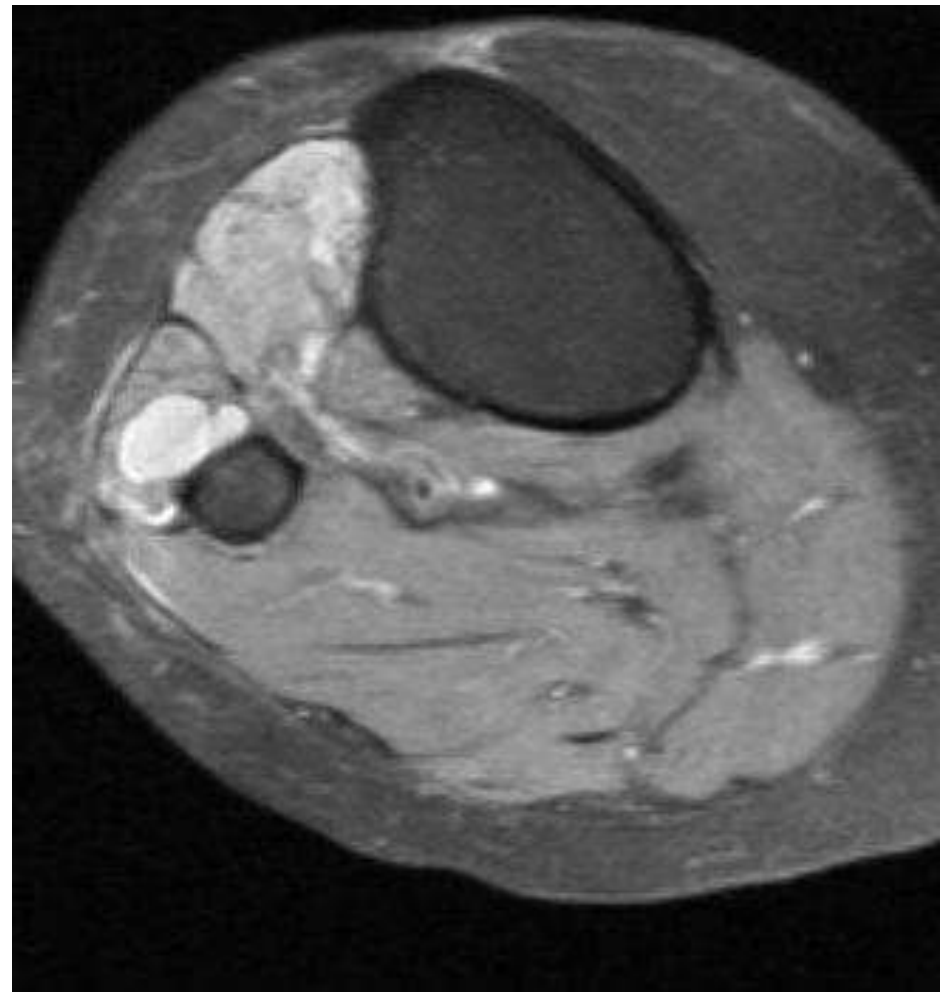


# Nerve Entrapment Syndromes



# Nerve entrapment syndromes

## Introduction

- Chronic entrapment
- Commonly as the nerve passes through an osseoligamentous tunnel, or between aponeurotic edges
- One side fixed, one moves -> friction
- May see mass pressing on nerve
- Secondary changes in muscles of nerve distribution
- Inflamed or thickened nerve

# Nerve entrapment syndromes

## History

- Initially described by:
  - Astley Cooper 1820
  - James Paget 1850
- First surgical decompression
  - Learmonth 1930
- Common types
  - Carpal tunnel syndrome
  - Ulnar nerve at the elbow
  - Guyon's canal
  - Suprascapular syndrome

# Nerve entrapment syndromes

## Pathology

- Chronic blunt injury -> ischemic changes
  - Edema
  - Dislocation of the nodes of Ranvier
  - Structural changes to myelin sheath and axon
  - Focal segmental demyelination is constant
  - Complete recovery is due to remyelination
- Incomplete recovery due to Wallerian degeneration

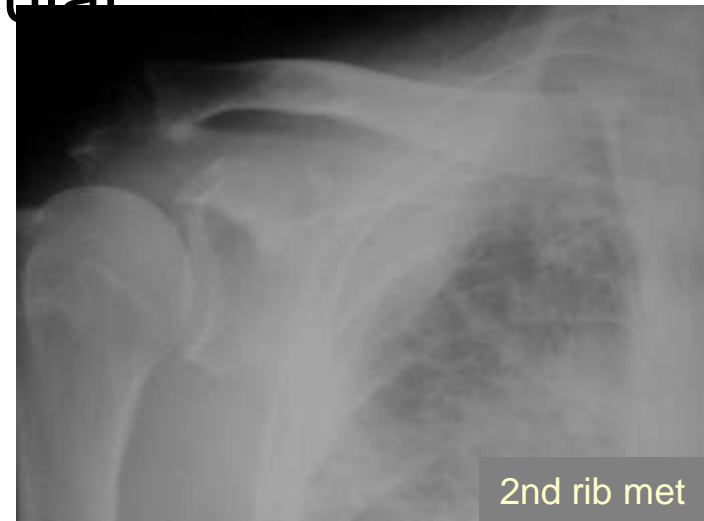
# Nerve entrapment syndromes

## Clinical

- Depends on nerve involved
- Irritative sensory symptoms
  - Pain and paresthesias
- Ablative sensory symptoms
  - Numbness
- Ablative motor signs
  - Weakness and atrophy
- If mixed nerve – sympathetic dystrophy
  - Dry, thin, hairless skin
- Most peripheral entrapped nerves Sens. and Motor
  - Except – deep ulnar (motor), Lateral femoral cutaneous (sensory)

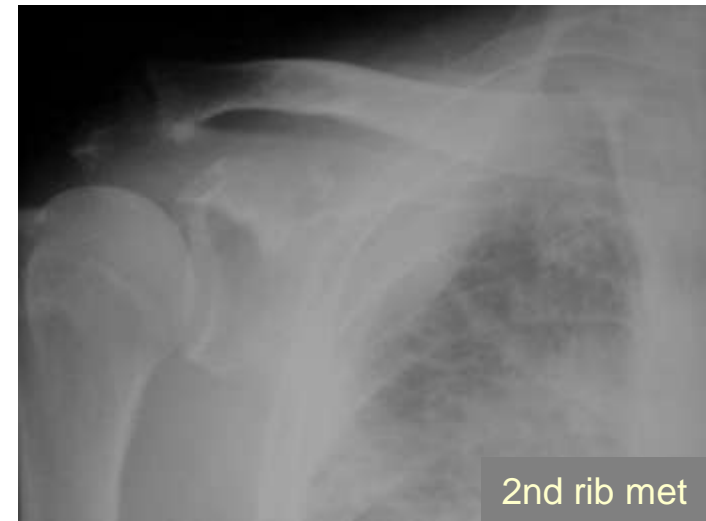
# Neurologic Thoracic Outlet Syndrome

- Brachial plexus compression
  - True (Classic)
    - Congenital band or Cx rib - rare
  - Nonspecific
    - Compression or traction in cervicoaxillary canal
- Can have combined neurovascular
  - Usually traumatic



# Neurologic Thoracic Outlet Syndrome

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  - Usually traumatic



2nd rib met

# Neurologic Thoracic Outlet Syndrome

- F:M 3.5:1
- Sensory symptoms > motor
  - Motor intrinsic hand muscle atrophy
- Principally arm pain, may be chest
  - Exacerbated by abduction





# Neurologic Thoracic Outlet Syndrome

## Radiology

- Bony abnormalities
  - Cx rib
  - Elongated C7 transverse process
  - Pancoast tumor
  - Arteriography – aneurysm
  - MRI – Cord lesion
    - Radiculopathy
    - Plexus distortion

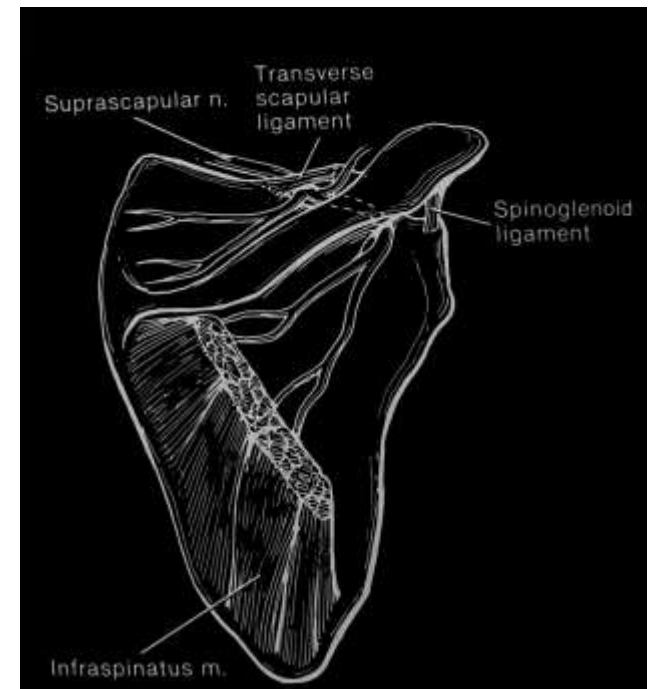
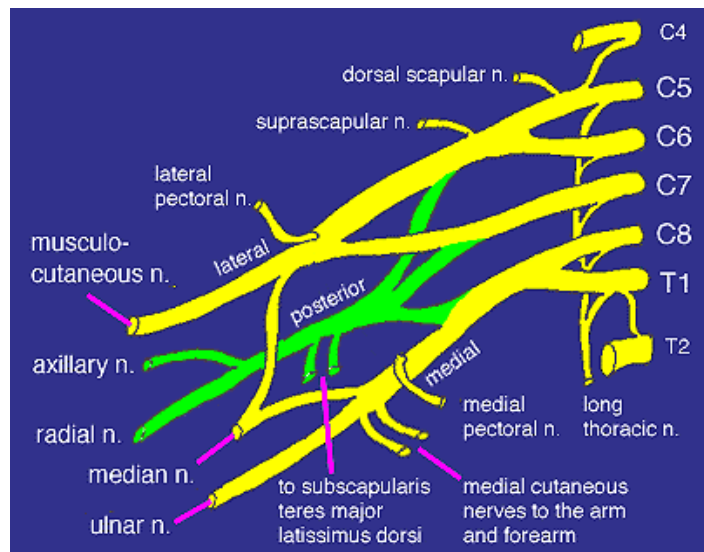


Large R C7 transverse process

# Entrapment syndromes

## Suprascapular nerve

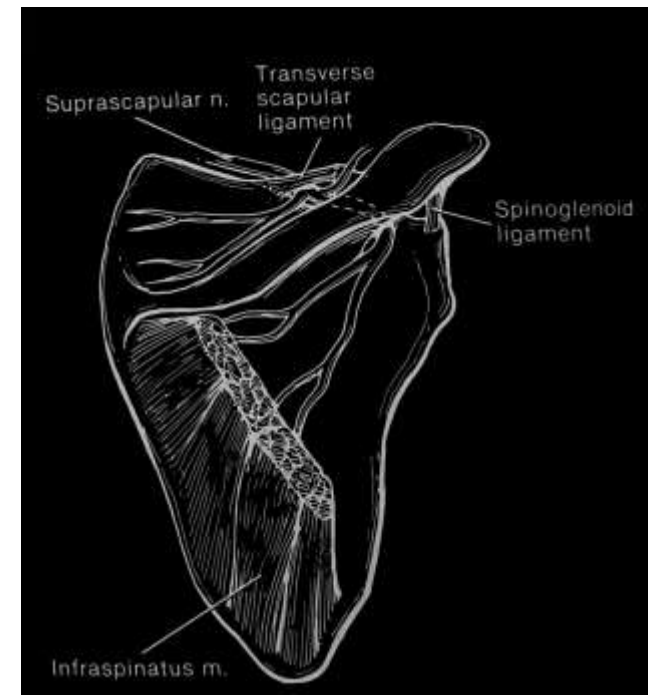
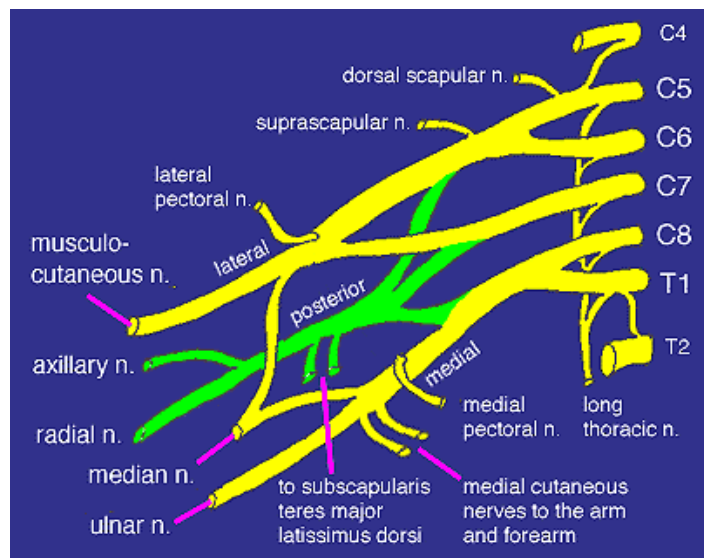
- Upper limb athletes
- Deep dull aching pain – sensory fibers to joint
- Weakness Abd and ER
- Hollow infraspinatus fossae



# Entrapment syndromes

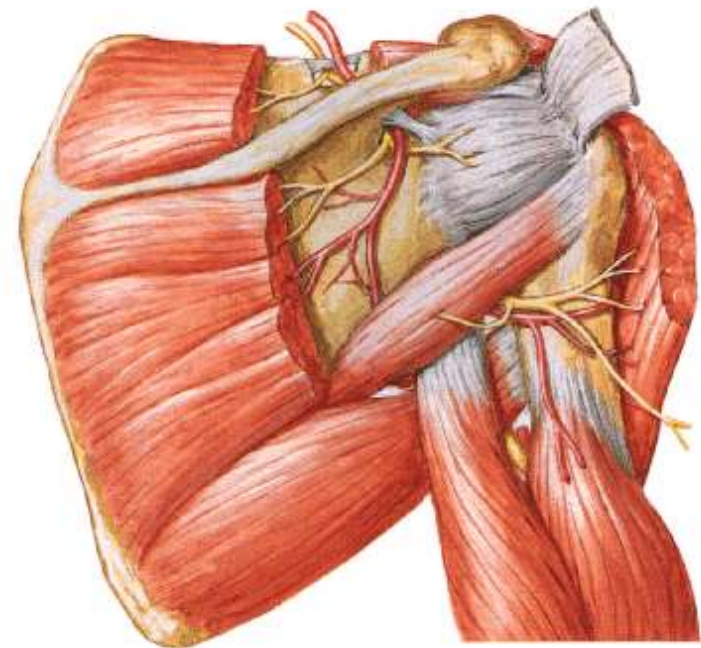
## Suprascapular nerve

- C5-6 roots, arises off superior trunk
- Supplies supra and infraspinatus
- Compressed in
  - Suprascapular notch - Supra and Infra
  - Spinoglenoid notch – Infra only



# Suprascapular notch ganglion

- Suprascapular nerve entrapment relating to a ganglion cyst
- Commonly superior labral tear
- Affects supra and infraspinatus



## Entrapment neuropathy

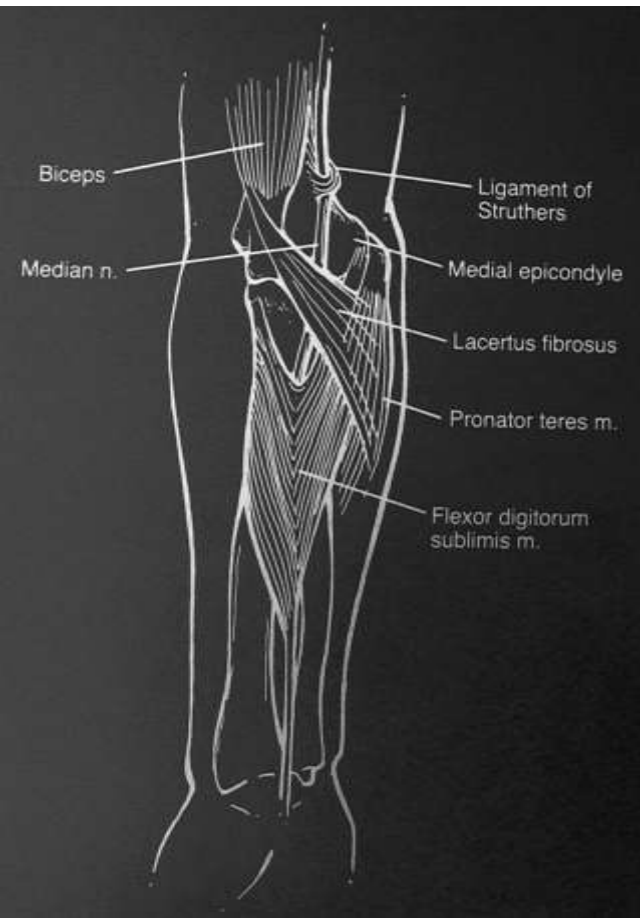
# Median Nerve

- C5-T1
  - Ligament of Struthers
  - Lacertus fibrosus
  - Pronator Syndrome
    - Between heads of pronator teres
  - Anterior Interosseous Syndrome
    - Within forearm
  - Carpal Tunnel Syndrome

# Entrapment neuropathy - Median Nerve

## Ligament of Struthers

- Supracondyloid foramen present in 1%



## Entrapment neuropathy - Median Nerve

# Carpal Tunnel Syndrome

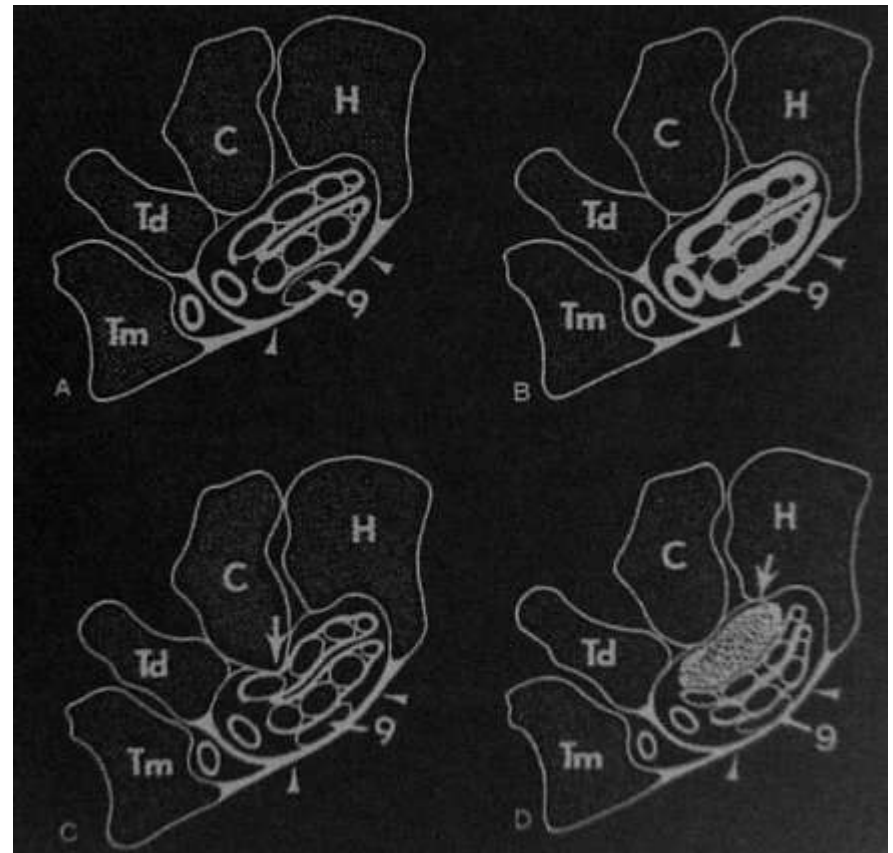
- Dull ache at wrist extending up to elbow
- Worse at night
- Paresthesia median finger and thumb
- AbPB weak, OPB later, FPB spared
- Phalen sign – Worse on forced flexion
- Tinel sign – Paresthesia on tapping



# Entrapment neuropathy - Median Nerve

## Carpal Tunnel Syndrome

- Tenosynovitis
- Osseous spur
- Mass





Entrapment neuropathy - Median Nerve

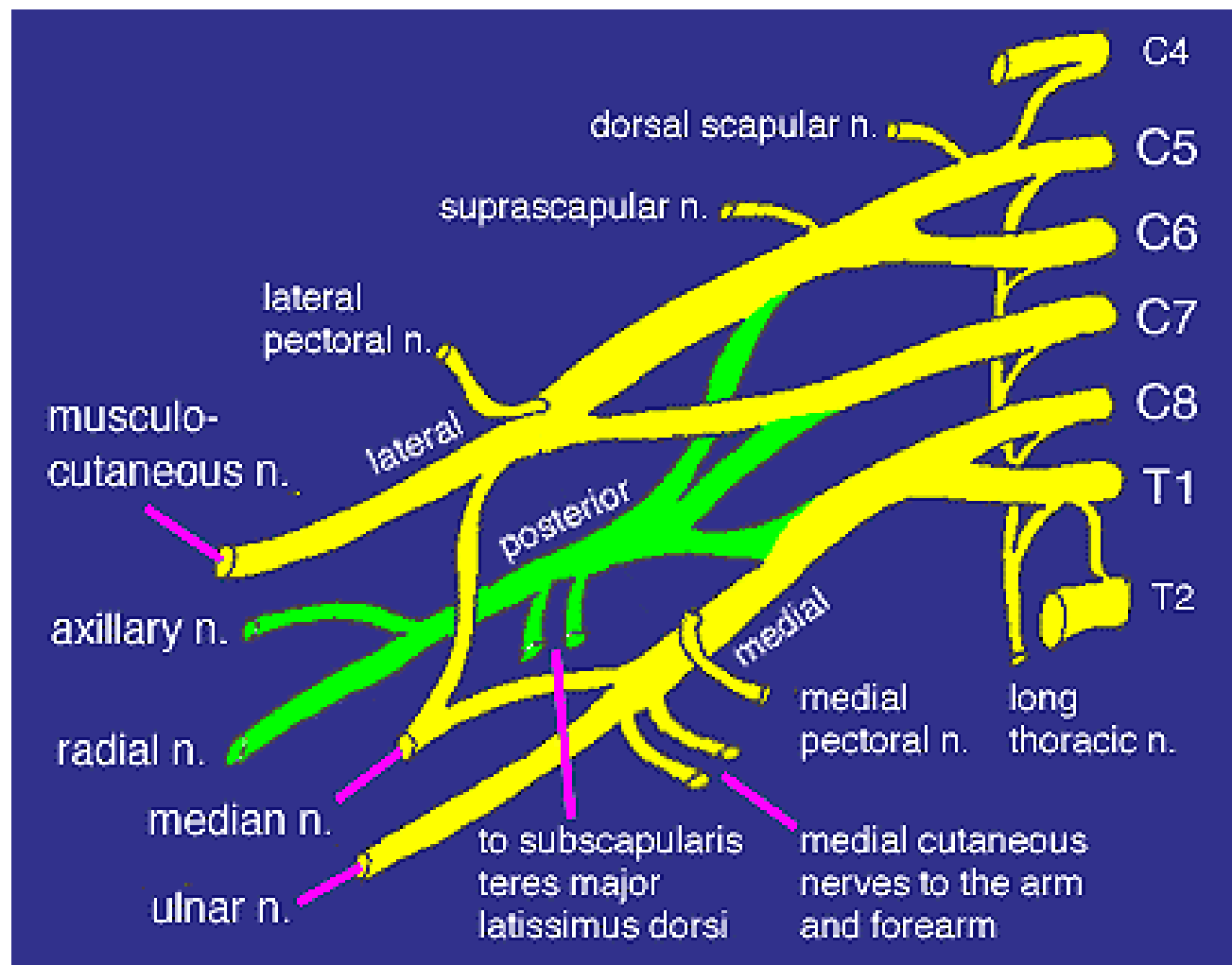
# Carpal Tunnel Syndrome - MRI

- Increased signal intensity of median nerve
- Swelling of median nerve proximally
- Flattening of median nerve distally
- Bowing of flexor retinaculum

## Entrapment neuropathy

# Ulnar Nerve – Sites of Compression

- C7-T1



# Ulnar Nerve – Sites of Compression

- 1<sup>st</sup> rib
  - Klumpke
- Axilla
  - Crutches
- Humerus
  - Arcade of Struthers, 70% of pop.
    - Medial triceps to medial intermuscular septum
  - Medial intermuscular septum – following anterior transposition
- Elbow
  - Cubital tunnel syndrome
  - FCU aponeurosis of Osborne
- Forearm
  - Aponeurosis between FDS and FDP
- Hand
  - Guyons canal
  - Ulnar tunnel syndrome

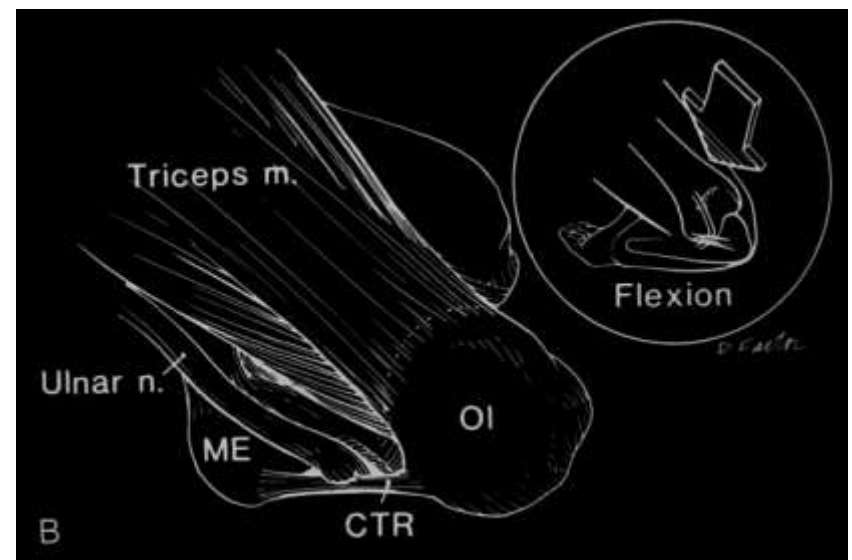
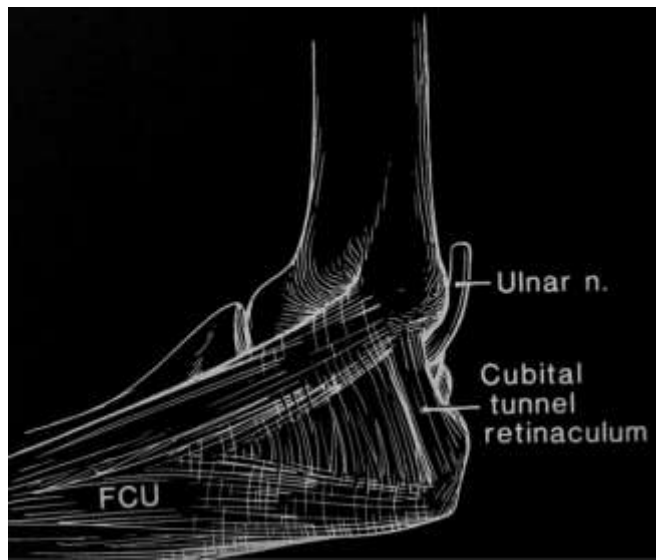
## Entrapment neuropathy

# Ulnar Nerve - Anatomy

- Upper arm, Medial side of brachial artery
- Pierces intermuscular septum mid arm
- Lies on distal medial head of Triceps
- Passes through Cubital Tunnel
- Passes under the strong aponeurotic arcade between the humeral and ulna heads of FCU
- Along forearm between superficial and deep finger flexors

# Cubital tunnel syndrome - Anatomy

- Ulnar nerve compressed in cubital tunnel
  - Anterior – medial epicondyle
  - Lateral – Olecranon
  - Posteromedial –
    - Cubital tunnel retinaculum
    - AKA - Osbornes ligament or fascia



# Entrapment neuropathy - Ulnar Nerve

## Cubital tunnel syndrome

- Traumatic
  - Single event or chronic repetition
- Nontraumatic
  - Work related
    - Rest on elbows
    - Elbow flexion/extension
    - Concert pianists Slammed by aponeurotic arch of FCU
- Scarring and adhesion
  - Cubital tunnel
  - Under Flexor carpi ulnaris aponeurosis

Entrapment neuropathy - Ulnar Nerve

## Cubital tunnel syndrome

- Spontaneous subluxation of ulnar nerve from the cubital tunnel (15% of population) may exaggerate symptoms

Entrapment neuropathy - Ulnar Nerve

## Cubital tunnel syndrome

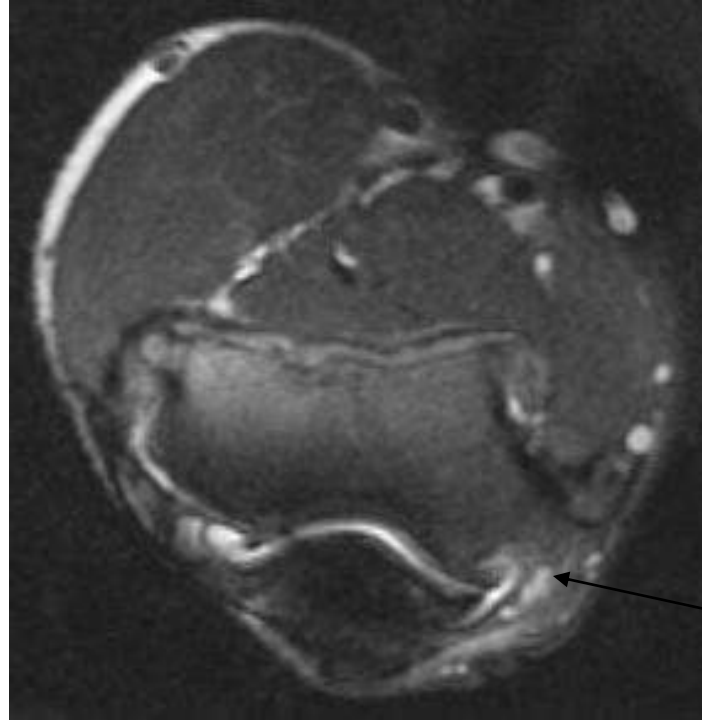
- Ring and little finger paresthesia
- Discomfort medial forearm
- Pain medial elbow
- Tapping nerve causes distress
- Occ. Weak finger add/abd
- Ulnar claw hand





# Cubital tunnel syndrome - Causes

- Masses in cubital tunnel
  - Muscles
    - Anconeus epitrochlearis
    - Prominent medial head of triceps
  - Ganglion
  - Osteophytes

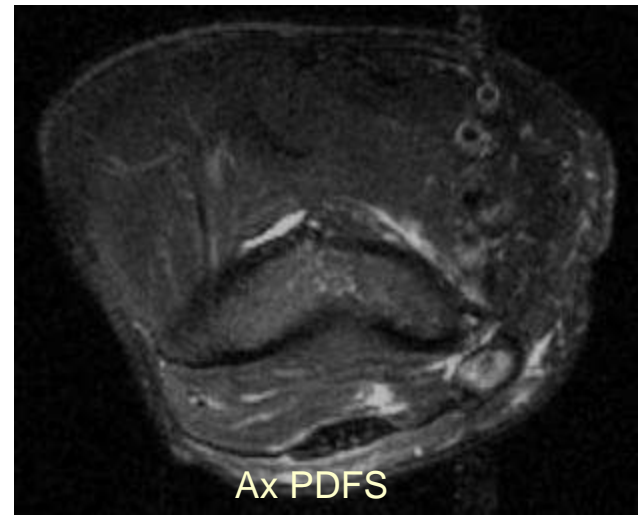
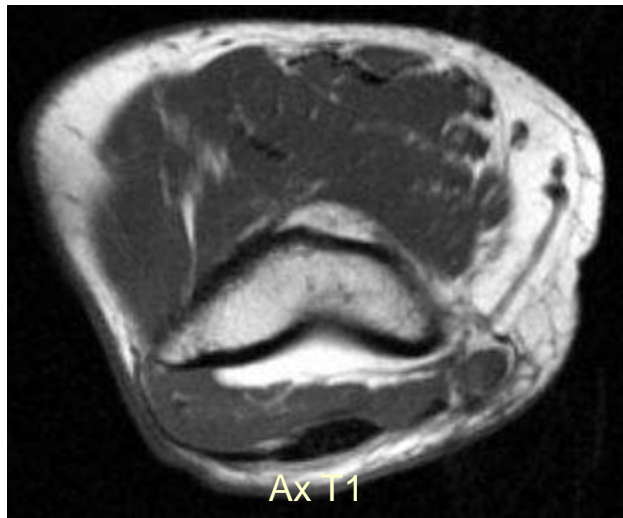


# Anconeus epitrochlearis

- Cubital tunnel retinaculum - 27 cadavers
  - Absent (1)
    - Allows subluxation
  - Type 1a (17)
    - Taut in full flexion
      - Normal
  - Type 1b (6)
    - Taut in partial flexion
      - Causes dynamic nerve compression
  - Type 2 (3)
    - Replaced by Anconeus epitrochlearis
      - Static compression
- Cubital tunnel retinaculum probably a remnant of the anconeus epitrochlearis

# Cubital tunnel syndrome - MRI

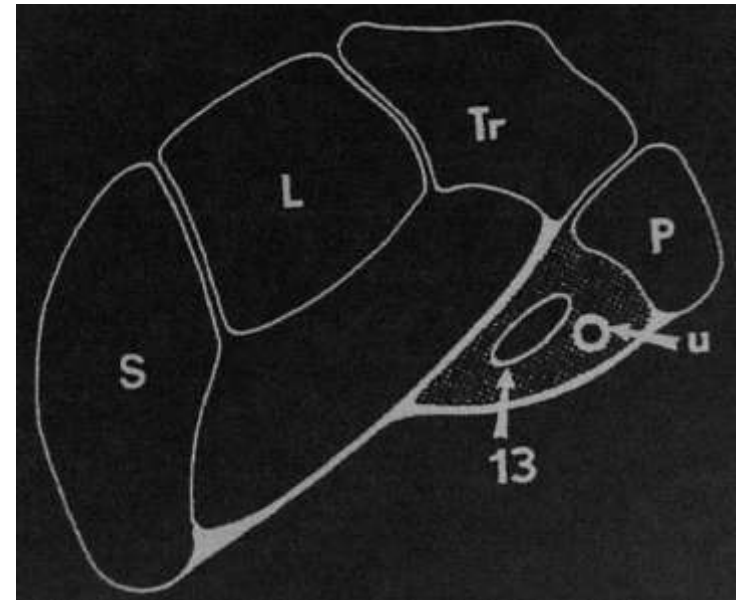
- Nerve
  - Compressed, Thickened, Displaced
  - Inflamed and enhancing
- Cause
  - OA, Ganglion, Synovitis, Muscle



# Entrapment neuropathy - Ulna Nerve

## Ulnar Tunnel Syndrome

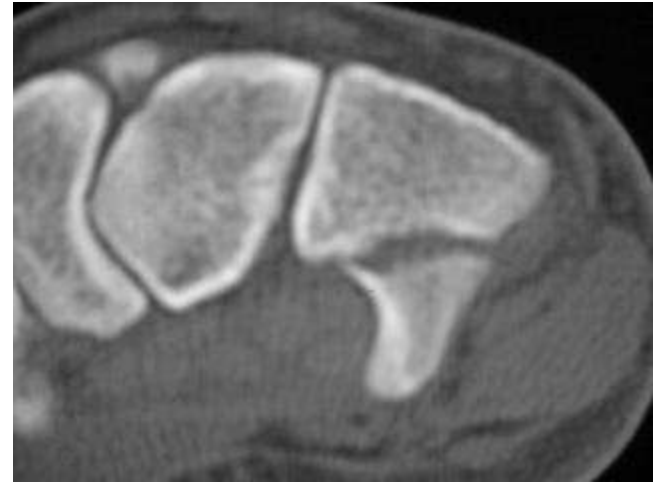
- AKA - Guyon's canal syndrome
- Superficial to flexor retinaculum
- Lateral to flexor carpi ulnaris
- Medial to ulnar artery
- Roofed by transverse carpal lig
- Superficial hypothenar branch
  - Proximal to canal 65% - silent paralysis
  - In canal 35% - additional pain and numbness
- Deep motor branch
  - Paralysis – AddPol, Interossei, ulnar lumbricals
    - ODM > FDM > AbDM



# Entrapment neuropathy - Ulna Nerve

## Ulnar Tunnel Syndrome

- Masses
  - Ganglion
  - Lipoma
- Synovitis
- Fractures
  - Hook of hamate
- Accessory muscle
- Aneurysm
  - Hypothenar hammer syndrome



# Entrapment neuropathy

## Radial Nerve

- Axilla
  - Crutches, Saturday night palsy
- Passes laterally under long head of triceps
  - Fibrous arch
- Lies on humerus between medial and lateral heads of triceps
  - Fibrous arch of lateral head
  - Fractures Holstein-Lewis
  - Tourniquet
- Passes into anterior compartment through lateral intermuscular septum
  - Compression
- Lies between brachialis/biceps and ECRB/L, brachioradialis at cubital fossa
  - Body builders
- Intimate to anterior radiocapitellar joint
  - Synovial lesions
- Divides
  - Motor – PIN
  - Sensory – Superficial radial nerve
- PIN enters radial tunnel under arcade of Frohse
  - Leash of Henry (← recurrent radial artery) cross over just proximal to arcade
- Lies between deep and superficial heads
  - Supinator syndrome

## Entrapment Syndromes - Radial Nerve

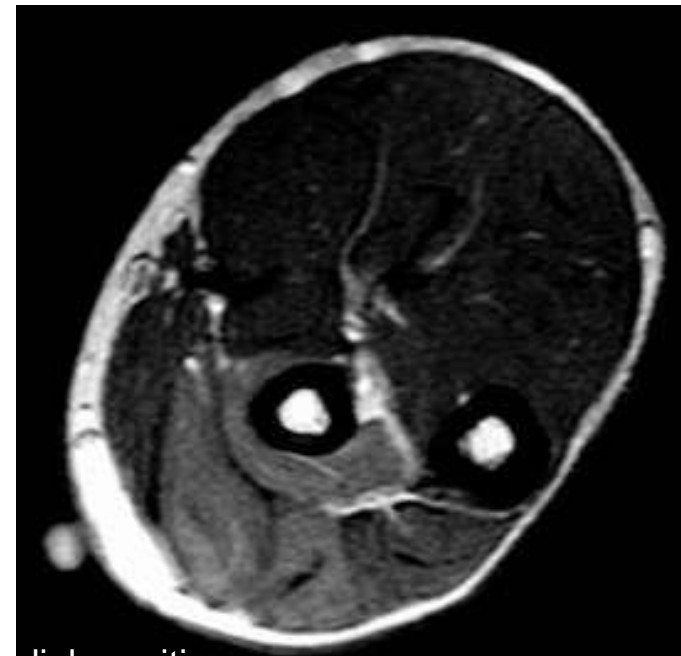
# Posterior Interosseous Syndrome

- Motor nerve
- Occ. Dull ache front elbow
  - Nervi nervorum
- Fatigue of forearm extensors
- Weak forearm extensors
  - Weak MCPJ extension esp. 3-4
  - Preserved IPJ extension from lumbricals
- Radial wrist extensors preserved
  - Origin proximal to radial tunnel

Entrapment Syndromes - Radial Nerve - PIN

## Resistant Tennis Elbow

- Radial collateral ligament rupture.
- Radial tunnel syndrome
  - Posterior interosseous branch of radial n.
  - Fibrous arch of supinator (Arcade of Frohse)
  - Distally through supinator



Radial neuritis



# Posterior Interosseous Nerve Syndrome

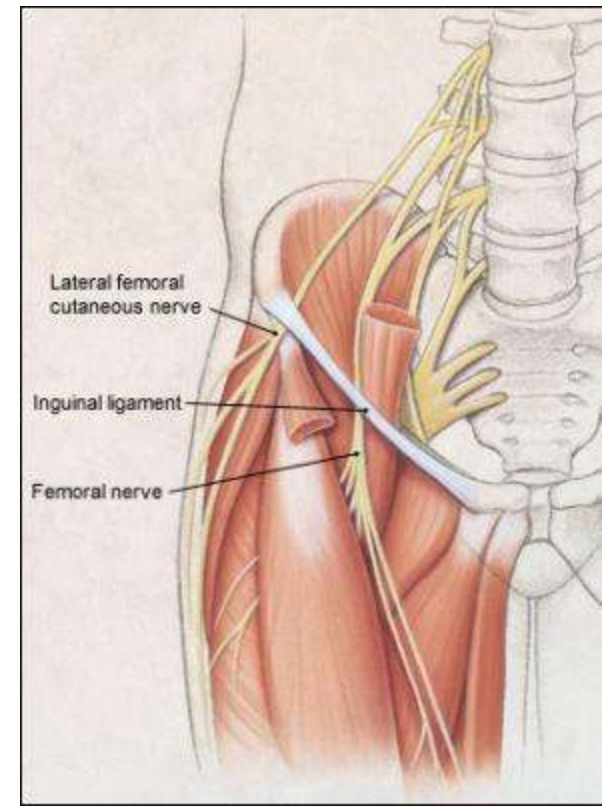
- 51 y.o. female with weakness of hand extensors and radial deviated wrist



## Entrapment neuropathy

# Lateral Femoral Cutaneous Nerve

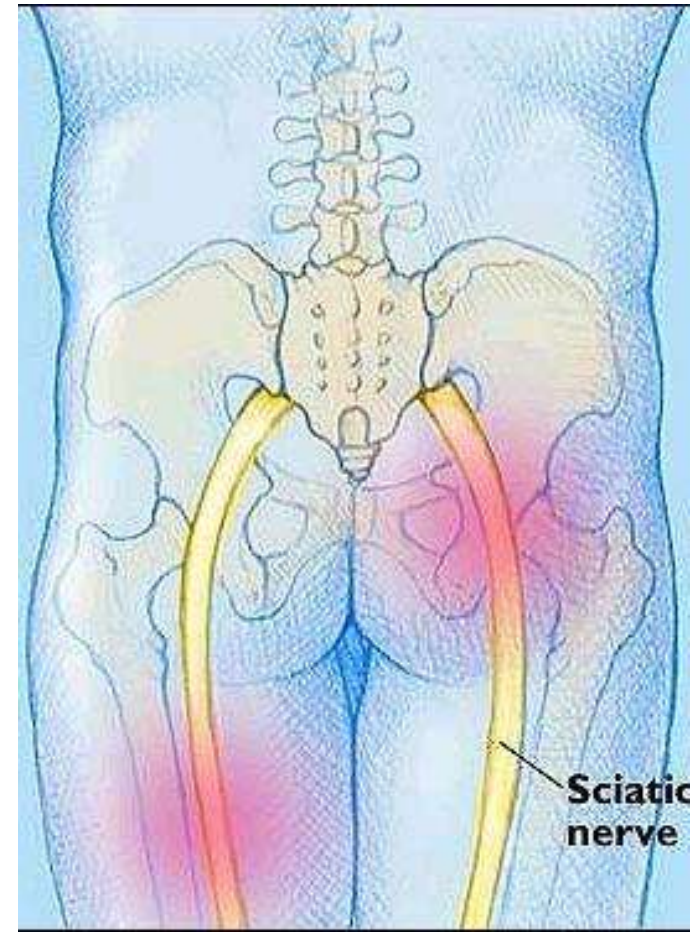
- Meralgia paresthetica L1-2
- Obesity, Pregnancy, Hyperextension
- Sensory changes lateral thigh
- Kinked under inguinal ligament



## Entrapment neuropathy

# Sciatic nerve

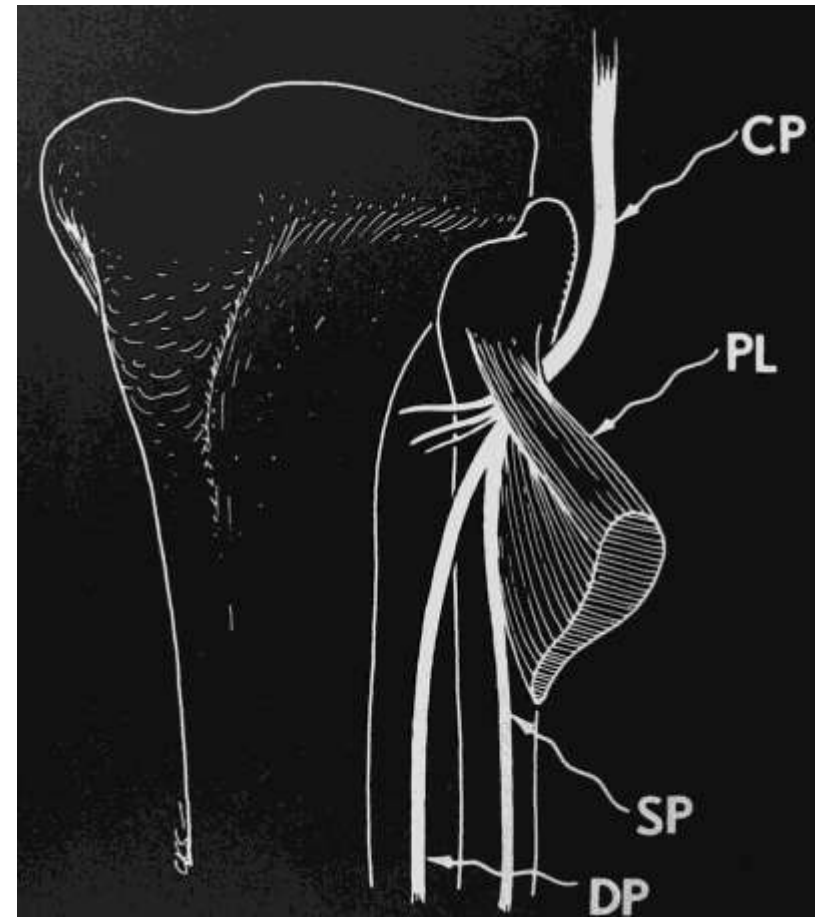
- Sciatic Nerve L4-S3
  - Piriformis Syndrome
  - Tumor
- Tibial nerve
- Common peroneal nerve



Entrapment syndromes

# Common Peroneal Nerve

- L4-S2
  - Popliteal fossa
  - Fibular tunnel



## Entrapment syndromes

# Tibial Nerve

- L4-S1
  - Popliteal fossa
  - Tarsal tunnel syndrome
  - Plantar nerves
  - Digital nerves
  - Sural nerves

## Entrapment Syndromes - Tibial nerve

# Tarsal Tunnel Syndrome

- Roof – Flexor retinaculum
- Floor – Tarsal bones and muscles
- Contains
  - Flexor tendons
  - Artery and vein
  - Tibial nerve

## Entrapment Syndromes - Tibial nerve

# Tarsal Tunnel Syndrome

### Tibial nerve

- Medial calcaneal branches
  - Perforate laciniated ligament
  - Sensory medial skin
- Medial plantar nerve
  - Muscles – AbH, FHB, FDB, 1<sup>st</sup> lumbrical
- Lateral plantar nerve
  - Muscles – QP, AbDquinti

# Tarsal Tunnel Syndrome

- AKA - Posterior or Medial TTS, Tibial neuropathy
- Commonest nerve compression syndrome in foot
- Pain and parasthesia plantar foot and toes
- Tibial nerve or branch
- In fibroosseous tunnel
- Deep to flexor retinaculum –laciniated ligament



# Tarsal Tunnel Syndrome - Anatomy

- Floor - Talus, Calcaneus, QPM
  - Roof - Flexor retinaculum, AbHM
  - Anterior - FDL,
  - Posterior FHL
- 
- Divided into channels by septae
  - 2 cm long, narrowest distally
  - Contents - PTT, FDL, FHL, PTNVB
  - TN => MCN, LPN, MPN\*



# Tarsal Tunnel Syndrome - Aetiology

- Compression of nerve
- Intrinsic
  - Ganglions, Varicosities, Lipomas
  - Neurilemmomas, Neurofibromas
  - Synovial sarcoma, Tenosynovitis
  - Fibrosis from trauma, Rheumatoid arthritis
- Extrinsic
  - Trauma, Biomechanical - Jogger's foot

# Peripheral Neuritis

- Mechanical
- Radiation
- Post viral
  - Parsonage Turner Syndrome
  - Polio
- Ischemic neuropathy
  - Diabetic
- Polyneuropathy

Peripheral Neuritis

# Parsonage Turner Syndrome

– AKA

- Neuralgic amyotrophy
- Acute brachial neuritis / radiculitis
- Nontraumatic neuropathy
- Shoulder girdle syndrome

– Idiopathic denervation syndrome of shoulder muscles

Peripheral Neuritis

# Parsonage Turner Syndrome

## – Pathology

- Neuritis of lower motor neurons of brachial plexus
- Probably post viral
- Also follows trauma, surgery and immunization

## Peripheral Neuritis

# Parsonage Turner Syndrome

### – Acute findings (after 2w symptoms)

- Swollen muscles
- ↓T1, ↑T2 / STIR, Enhance
- No focal lesion on nerve

### – Chronic findings

- Fatty atrophy
- ↑ T1, ↑T2, ↓STIR
- No focal tear