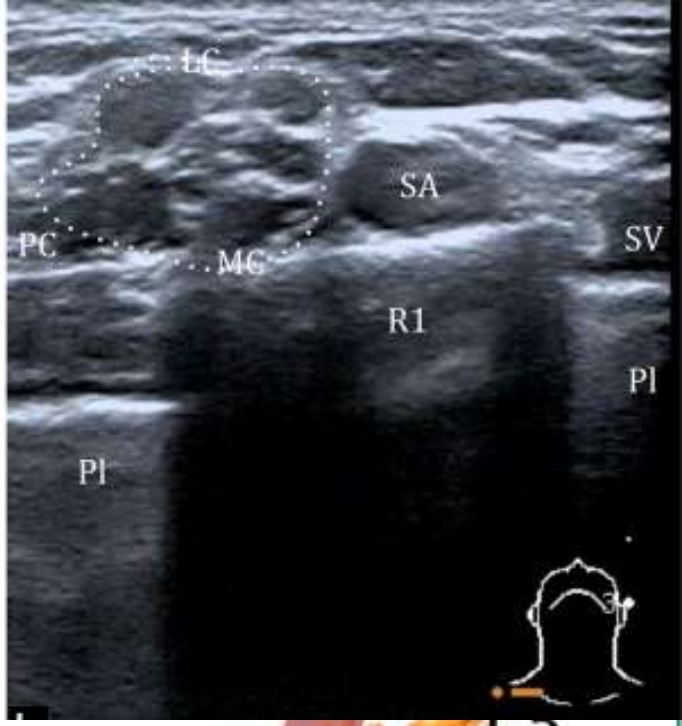
# Nerve Symptoms

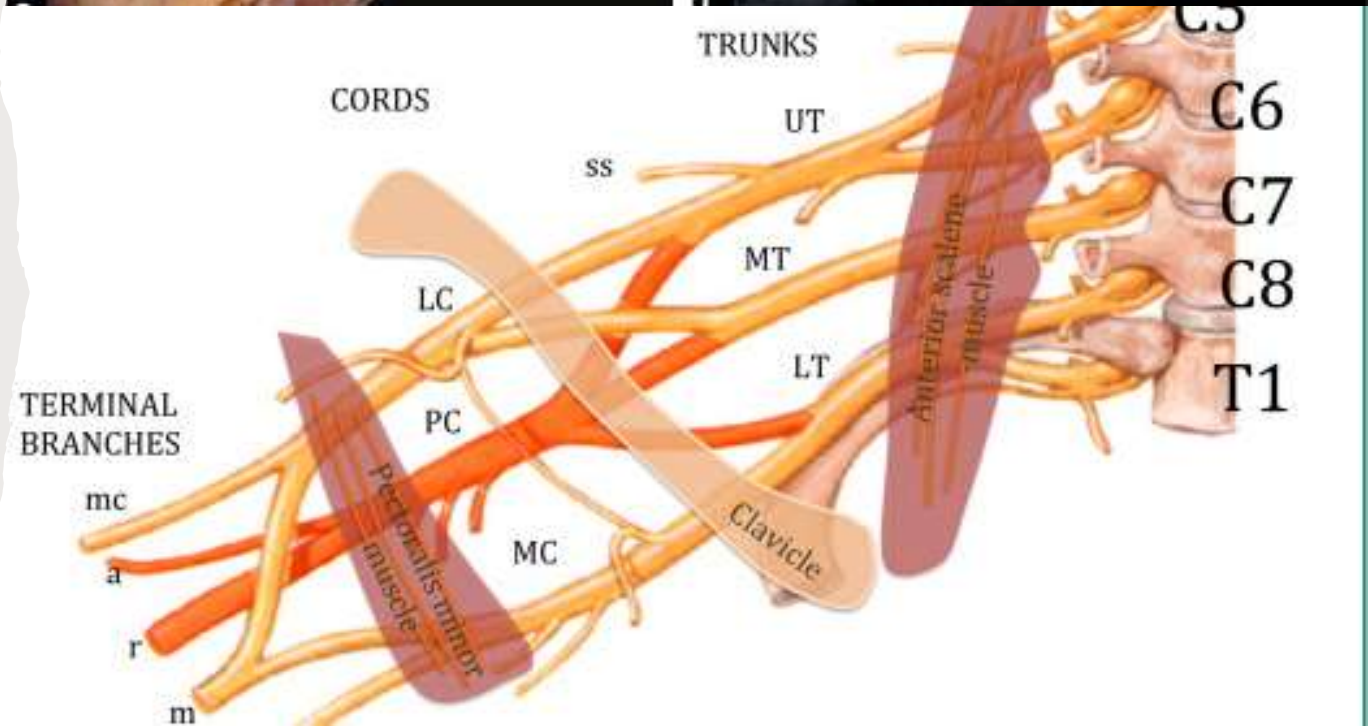
- Muscle wasting in the fleshy muscle at the base of thumb
- Numbness/ tingling in arm or fingers
- Pain in neck, shoulder or hand
- Weakened grip
- Venogram referral?

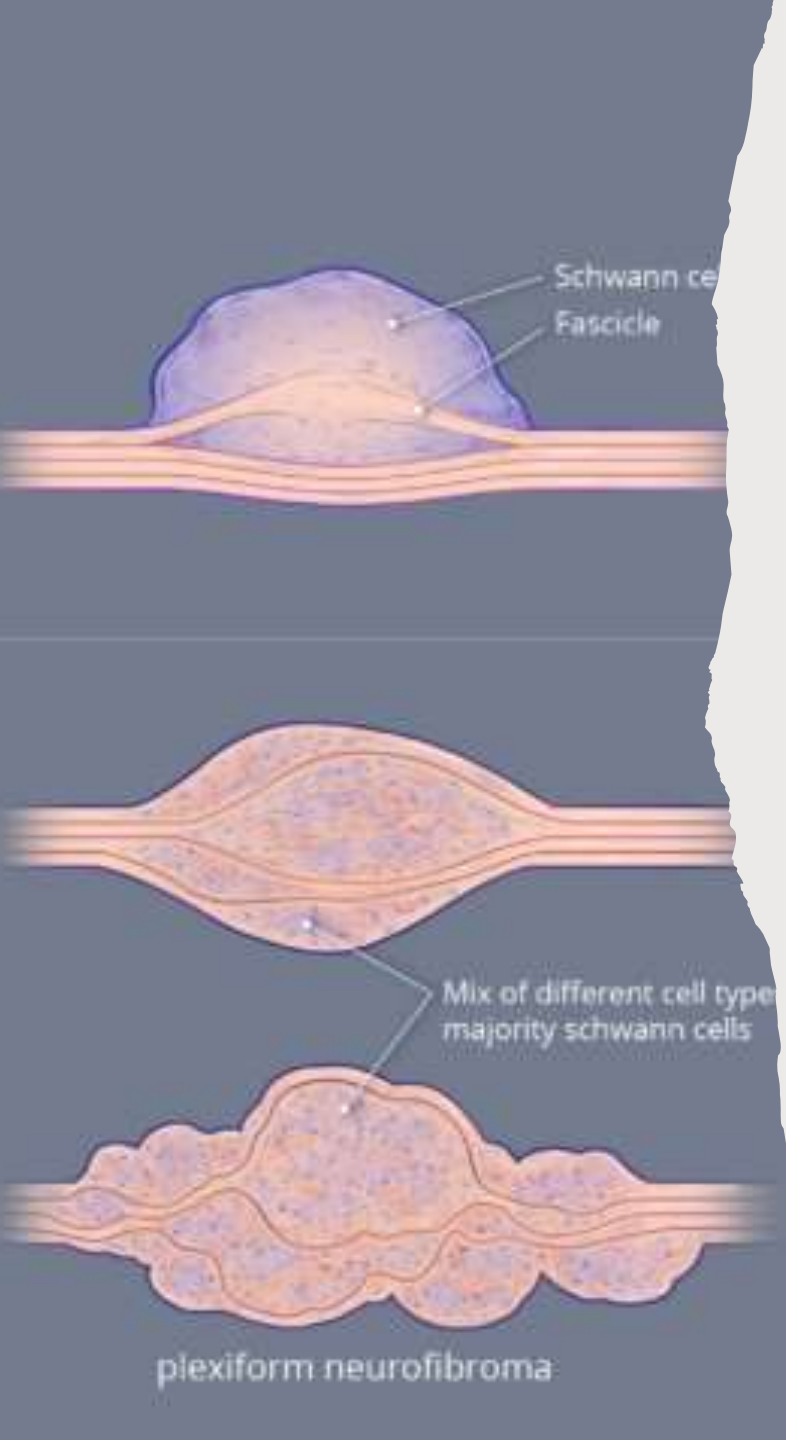
# Branchial plexus

- Scalene triangle
- Confluence of nerves
- Originating C5-T1
- Through the thoracic outlet
- Supplies skin and musculature of the upper limb
- Head and Neck ultrasound
- Carotid ultrasound
- Schwannoma
- Neurofibroma



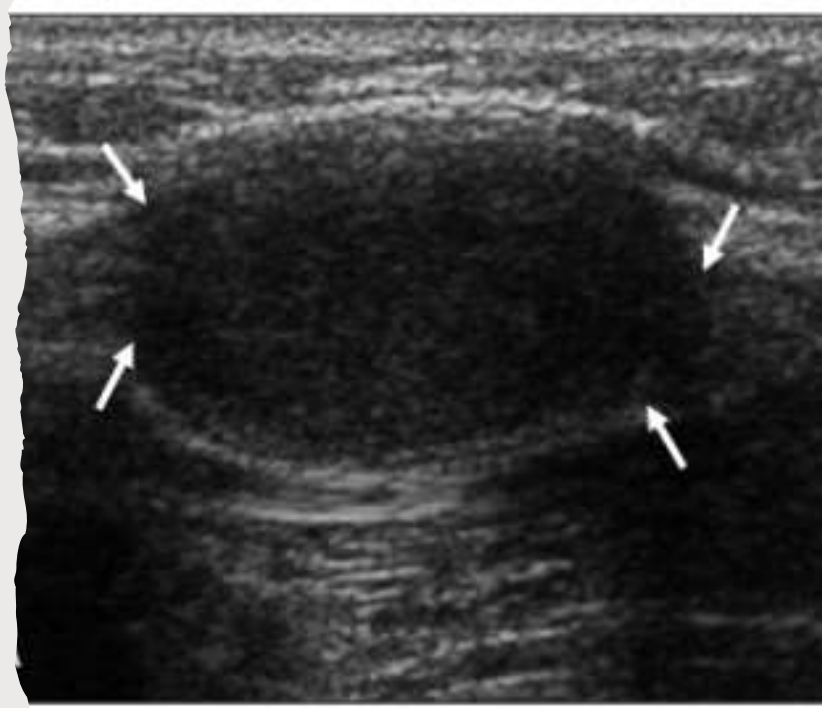



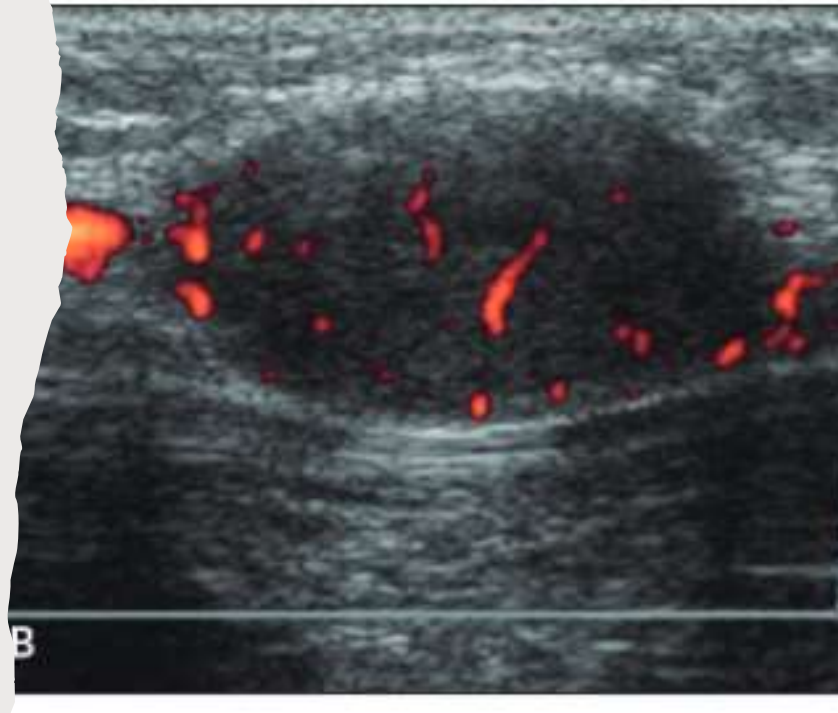






# Nerve Tumors

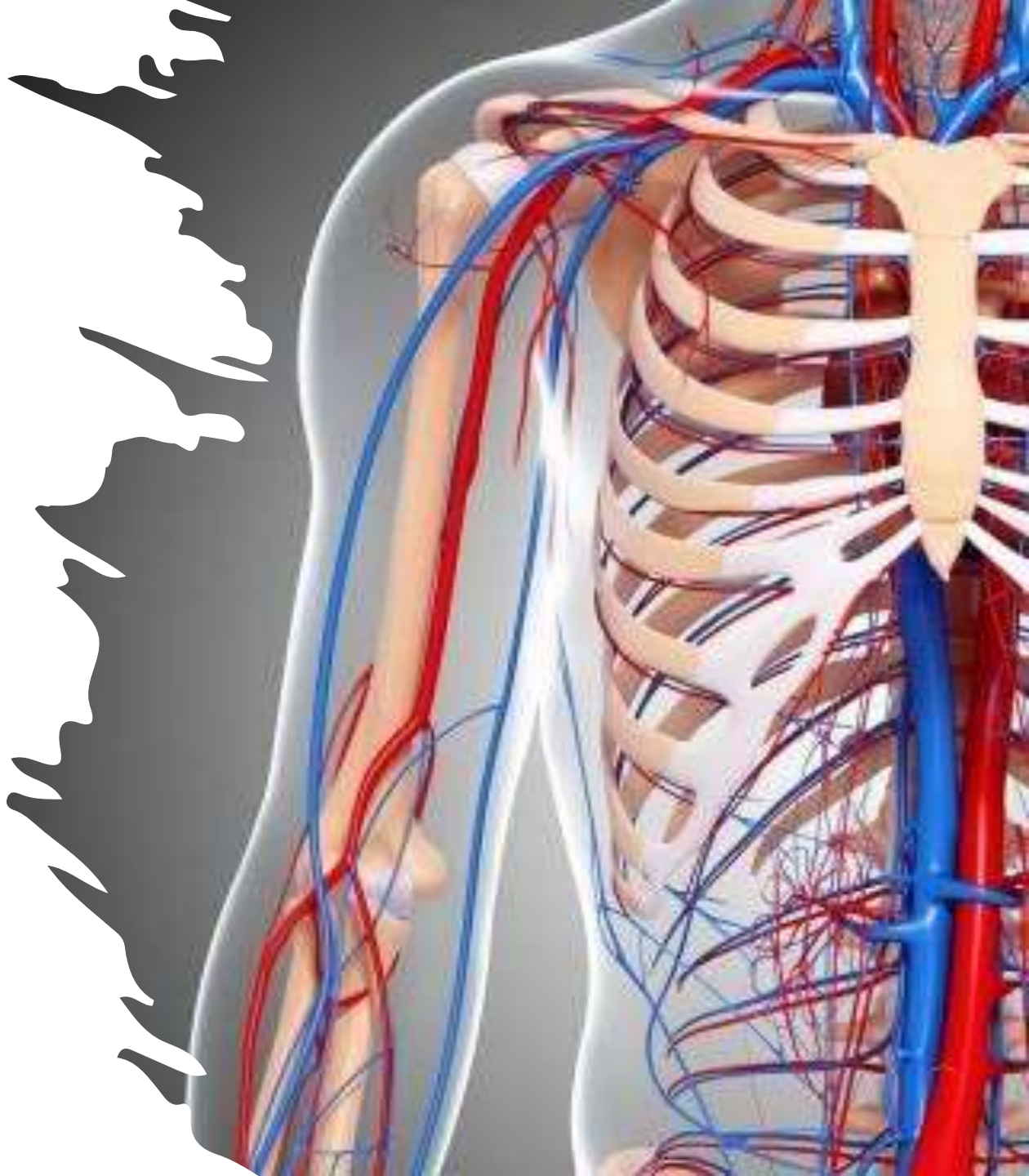
- Ultrasound can easily visualise nerve sheath tumors
- Schwannoma and Neurofibroma
- Usually benign
- Originate from Schwann cells
- Associated with neurofibromatosis
- Increase risk of TOS symptoms
- Gold standard =  MRI assessment
- Don’t FNAC





# Arterial Supply Symptoms

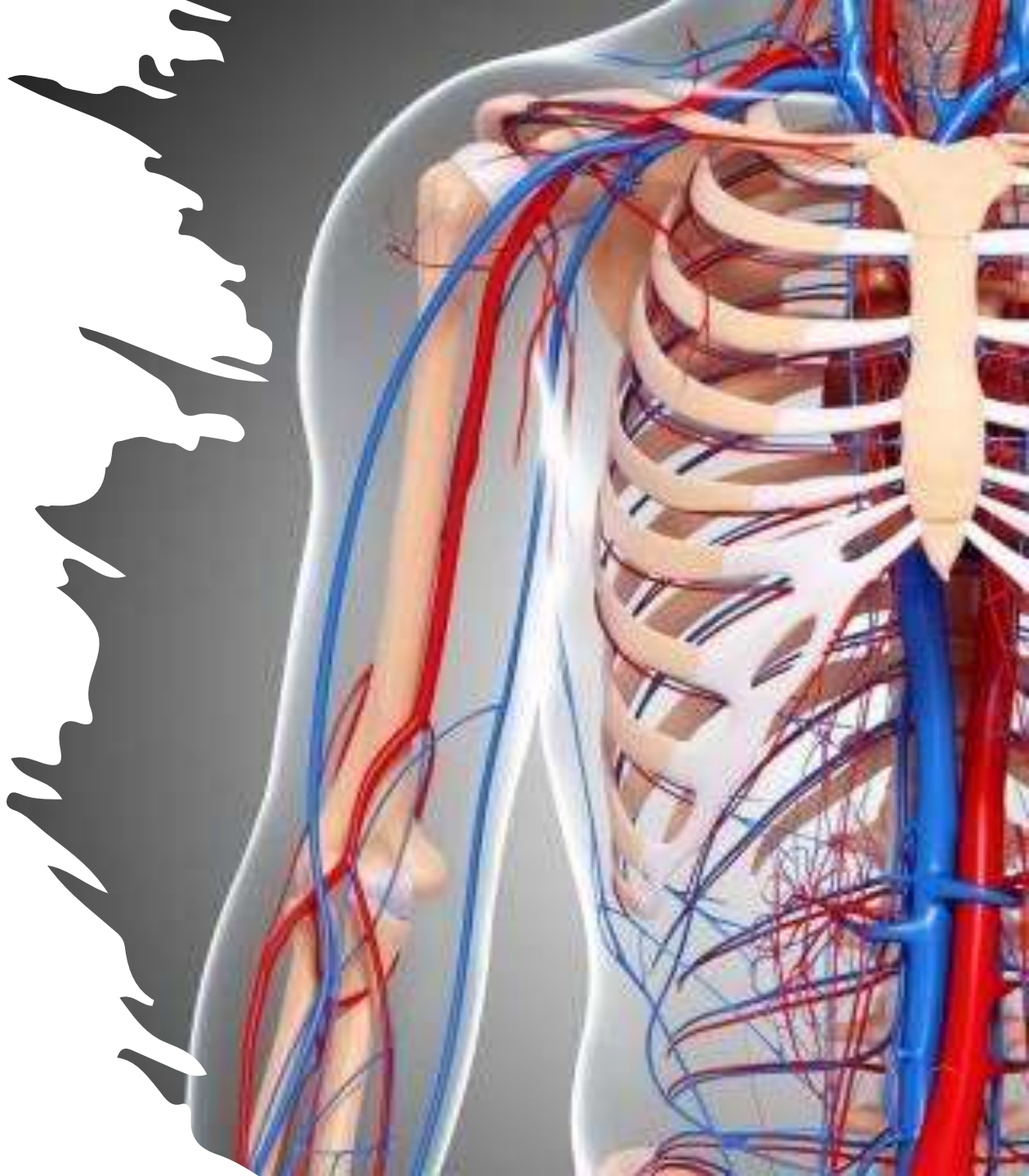
- Claudication (Muscle pain on exertion)
- Pallor/Paleness
- Numbness
- Weak or absent pulse in affected arm
- Cold fingers, hands or arms
- Quickly fatigued through activity



# Venous Supply Symptoms

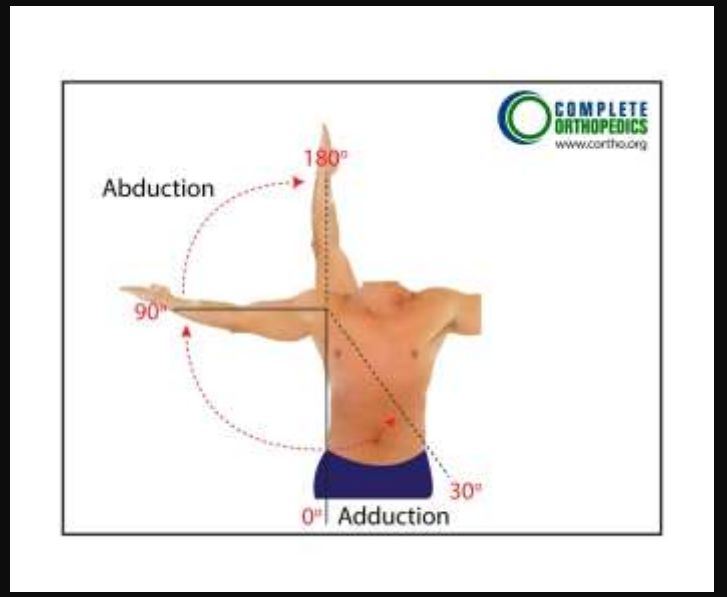
- Deep upper limb pain in rest
- Increased pain in movement/activity
- Swelling
- Cyanosis bluish-purple discoloration in hand
- Oedema
- Heaviness

- Paget-Schroetter Syndrome or
- Primary effort thrombosis



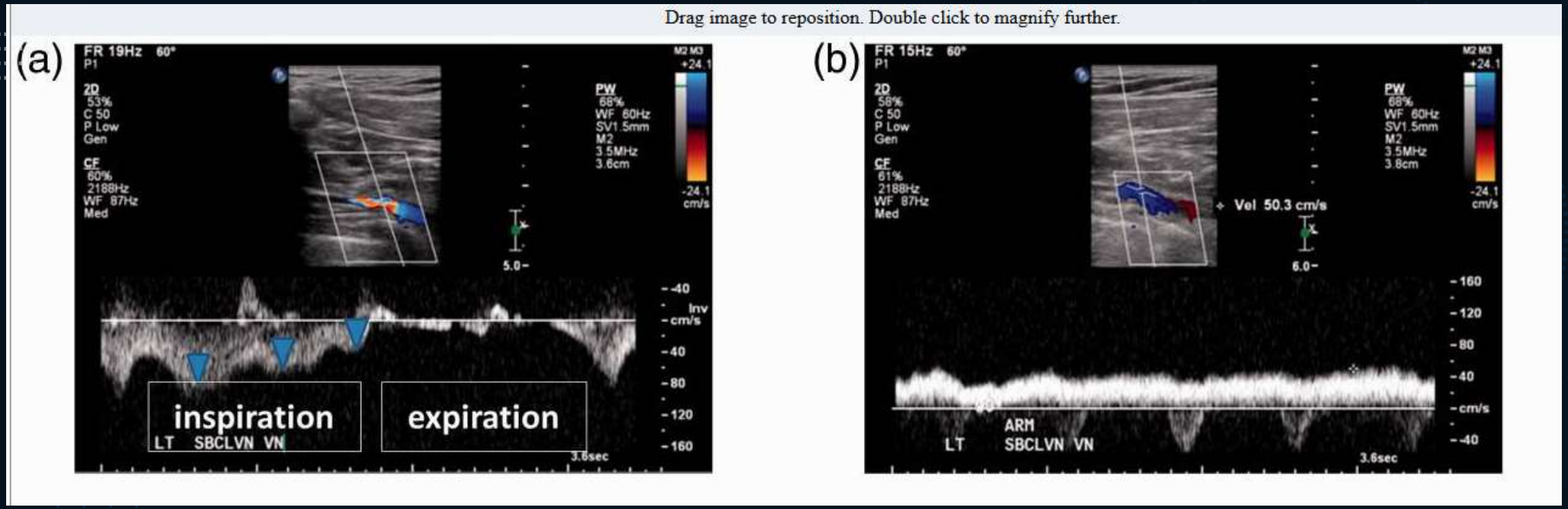
# Ultrasound Diagnosis

- Hyper-abduction / “Wright Test”
  - Neutral, 90º and 180º abduction
  - Compression of Subcoracoid / Retro or sub-pectoralis minor space
- Military Brace / “Eden’s test”
  - Compression of costoclavicular space
- Dynamic scan of the subclavian vein
- Assess in:
  - B-mode
  - Colour doppler
  - Spectral/pulse wave Doppler




# 90 degree abduction

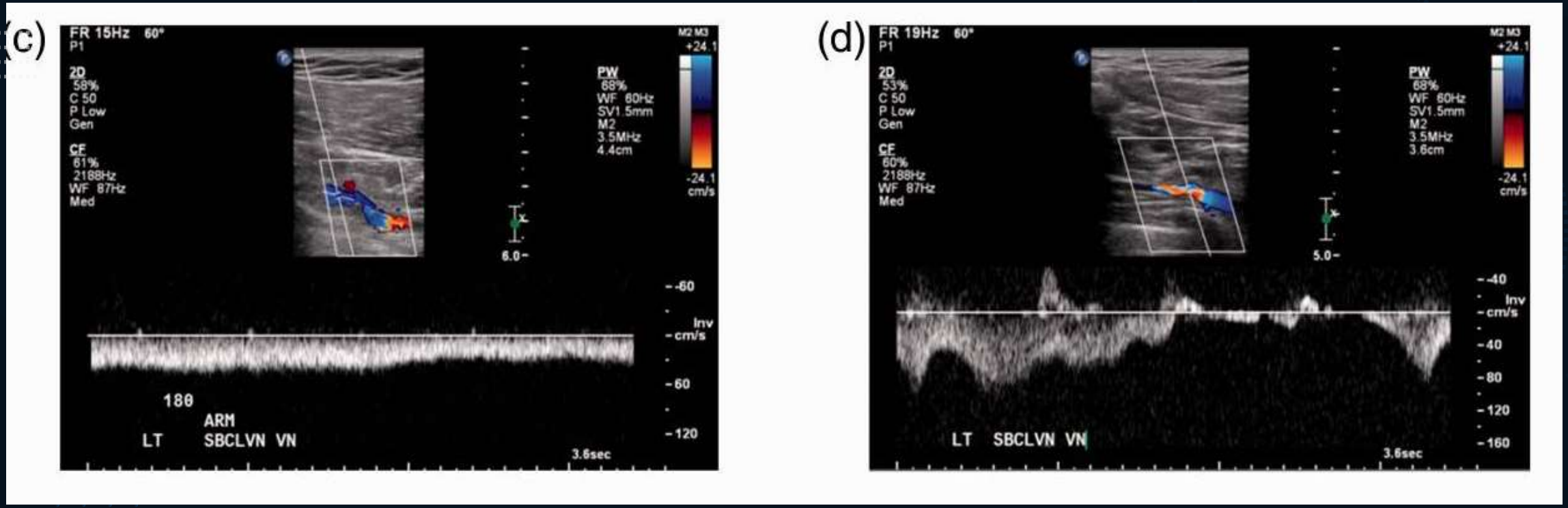
- *(a) Neutral shoulder position*
  - *Normal respiratory phasicity*
  - *Normal cardiac pulsatility*
- *(b) 90° abduction*
  - *Loss of phasicity and pulsatility*
  - *Due to subclavian compression*
  - *Continuous Doppler flow signal.*




*(Biederman et.al. 2021)*

# 180 degree abduction

- *(c) 180° abduction*
  - *continuous flow again*
  - *compression without occlusion*
- *(d) Neutral Position*
  - *Normal venous flow Doppler signal.*




*(Biederman et.al. 2021)*

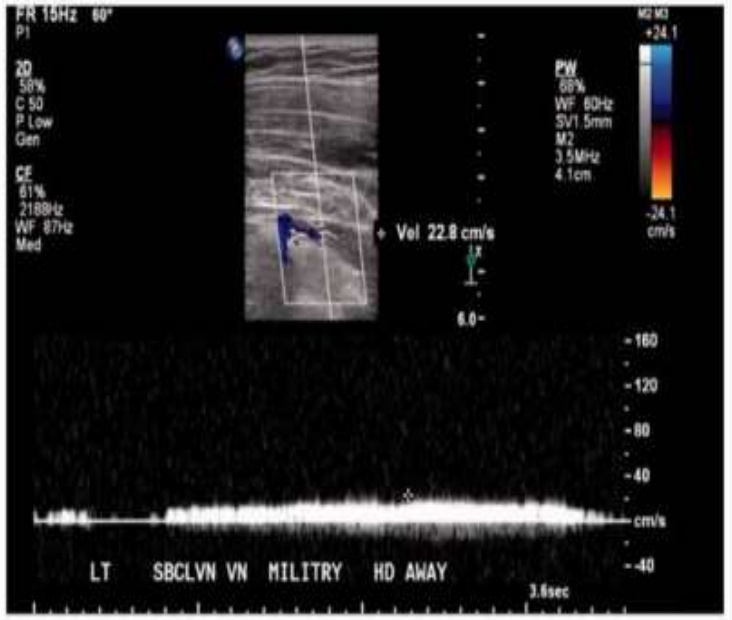
# Military Brace / Eden's Test

- *(e) Military Brace*
  - *Abrupt cessation of flow*
  - *Complete obstruction/occlusion*
- *(f) Military Brace + left head turn*
  - *Shows ongoing obstruction/occlusion*
- *(g) Military Brace + right head turn*
  - *Relieved obstruction/occlusion*
  - *Compression remained*
  - *No return of pulsatility and phasicity.*

(e)


(f)

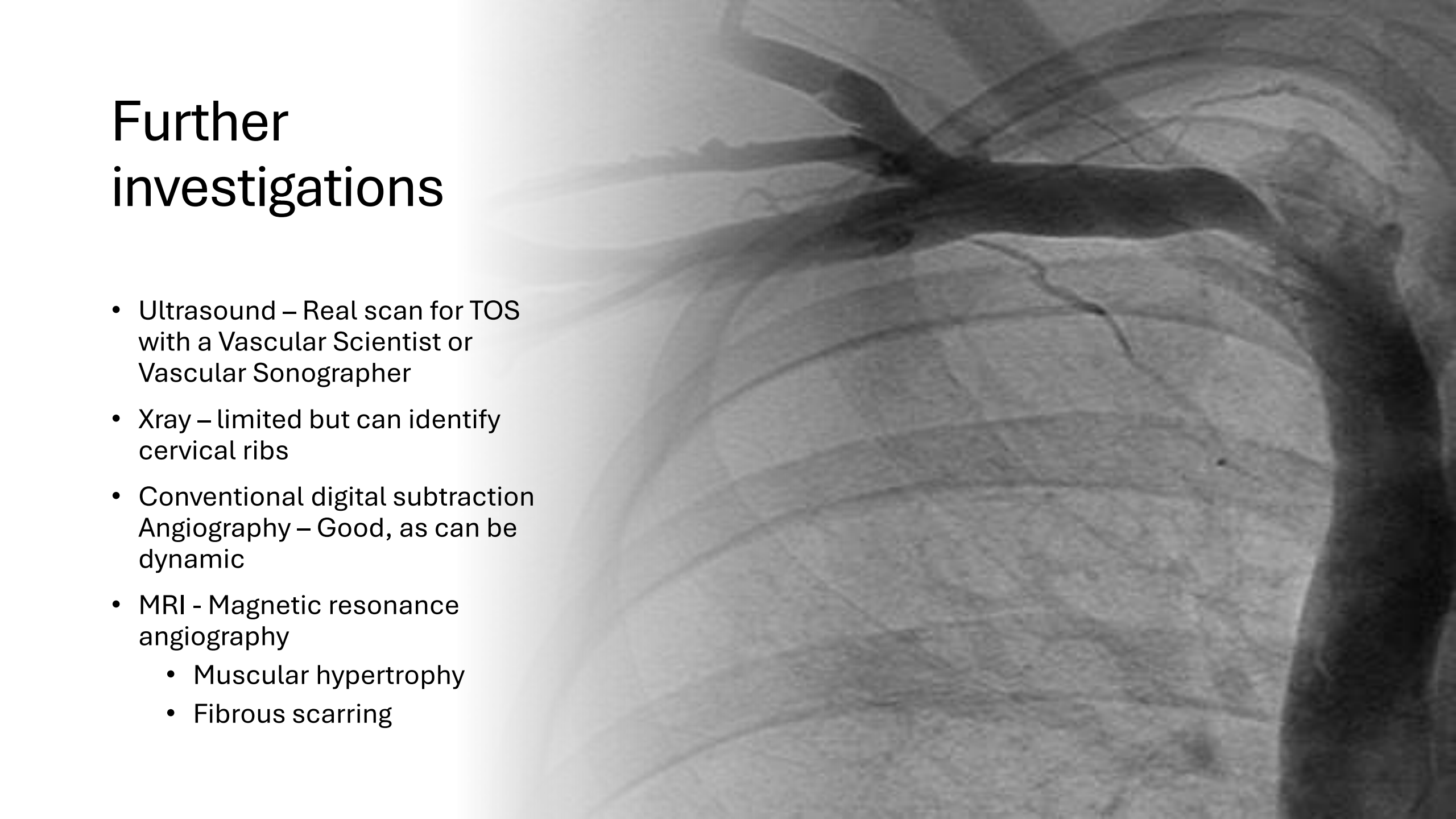

(g)

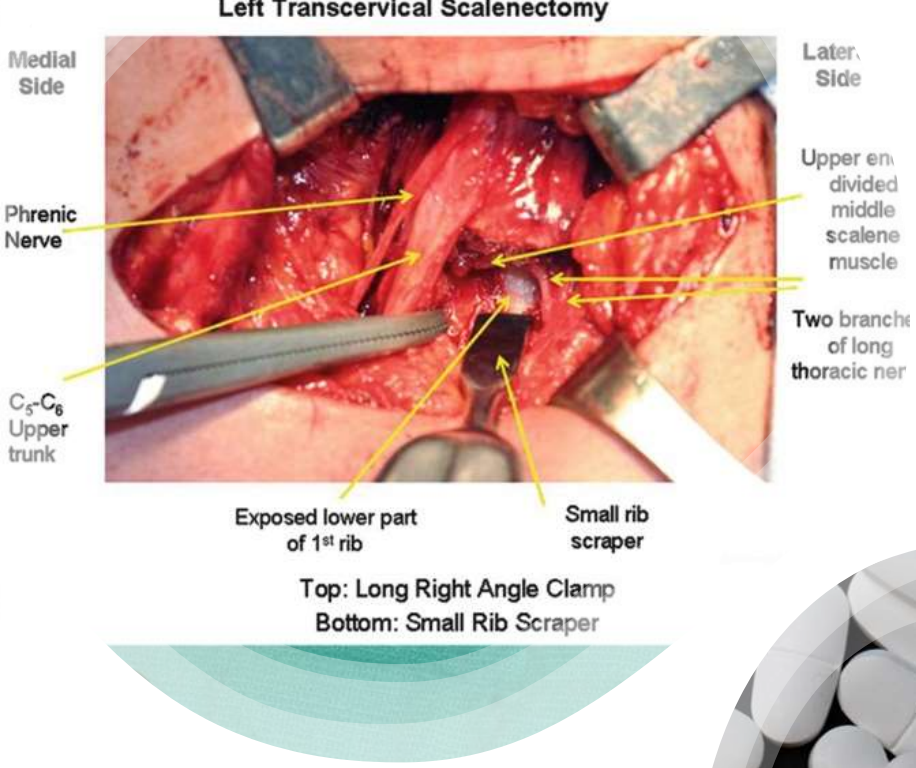



*(Biederman et.al. 2021)*

# Further investigations

- Ultrasound – Real scan for TOS with a Vascular Scientist or Vascular Sonographer
- Xray – limited but can identify cervical ribs
- Conventional digital subtraction Angiography – Good, as can be dynamic
- MRI - Magnetic resonance angiography
    - Muscular hypertrophy
    - Fibrous scarring






# Treatment

- Physiotherapy and kinesitherapy
  - Most common
  - Scalene muscles hypertrophy
  - Reduction in vascular compressions
- Medical
  - Pain relief
- Surgical treatment
  - Reserved for severe cases
  - Scalenectomy
  - Removal of first cervical rib
  - Fibrous band removal
  - Vascular decompression

# Outcomes


- Training sessions
  - Presentation
  - Vascular lab support
  - Survey
- Vetting guidelines
  - Exclude all arterial and nerve TOS symptoms
  - Only accept Upper limb venos that specifically state “Swelling”
- Rejection phrase
  - Include TOS
- Standard report
  - Negative
  - Positive

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Questions?