



Brachial Plexus Imaging

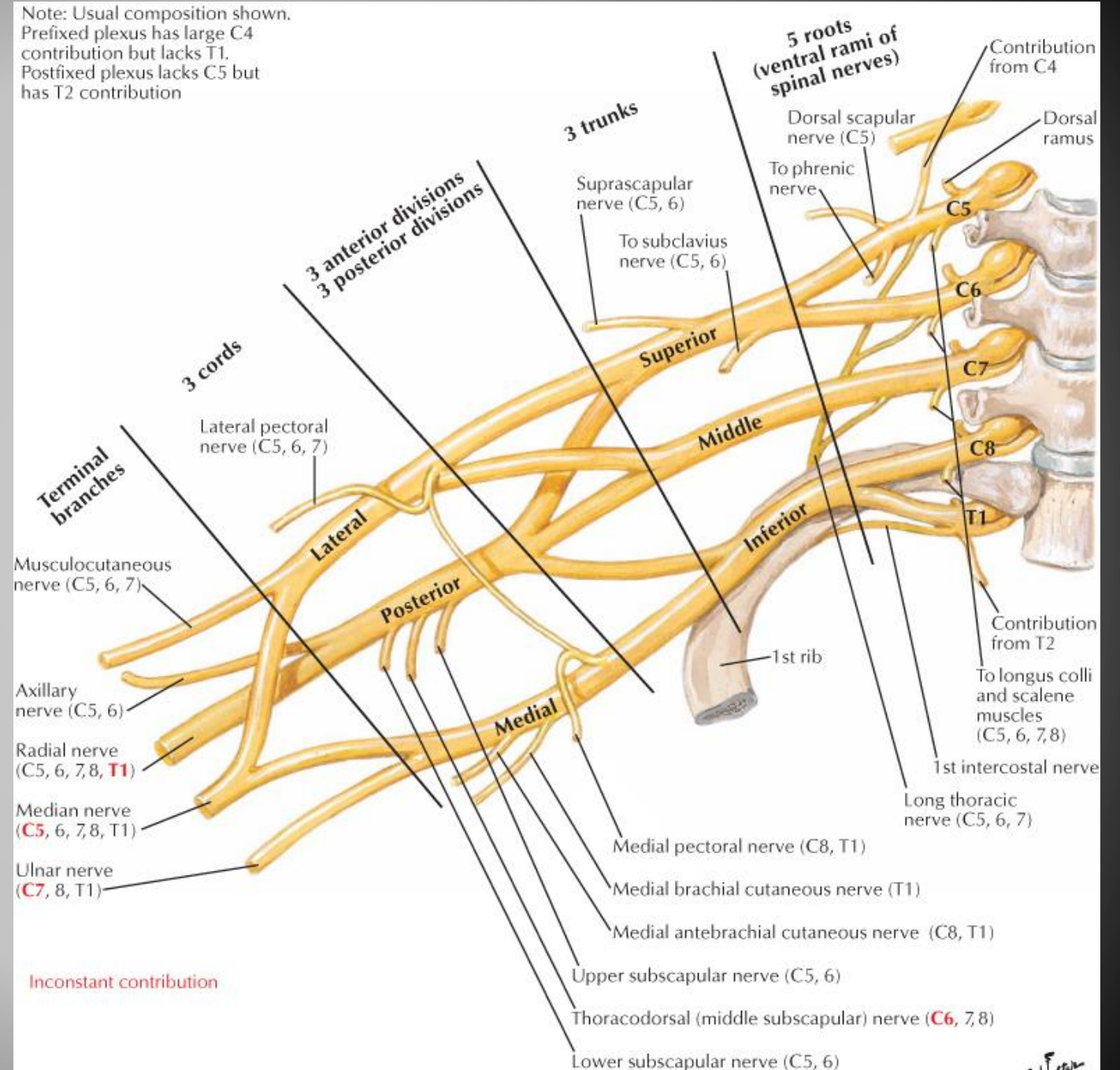
Mahmud Mossa-Basha, M.D.

University of Washington School of Medicine

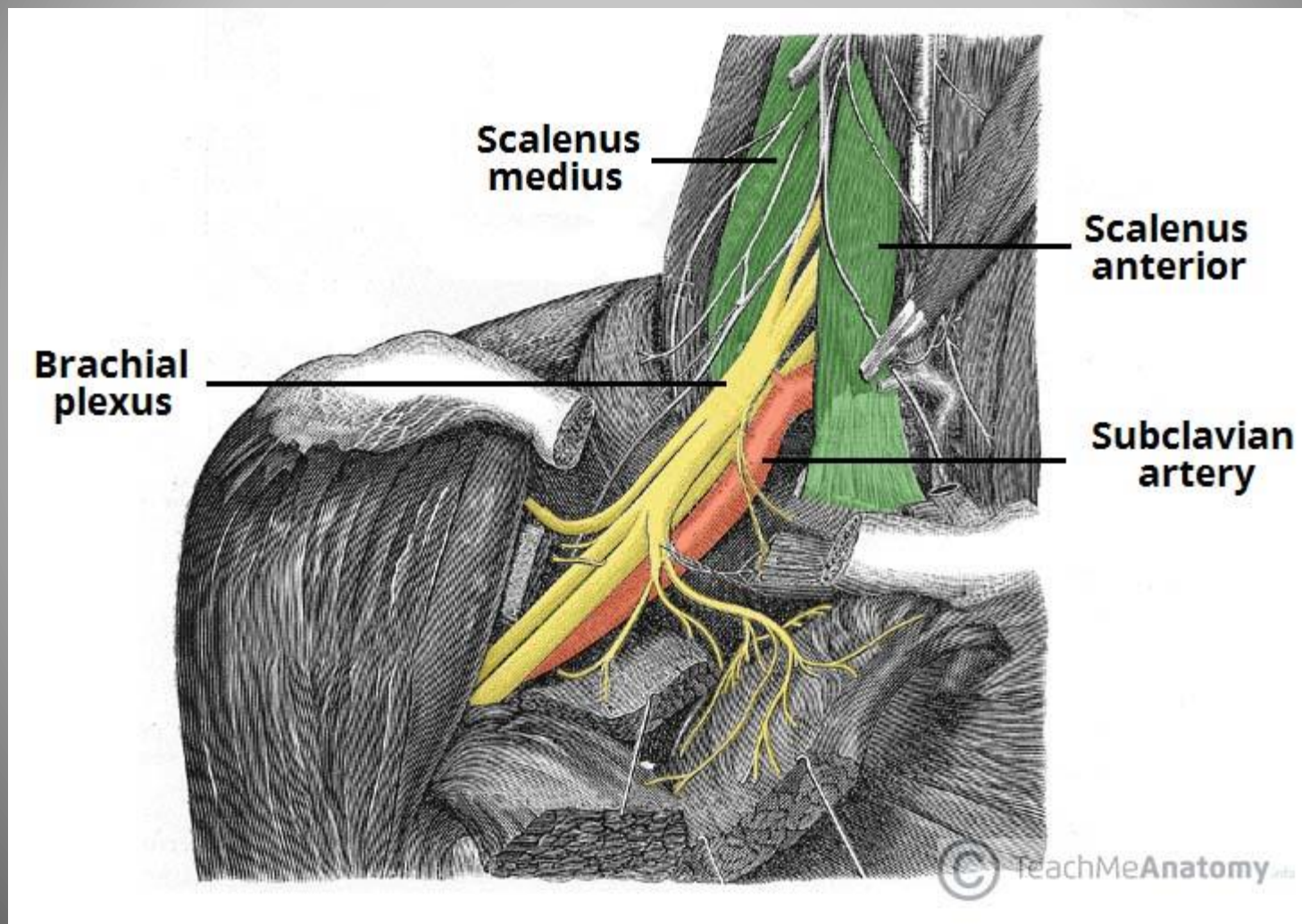
Department of Radiology, Division of Neuroradiology

Brachial Plexus Anatomy

Note: Usual composition shown.
 Prefixed plexus has large C4 contribution but lacks T1.
 Postfixed plexus lacks C5 but has T2 contribution



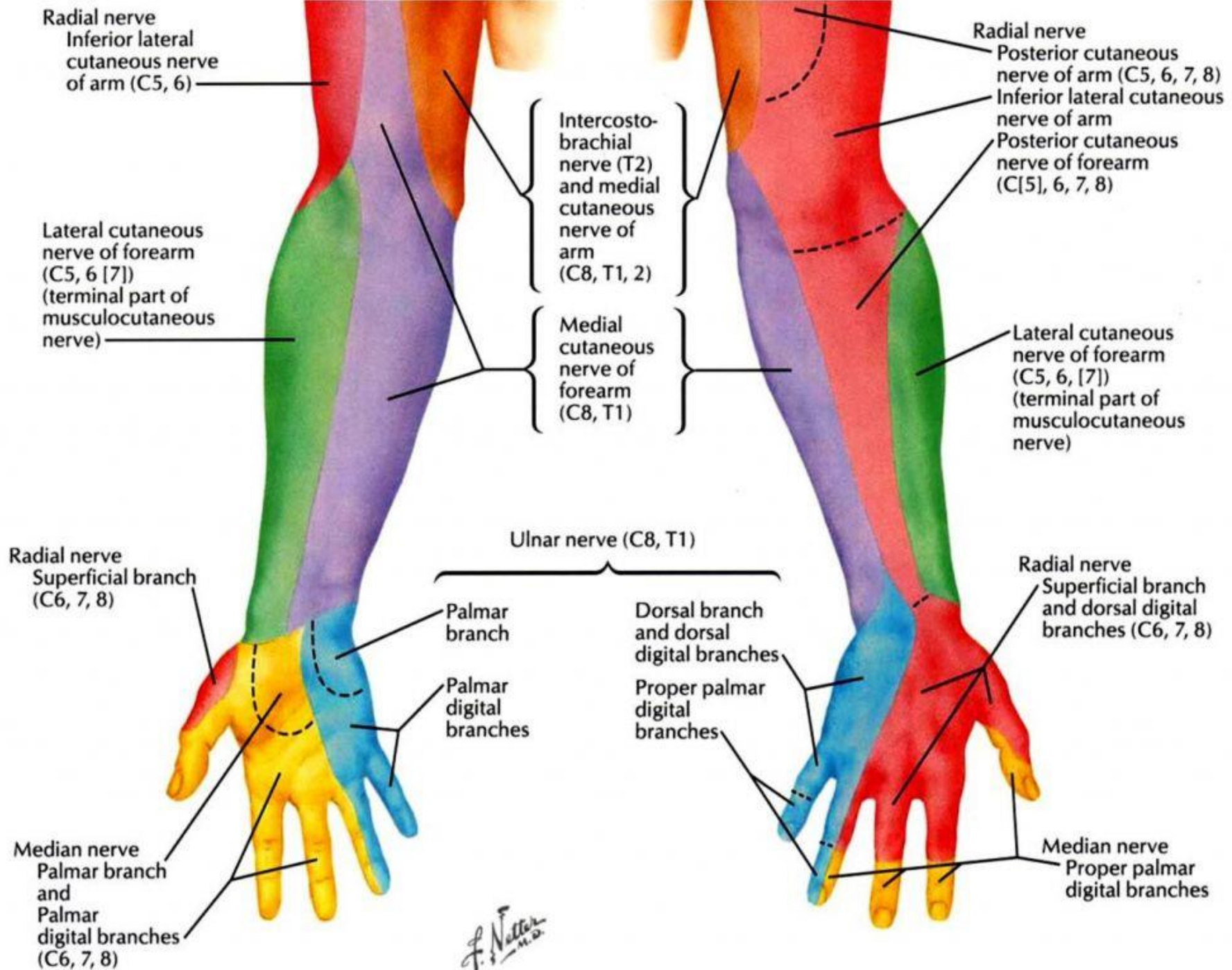
Brachial Plexus Anatomy





Innervation

- Musculocutaneous nerve (C5-7)- coracobrachialis, biceps brachii, brachialis
- Axillary nerve (C5, C6)-deltoid, teres minor
- Radial nerve (C5-8)- extensors of the arm
- Median nerve (C6-T1)- anterior forearm muscles, intrinsic hand muscles
- Ulnar nerve (C8, T1)- intrinsic hand muscles



Brachial Plexus Imaging

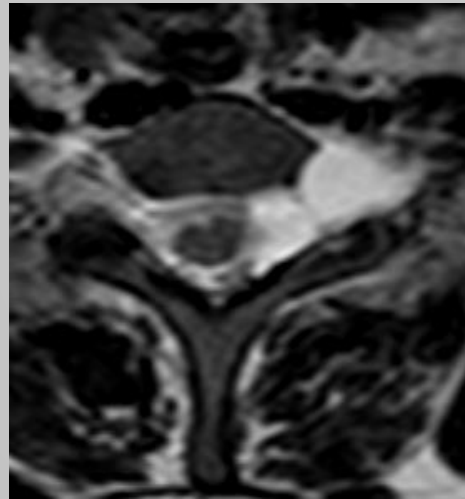
- MRI protocol
 - Coronal STIR and T1
 - Coronal T2 Dixon
 - Sagittal T1 FS pre and post
 - Coronal T1 FS post

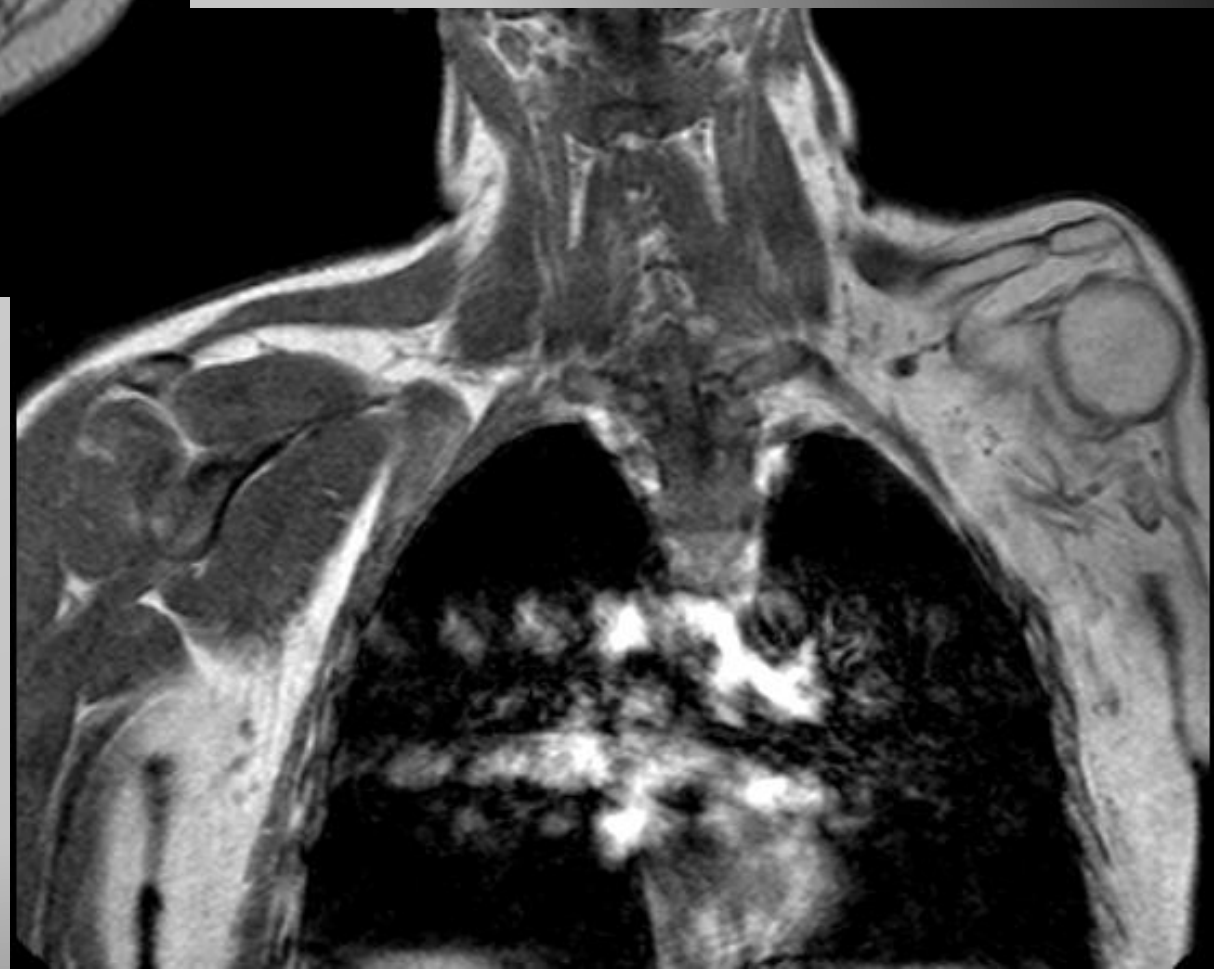
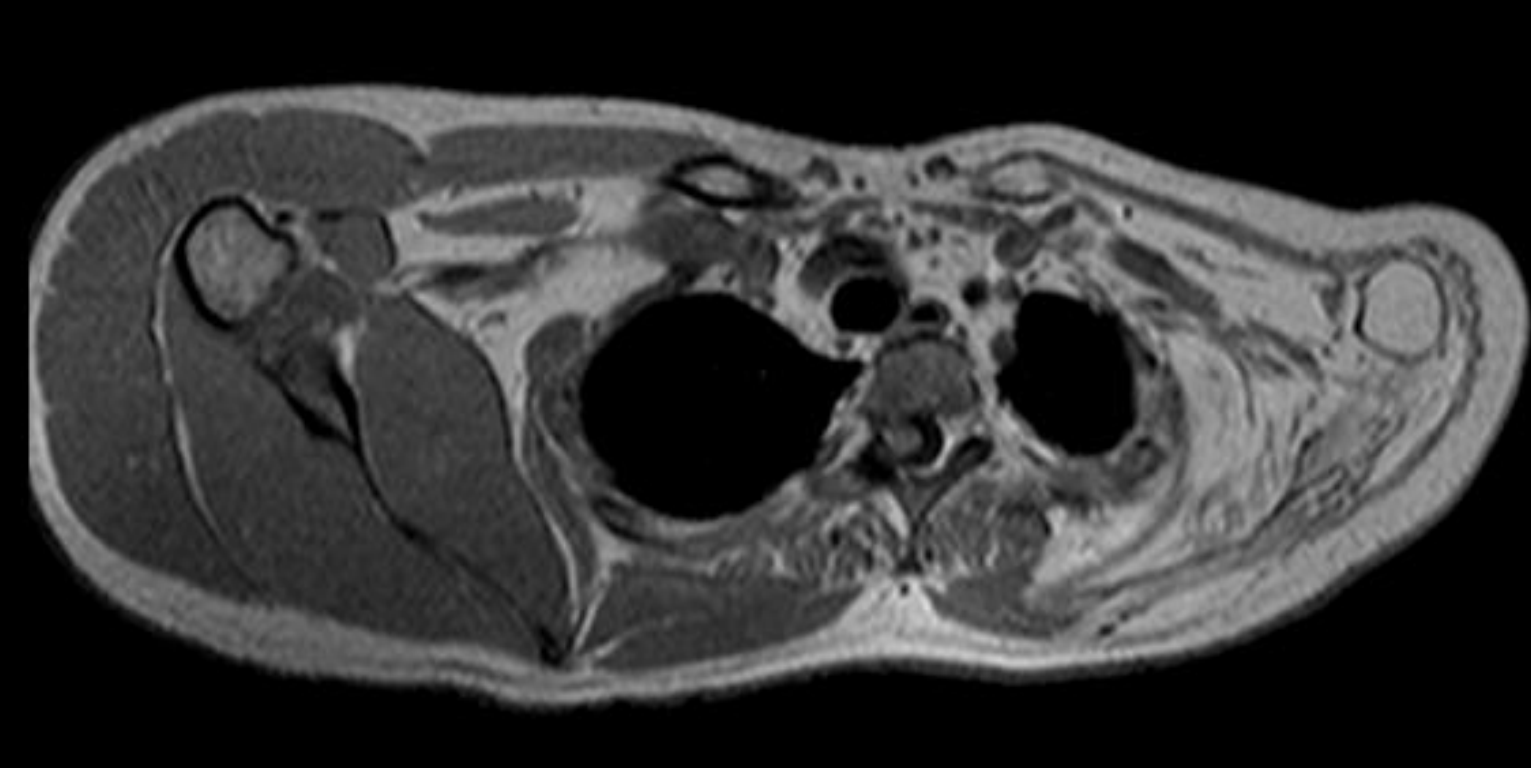
Etiologies for Brachial Plexopathy

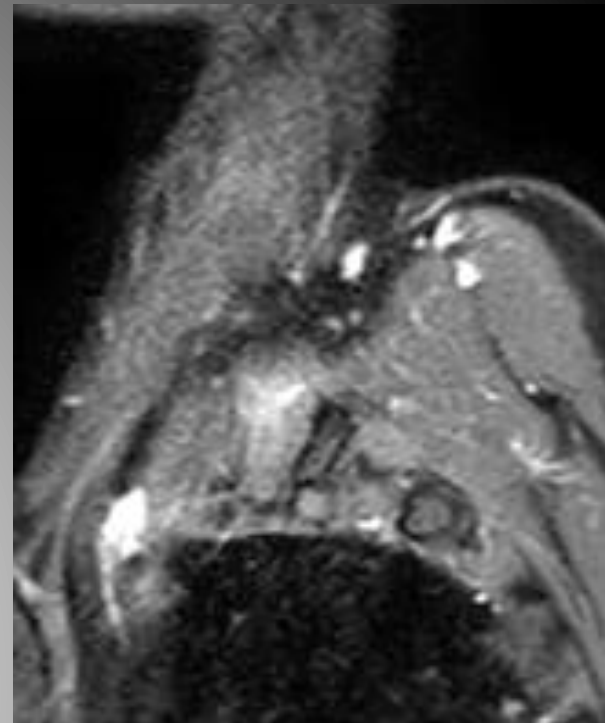
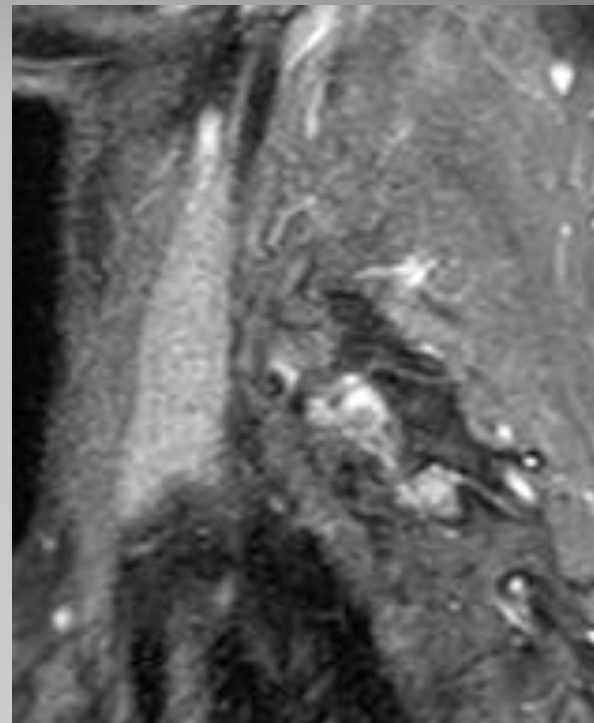
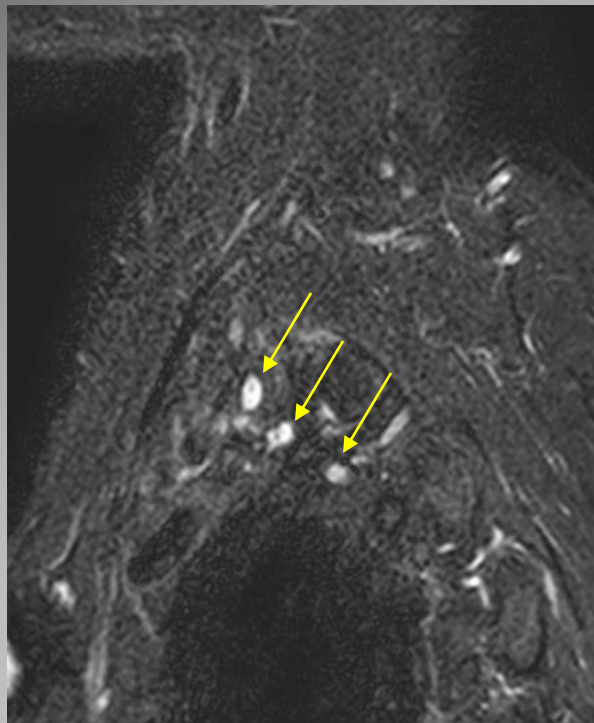
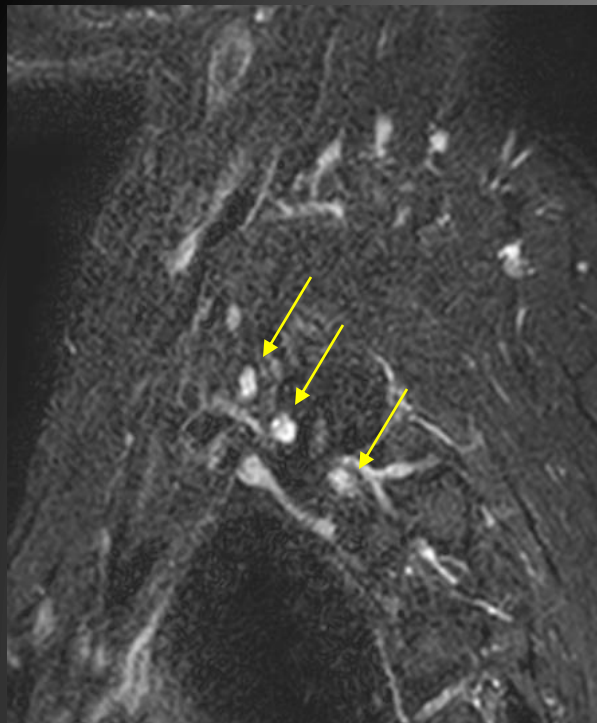
- Trauma
- Infectious/inflammatory
- Neoplasms (benign or malignant)
- Radiation plexopathy
- Vascular
- Compression

Traumatic Nerve Root Avulsions

- Pre-ganglionic Nerve Root Avulsions
 - Direct Signs
 - Discontinuity of the intradural nerve roots
 - Indirect Signs
 - Pseudomeningocele-invasion into foramen
 - Contralateral deviation of the spinal cord
- Post-ganglionic Nerve Root Avulsions
 - Post-DRG nerve signal abnormality
 - Nerve discontinuity
 - Peri-plexus hematoma
 - Nerve clumping

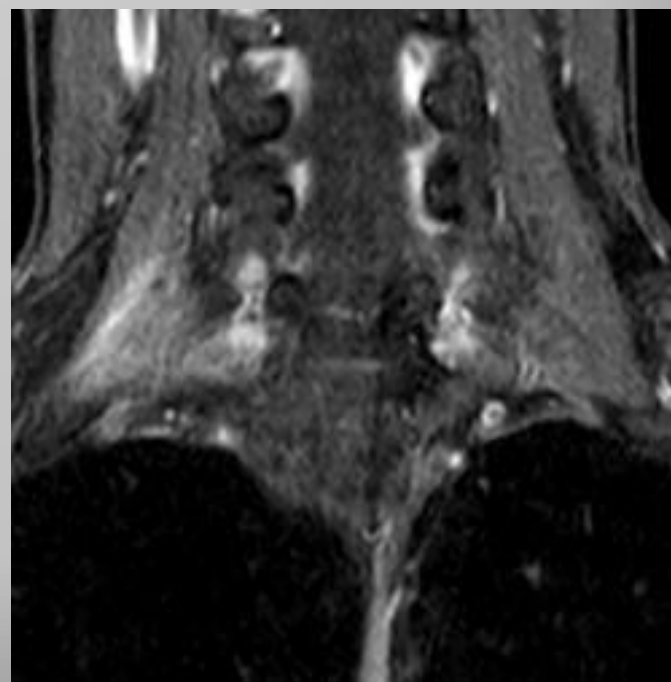






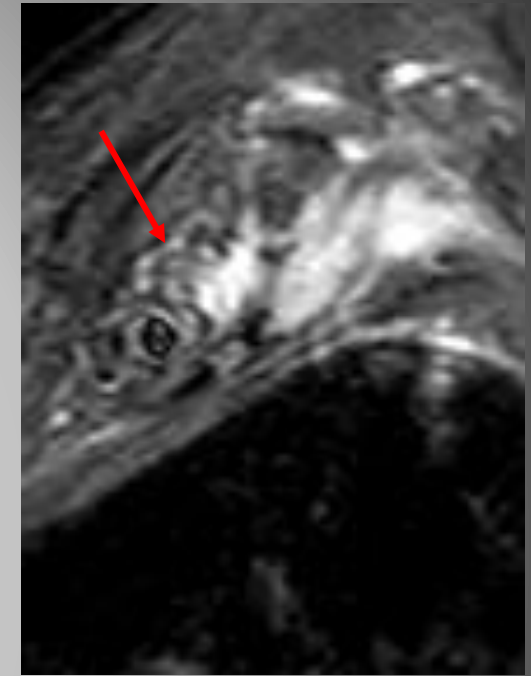
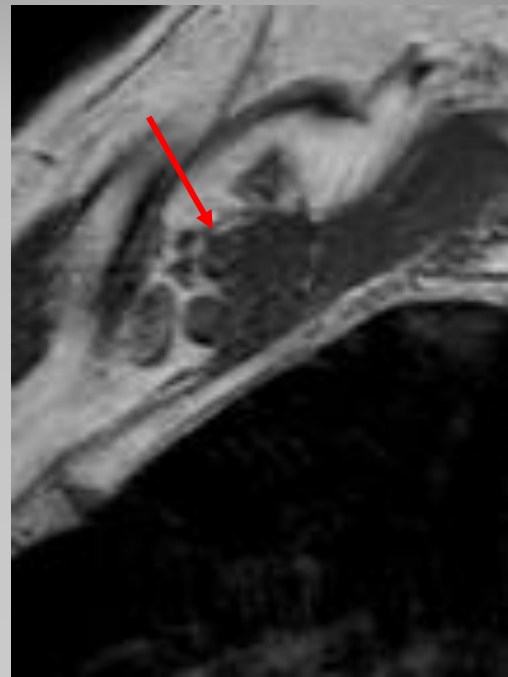
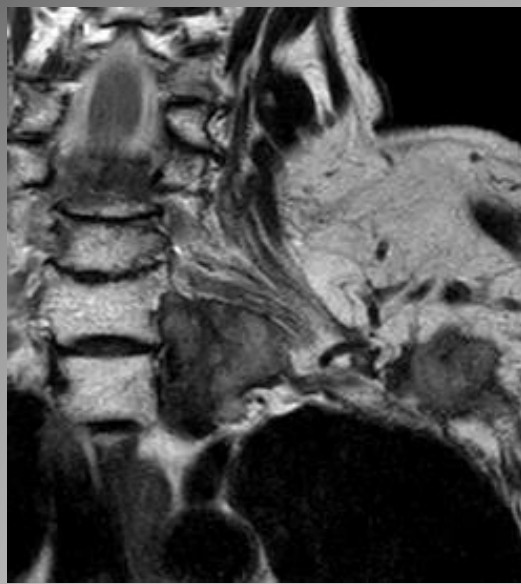
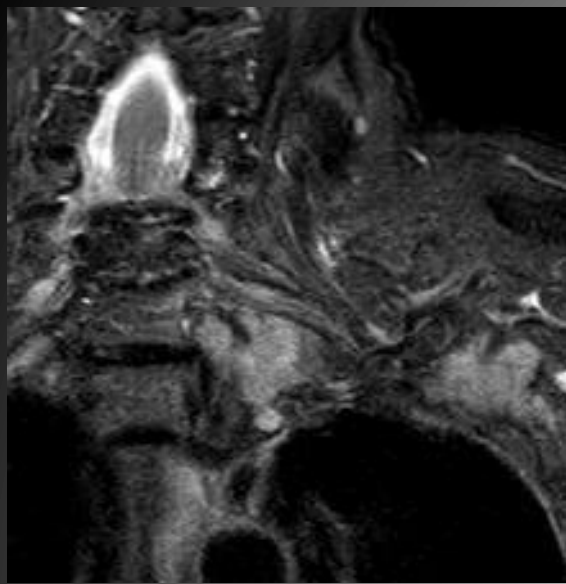
Inflammatory plexopathy with acute denervation of the right anterior scalene muscle

- Clinical
 - Usually presents with acute severe burning pain
 - Delayed weakness and atrophy
- MRI
 - T2 hyperintensity, enlargement, $\pm$ enhancement of affected nerves
 - Acute muscle denervation: thickening, enhancement, T2 hyperintensity

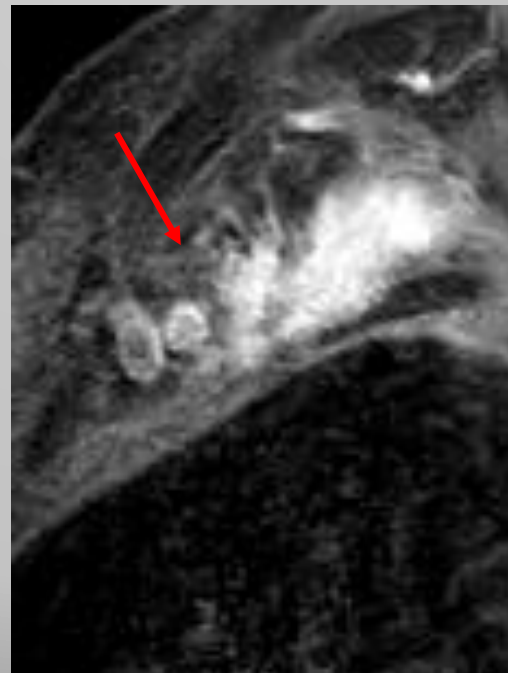
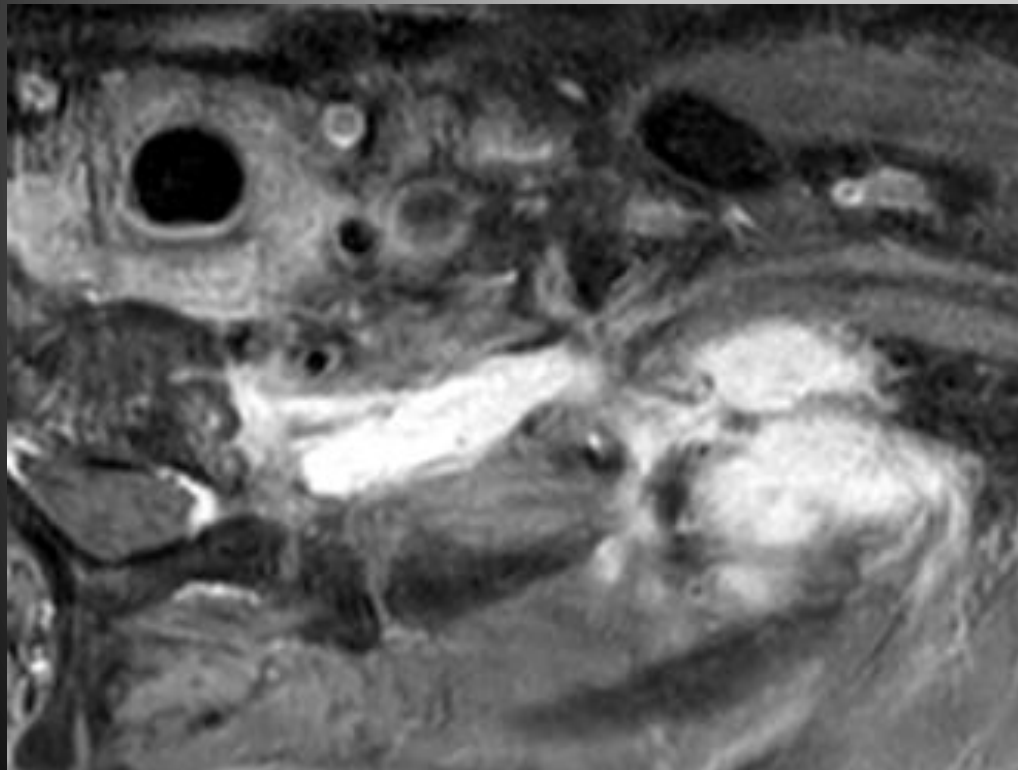


Benign Tumor Involvement

- Fibromatosis (Desmoid)
- Nerve Sheath Tumors
- Proliferative fasciitis
- Lipoma
- Hemangioma
- Brachial Cleft Cyst
- Lymphangioma

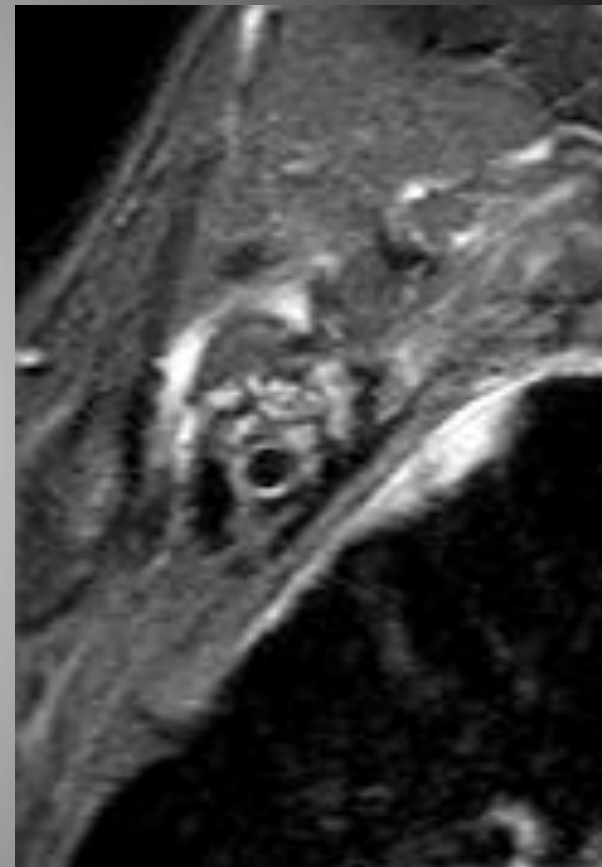
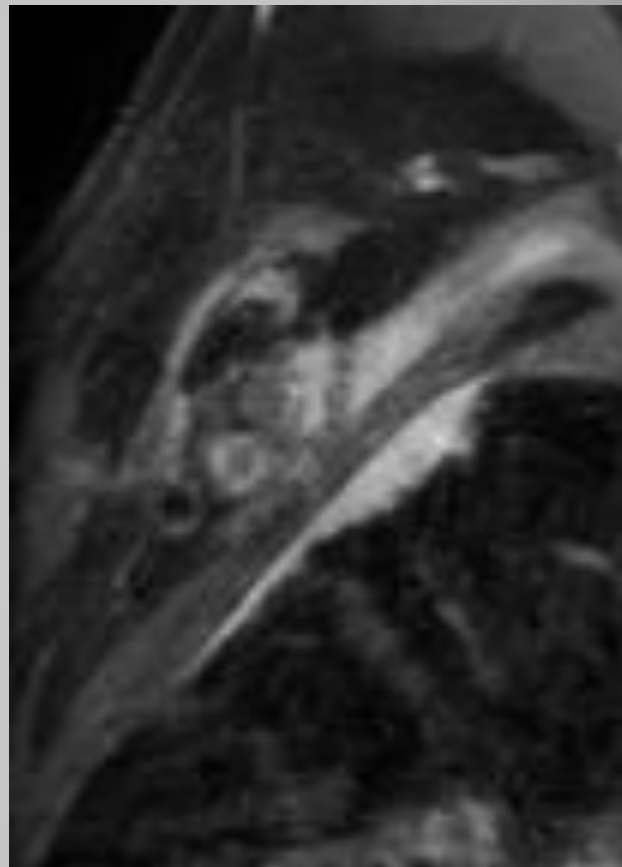
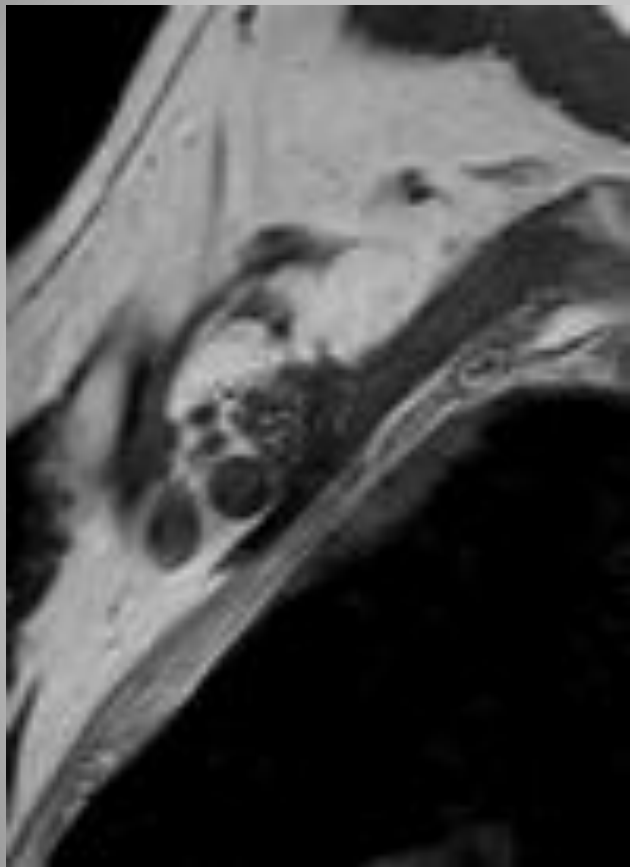
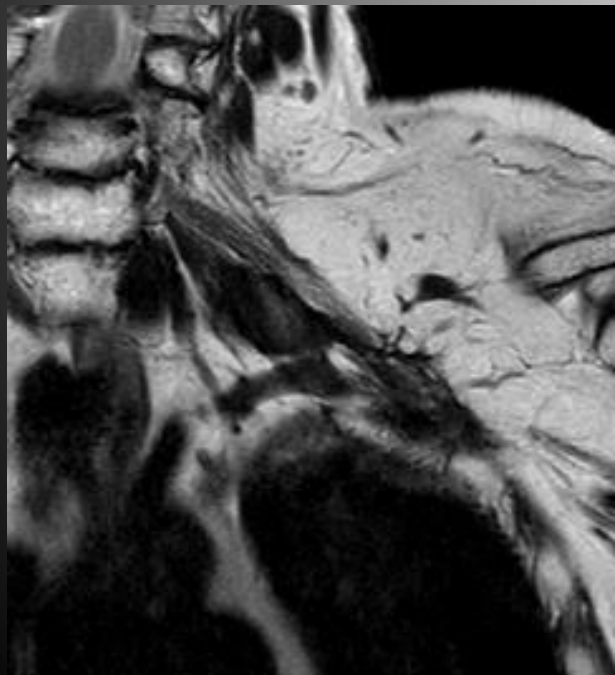
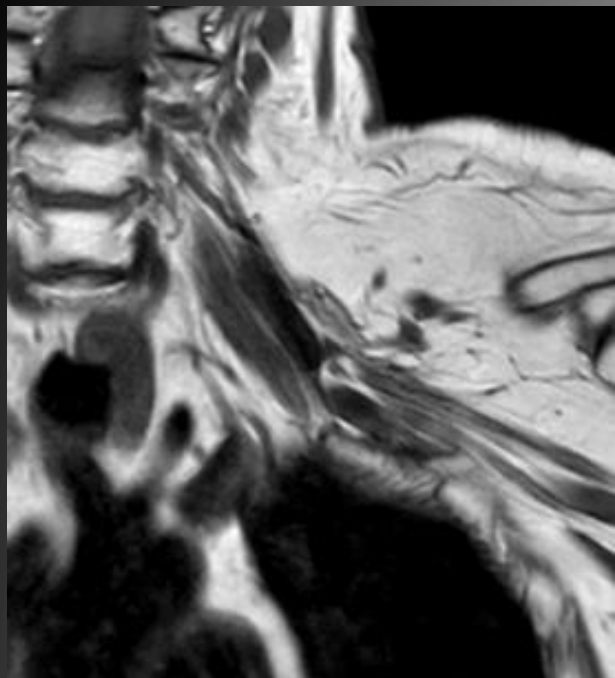


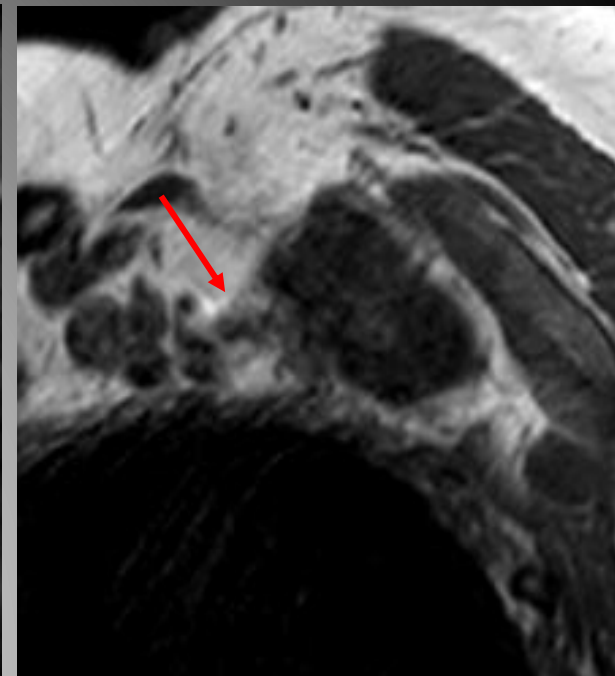
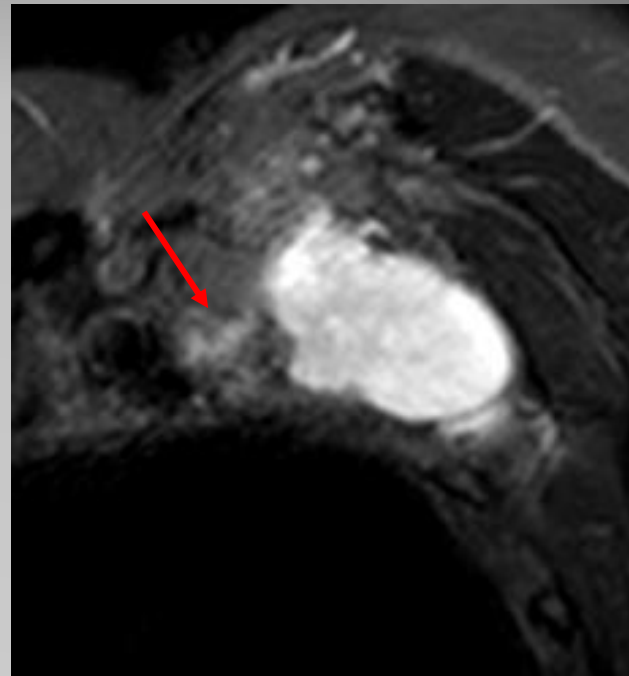
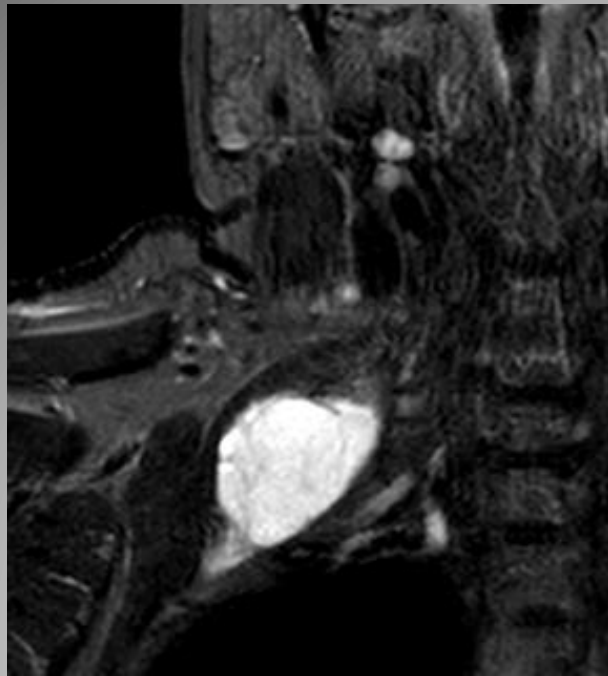
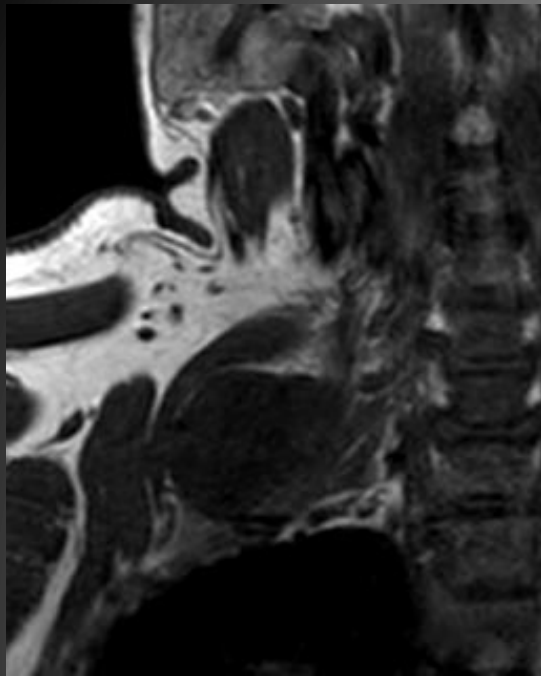
67 year old female with left brachial plexopathy



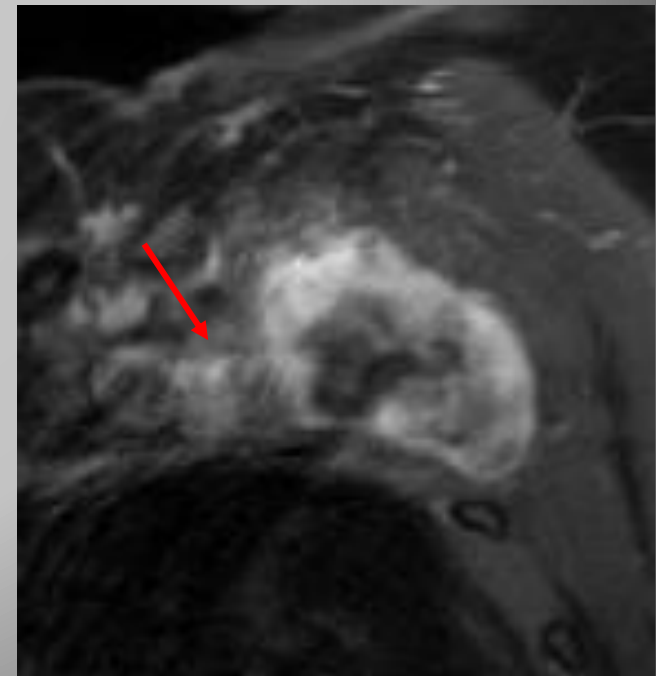
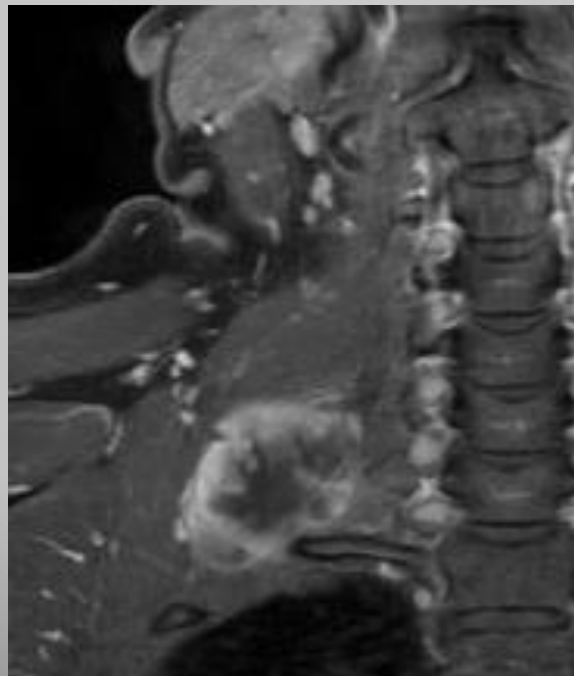
- Desmoid Tumor
- T1 iso, heterogeneous T2 hyper, avid enhancement
- Significant pain and tenderness

1 year follow up s/p radiation therapy





- Nerve Sheath Tumor
 - Schwannoma/neurofibroma



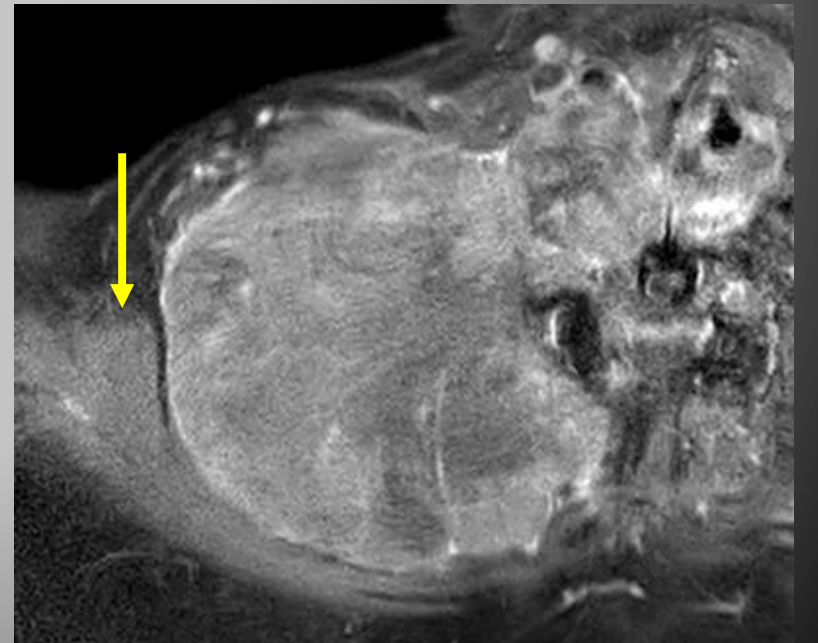
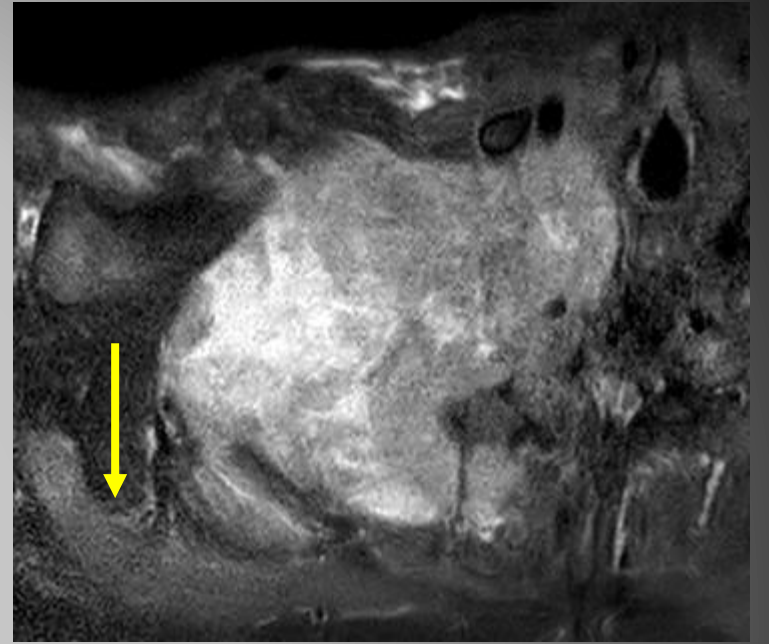
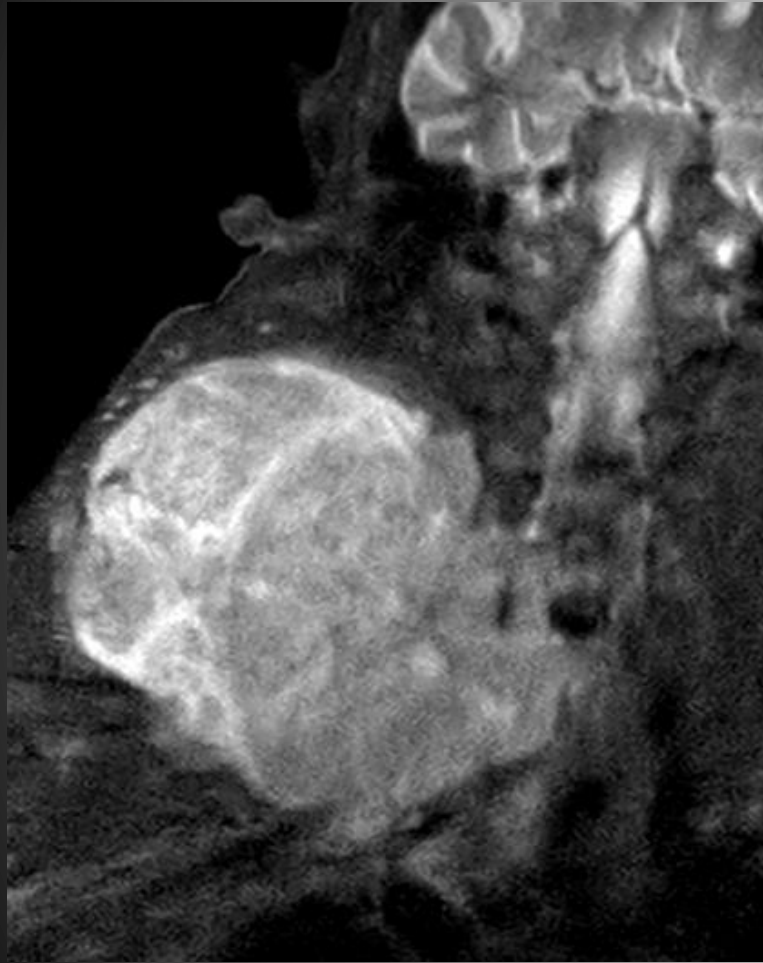
Schwannoma

- T2 Iso to hypointense, less likely hyperintense, may be heterogeneous
 - Can show target sign
- Well circumscribed, encapsulated
- Peripheral along course of nerve
 - Displace rather than invade
- Small tumors avidly enhance, larger tumors may have heterogeneous enhancement and cystic changes
- Hemorrhage on T2*
- Surgically resected
- Rarely recur after resection

Neurofibroma

- Target sign: Central T2 hypointensity with rim hyperintensity
- Non-encapsulated
- Centrally located within nerve
 - Infiltrative
- Heterogeneous enhancement
- Can be resected, but may be difficult due to infiltrative nature

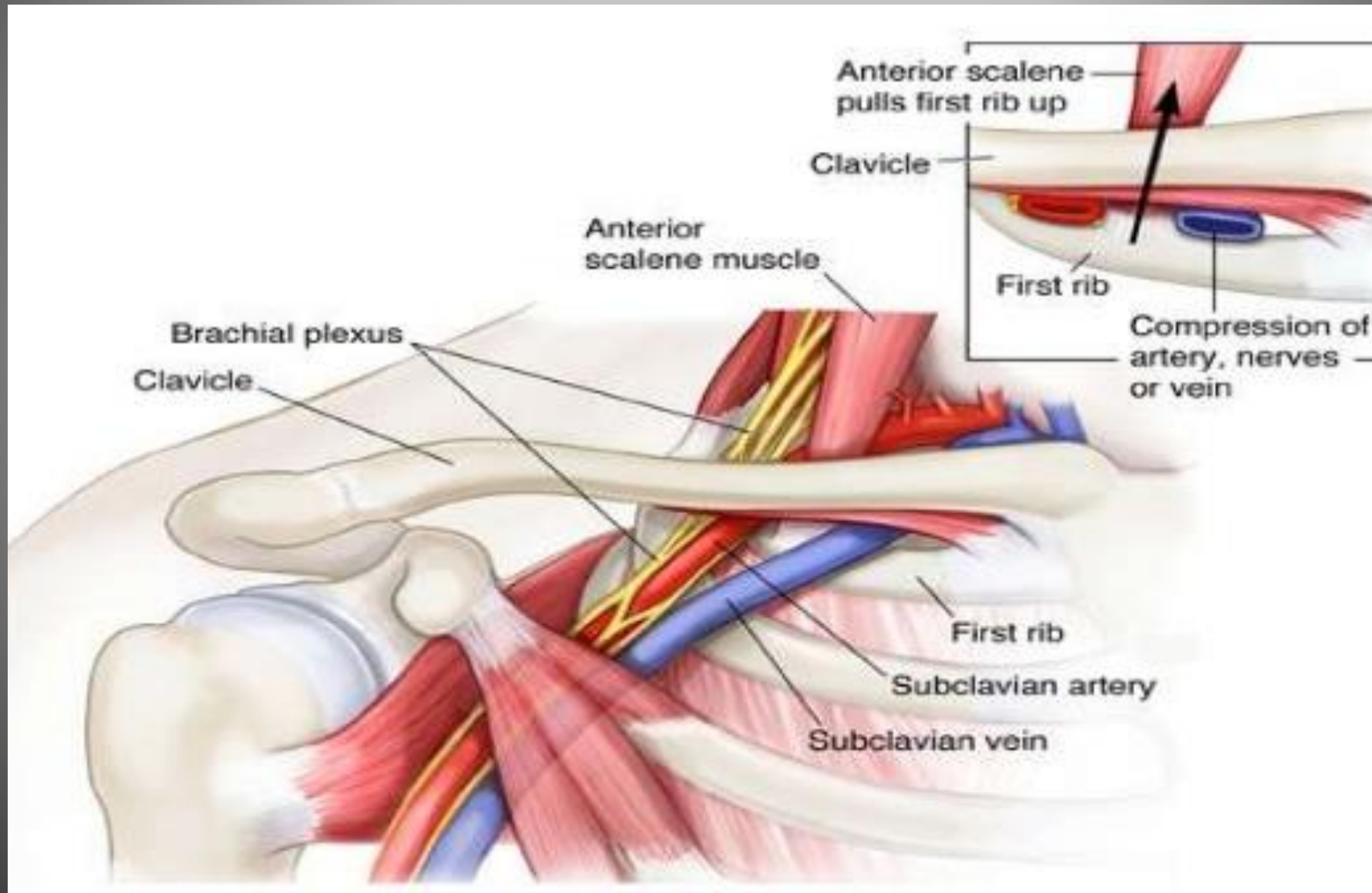
Sarcoma



Malignant Brachial Plexus Tumors

- Sarcomas most common
- Metastases (breast, lung, lymphoma, HN cancers)
- Mesothelioma, malignant nerve sheath tumors, chondrosarcoma, chordoma less common

Thoracic Outlet



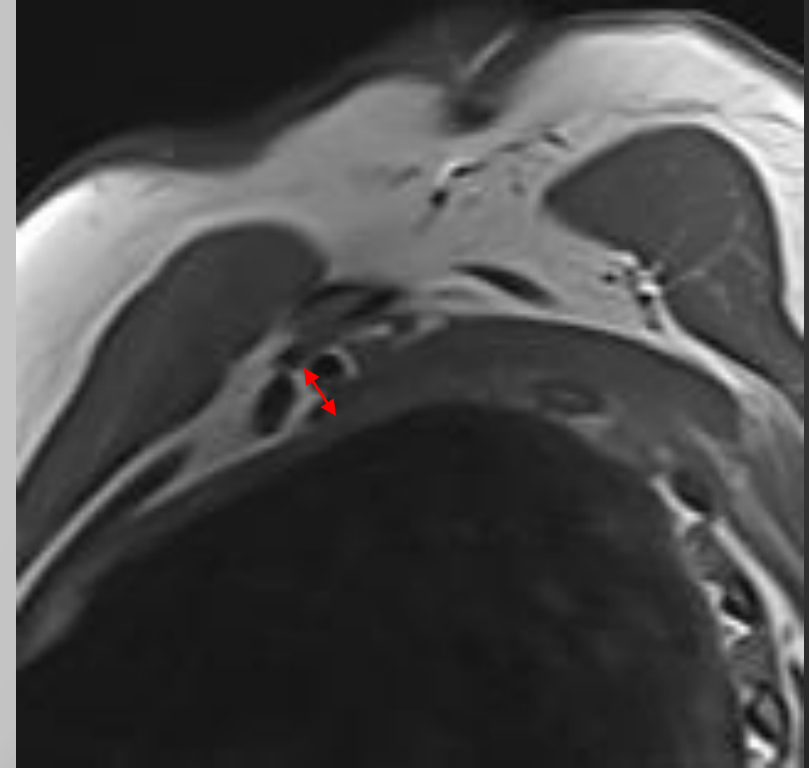
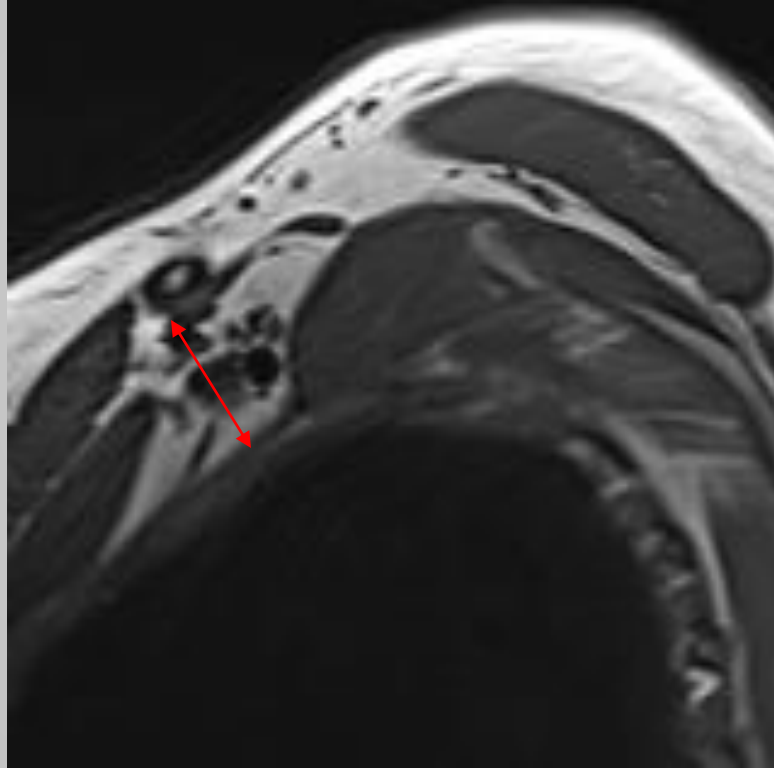
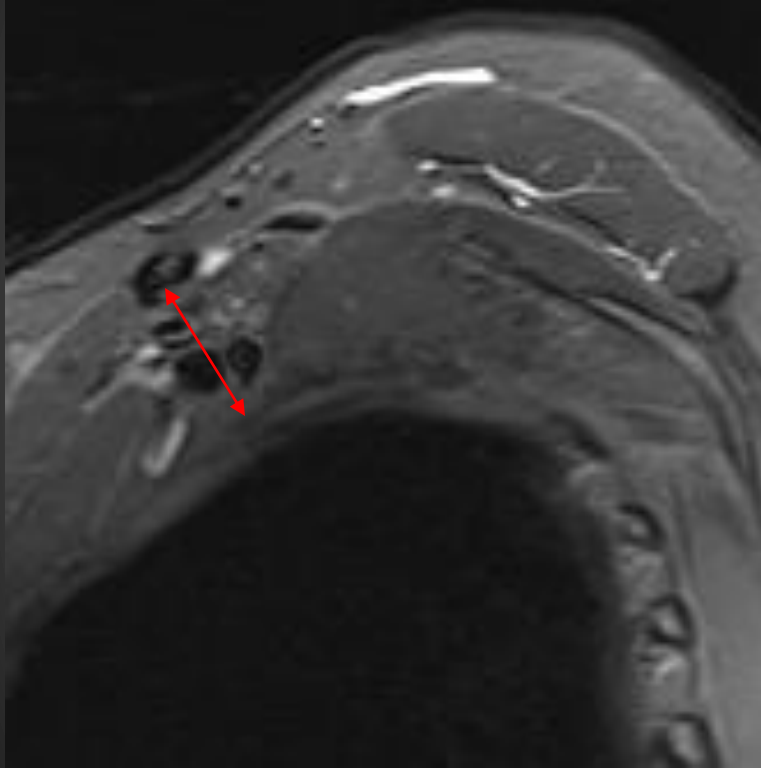
Thoracic Outlet Syndrome

- Congenital or acquired process with compression of brachial plexus or subclavian vasculature at thoracic aperture
 - Neurogenic- >90%
 - Pain, paresthesia, numbness
 - Venous- 5%
 - Swelling, pain, W (Pagett Schroeter) or wo (McLeery) thrombosis
 - Arterial- Approximately 1%
 - Ischemic symptoms- pain, pallor, paralysis, pulse deficit, poikilothermia, paresthesia (6 P's)
 - Combination
 - Symptoms exacerbated by arm abduction and rotation

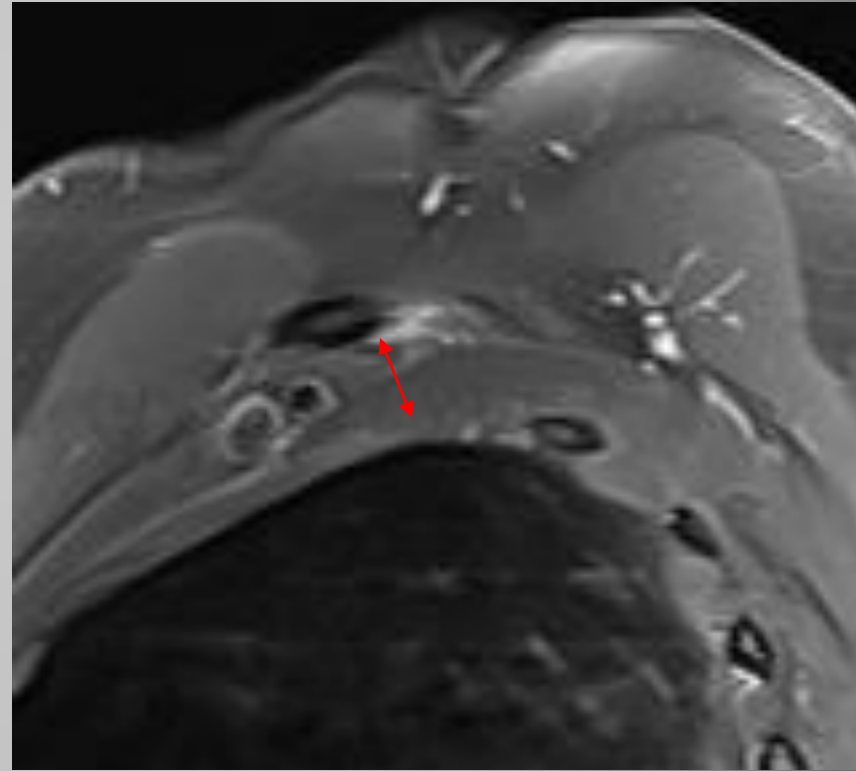
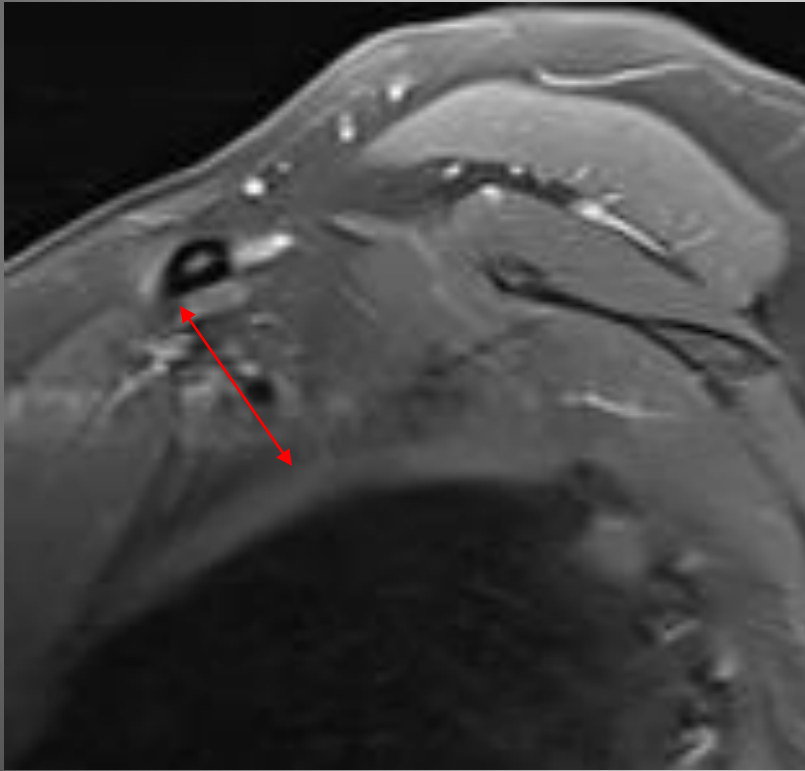
Imaging Approach

- Coronal STIR
- Coronal T1
- Sagittal STIR
- Axial 3D T1 SPGR pre and post fast acquisition
- Sagittal T1 pre and post-arm neutral and abducted
- Sagittal T1 FS pre and post-arm neutral and abducted
- Coronal MRA early and delayed
- Coronal MRA early and delayed arm abducted

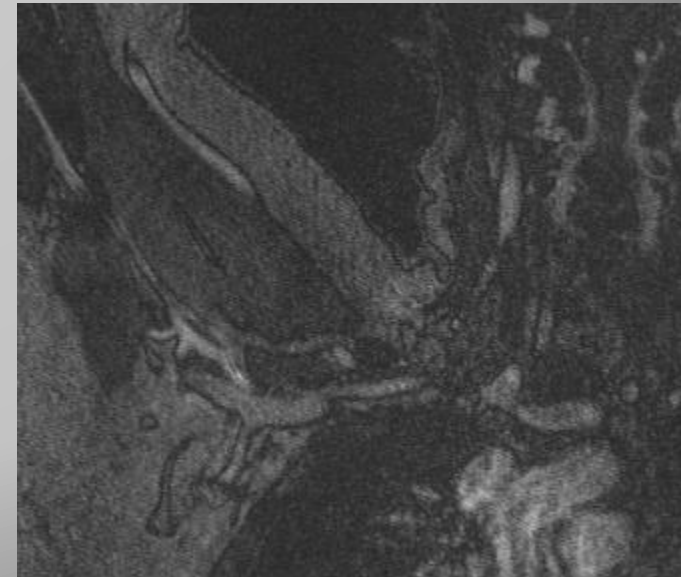
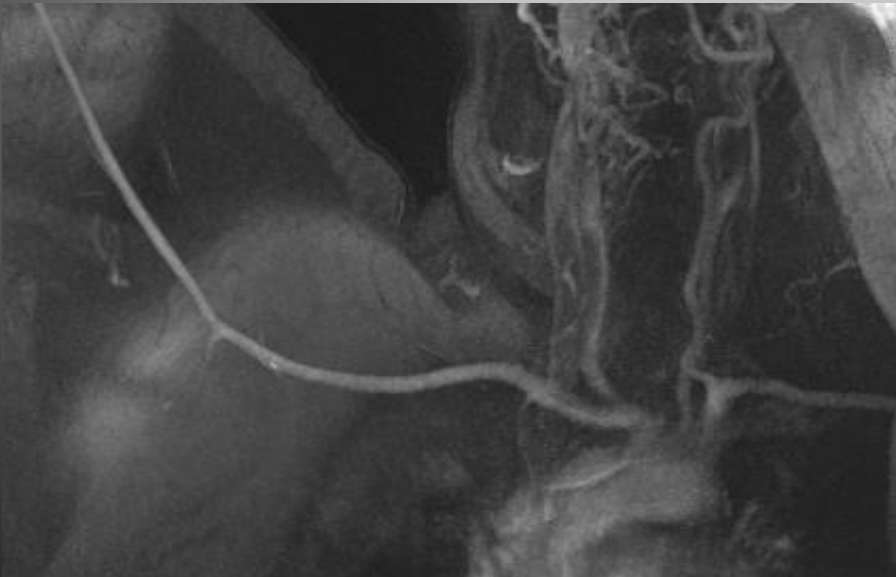
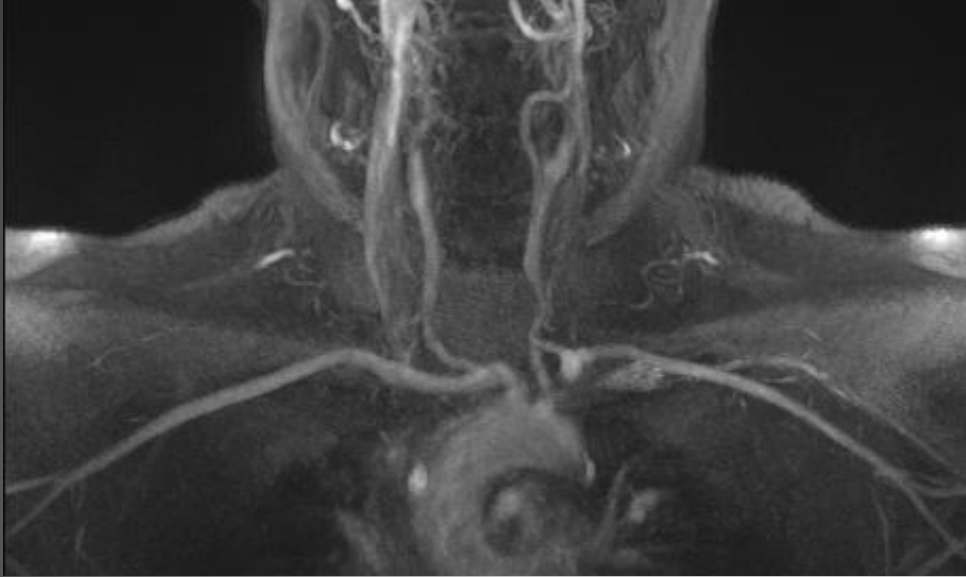
Thoracic Outlet Syndrome Study



Thoracic Outlet Syndrome Study



Normal Thoracic Outlet Syndrome Study



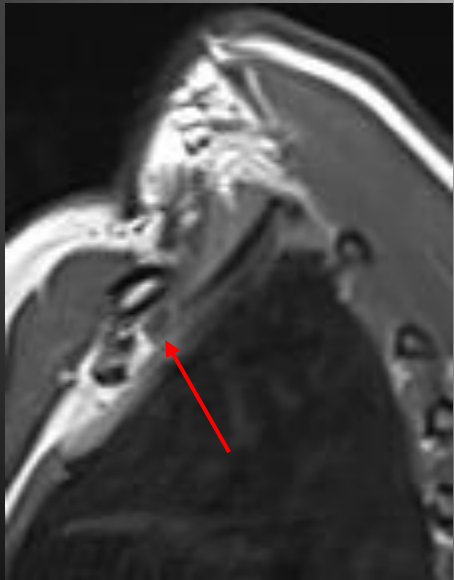
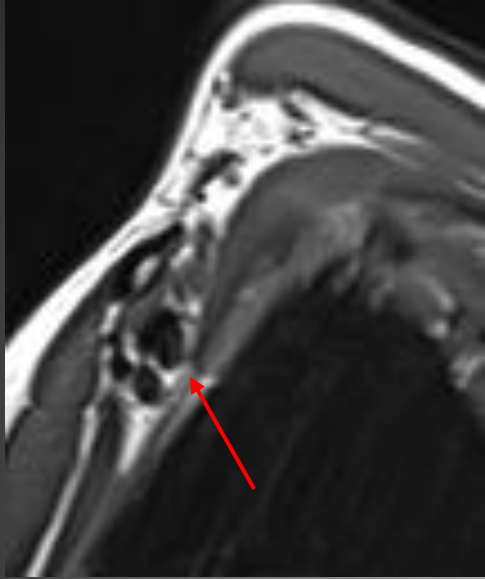
Thoracic Outlet Syndrome

- Etiology
 - Aberrant insertion of anterior scalene onto 1st rib
 - Cervical rib
 - Abnormality of 1st rib or clavicle
 - Elongated C7 transverse process
 - Muscle hypertrophy
 - Fibrous bands
 - Supraclavicular tumor/lymphadenopathy

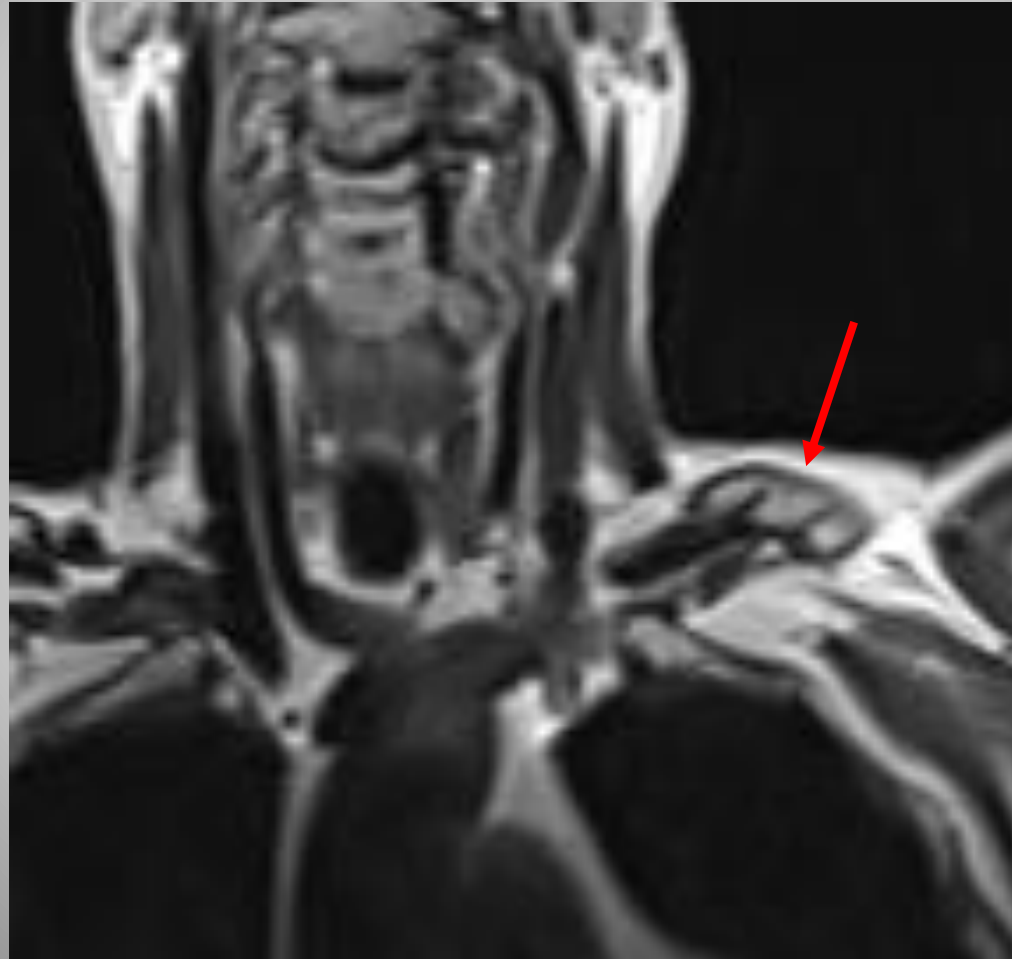
Interpretation

- STIR signal abnormality within the brachial plexus in neutral or abducted
- Dynamic compression of brachial plexus, artery or vein on abducted view
- Mass lesions along brachial plexus course
- Abnormal course of brachial plexus
- Sources for potential compression

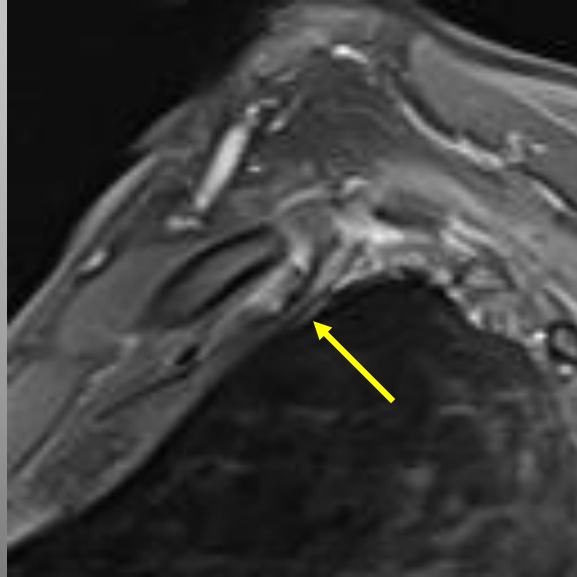
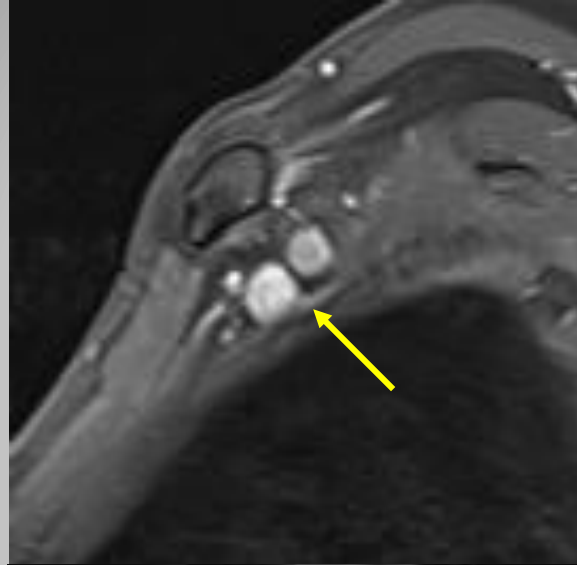
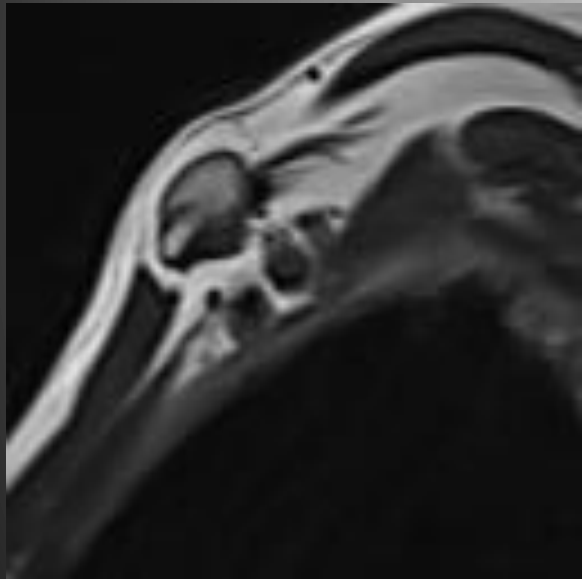
Clavicular Compression



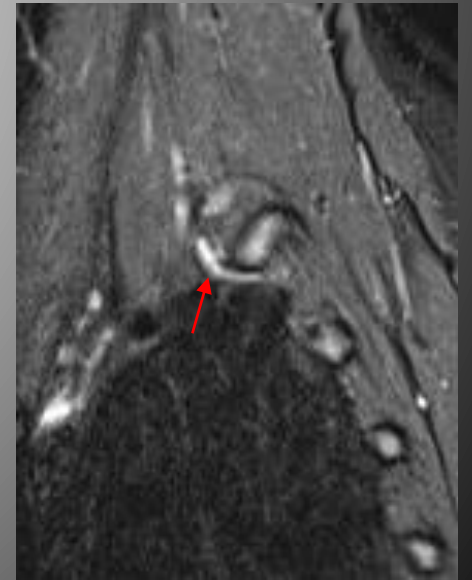
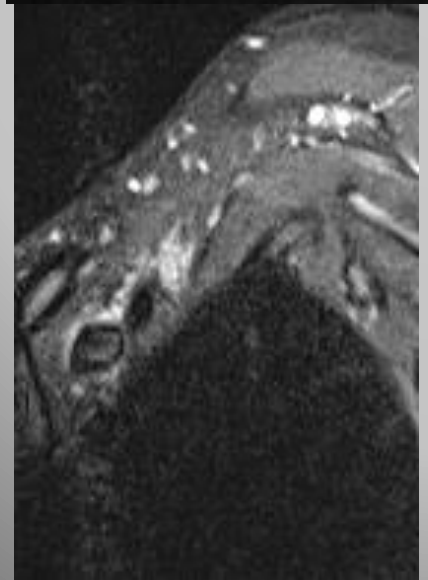
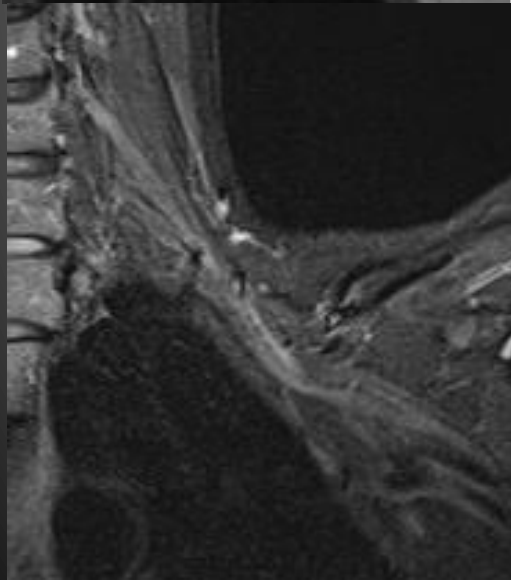
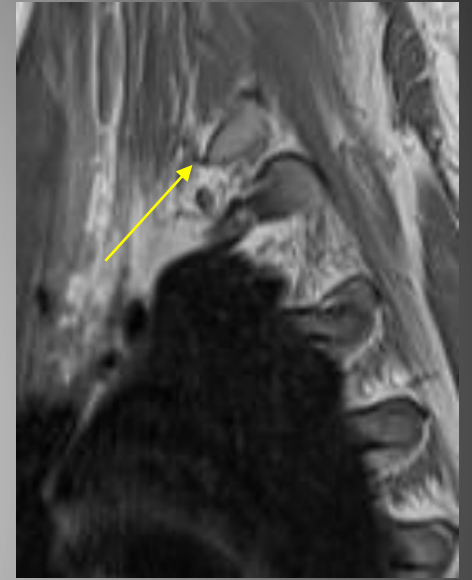
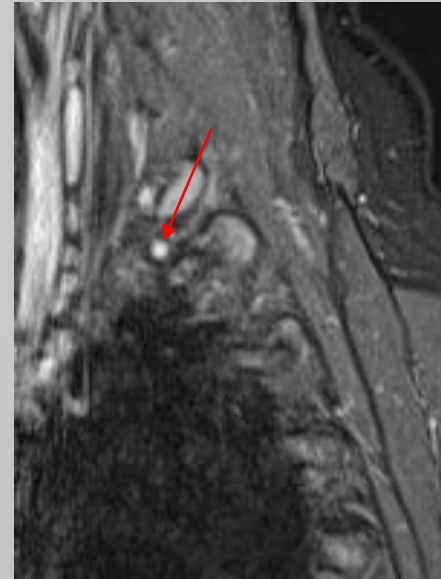
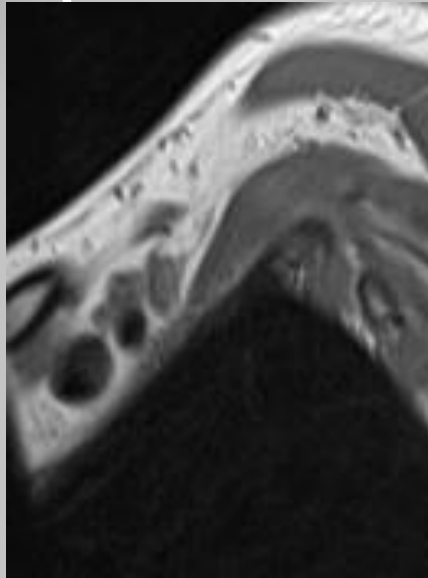
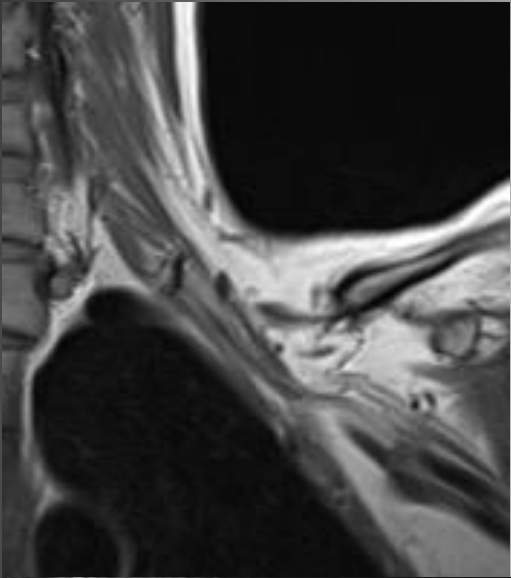
Callus of old L Clavicular Fracture



Old Clavicular Fx with TOS



Thoracic Outlet Syndrome- Fibrous Band Compression and Cervical Rib



Summary

- Brachial plexus imaging- STIR, T1 and T1 FS post-gad
- In addition to looking for signal abnormality and enhancement of brachial plexus structures, evaluate for underlying lesions and downstream effects
- Dynamic imaging important for outlet obstruction/compression
 - Sagittal T1 imaging very helpful for assessment of nerve compression



Thank you!
mmossab@uw.edu