Peripheral Nerve Injuries

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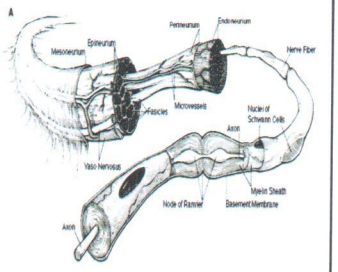
Objectives

- Peripheral nerve anatomy
- Classification of nerve injury
- General management approach
  - Radial Nerve
  - Median nrve
  - Ulnar nerve
  - Brachial plexus
- Examples of peripheral nerve injuries

Anatomy

- Cell body
- Axon
- Layers
  - Epineurium
  - Perineurium
  - Endoneurium

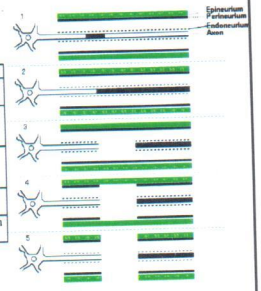


Types of nerve Injuries

- Trauma
  - Closed
    - High velocity (Motor cycles, car accidents)
    - Low velocity (sports, falls)
  - Open:
    - Stabbing
    - Gunshot
- Compression

Classification

Seddon	Sunderland	Disrupted	Prognosis
Neurapraxia	1st Degree	Axon (minimal)	Complete recovery in days/months
Axonotmesis	2nd Degree	Axon (total) – Wallerian degeneration	Complete return in months
	3rd Degree	Axon, endoneurium	Mild/moderate reduction in function
	4th Degree	Axon, endoneurium, perineurium	Moderate reduction in function
Neurotmesis	5th Degree	All structures	Marked reduction in functional return



General Approach

- Hx
- PEx
- DDx
- Ix (if needed)
- Consult (if needed)
- Treatment
  - Non-surgical
  - surgical

- Radial Nerve
- Median nrve
- Ulnar nerve
- Brachial plexus

- Common Template for all Peripheral Nerve

History

- ID:
  - Hand dominance
  - Occupation
  - Hobbies
- HPI
  - Main complaint
    - Loss of sensation
    - Motor weakness
    - Pain
  - Risk factors
    - Pathological(previous trauma or surgery)
    - Idiopathic (anatomical compression)
- Main complaint
  - When (time of onset)
  - Where (site of Numbness/ pain)
  - Why (Mechanism of the injury)
  - How long (duration)
  - Symptoms Progression
  - What has been done so far

History

- PMH
- PSH
- Meds.
- Social Hx (smoking)
- Allergy Hx

Physical Exam

- Sensory deficit
- Motor deficit
- Tests (e.g tinel sign)

Investigation

- NCS/EMG
- MRI (SOL)

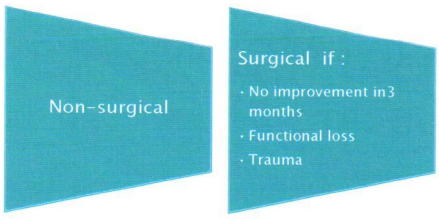
Consultation

- OT (splinting)
- PT(ROM)

Treatment options

- Non-surgical
  - Splint(night)
  - NSAID
  - Rest
  - Change life style
- Surgical (for N compression)
  - Nerve Decompression
  - Nerve transposition
  - Tendon transfer
- Surgical(for N trauma)
  - Nerve repair
  - Nerve graft
  - Nerve transfer
  - Tendon transfer

Treatment Algorithm



- Radial Nerve

Anatomy

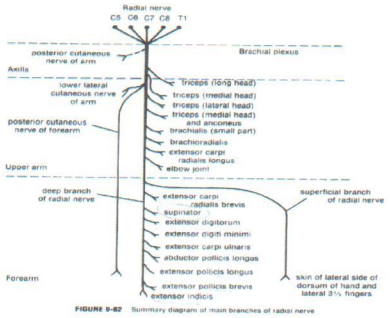


FIGURE 9-82 Summary diagram of main branches of radial nerve

History

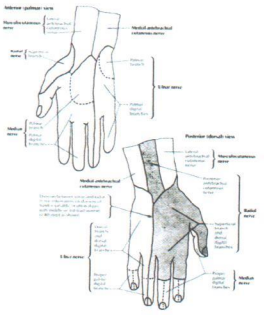
- ID:
  - Hand dominance
  - Occupation
  - Hobbies
- HPI
  - Main complaint
    - Sensory deficit
      - Radial nerve distribution
    - Motor deficit
      - weakness
      - Inability to extend
        - Elbow (axilla)
        - Wrist(arm)
        - Digits(forearm)
    - Pain
- Main complaint
  - When (time of onset)
  - Where (site of Numbness/ pain)
  - Why (Mechanism of the injury)
  - How long (duration)
  - Symptoms Progression
  - What has been done so far

History

- HPI
  - Risk factors
    - Anatomical (compression)
    - Pathological(trauma)
      - *Humerus shaft fracture* (**high** radial nerve injury) (**Arm**)
      - *Stab wound* forearm (**low** radial nerve injury) (**Forearm**)
- PMH
- PSH
- Meds.
- Social Hx (smoking)
- Allergy Hx

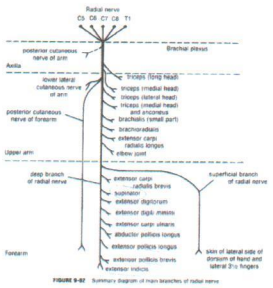
Physical Exam

- **Sensory deficit**
- Motor deficit
  - Inability to extend
    - Elbow (axilla)
    - Wrist(arm/forearm)
    - Digits(forearm)
- Tests (e.g tinel sign)

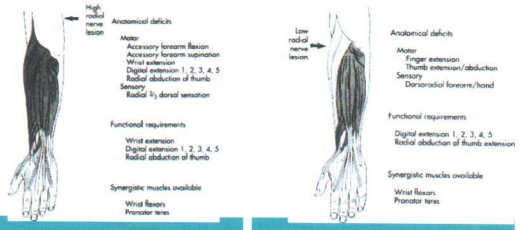


Physical Exam

- Sensory deficit
- Motor deficit
  - HIGH RN injury(arm)
    - Inability to extend
      - Wrist
      - Digits
  - LOW RN injury(forearm)
    - Inability to extend
      - Digits
- Tests (e.g tinel sign)



Physical Exam



High RN palsy | Low RN palsy

Investigation

- NCS/EMG
- MRI (SOL)

Consultation

- OT (splinting)
- PT(ROM)

Treatment (RN Compression)

- Non-surgical
  - Splint(night)
  - Physiotherapy
  - NSAID
  - Rest
- Surgical (for N compression)
  - Nerve Decompression
  - Nerve transposition
  - Tendon transfer

Treatment Algorithm

Non-surgical

Surgical if :

- No improvement in3 months
- Functional loss
- Trauma

Treatment (RN laceration)

- Surgical
  - Nerve repair
  - Nerve graft
  - Nerve transfer
  - Tendon transfer

Case 1

- Median Nerve

Anatomy

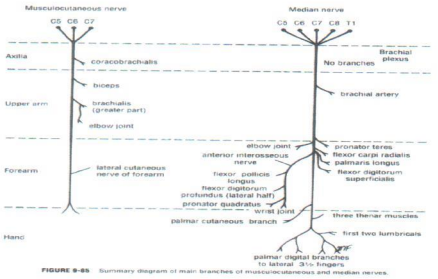


FIGURE 9-85 Summary diagram of main branches of musculocutaneous and median nerves.

History

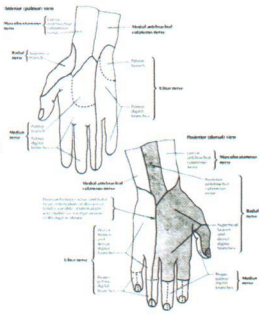
- ID:
  - Hand dominance
  - Occupation
  - Hobbies
- HPI
  - Main complaint
    - Sensory deficit
      - Median nerve distribution
    - Motor deficit
      - Hand weakness
    - Pain
- Main complaint
  - When (time of onset)
  - Where (site of Numbness/ pain)
  - Why (Mechanism of the injury)
  - How long (duration)
  - Symptoms Progression
  - What has been done so far

History

- HPI
  - Risk factors
    - Anatomical (compression)
    - Pathological(trauma)
- PMH
- PSH
- Meds.
- Social Hx (smoking)
- Allergy Hx

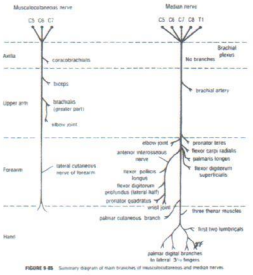
Physical Exam

- Sensory deficit
- Motor deficit
  - Inability to extend
- Tests (e.g tinel/phalen signs)

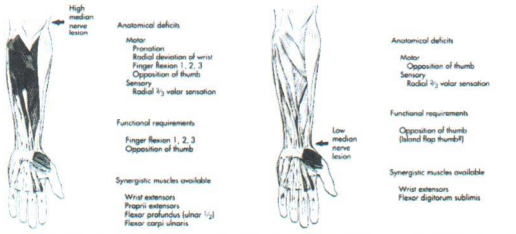


Physical Exam

- Sensory deficit
- Motor deficit
  - HIGH MN injury(arm)
  - LOW MN injury(Distal forearm/wrist)
- Tests (e.g tinel/phalen signs)



Physical Exam



High MN palsy | Low MN palsy

Investigation

- NCS/EMG
- MRI (SOL)

Consultation

- OT (splinting)
- PT(ROM)

Treatment (MN Compression)

- Non-surgical
  - Splint(night)
  - Physiotherapy
  - NSAID
  - Rest
- Surgical (for N compression)
  - Nerve Decompression
  - Nerve transposition
  - Tendon transfer

Treatment Algorithm

Non-surgical

Surgical if :

- No improvement in3 months
- Functional loss
- Trauma

Treatment (MN laceration)

- Surgical
  - Nerve repair
  - Nerve graft
  - Nerve transfer
  - Tendon transfer

Carpal Tunnel Syndrome

- Def : Compression of the median nerve in the carpal tunnel at the level of the wrist
- **LOW MN palsy**

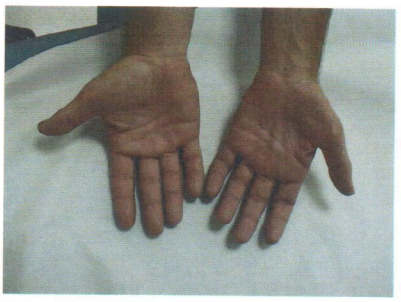
Carpal Tunnel Syndrom

- Treatment
  - Splinting (at night)
  - Lifestyle modification
  - Surgical decompression

Carpal Tunnel Syndrome Rx

- Non-surgical
  - Splint(night)
  - Physiotherapy
  - NSAID
  - Rest
- Surgical
  - Nerve Decompression

Case 2



- Ulnar Nerve

Anatomy

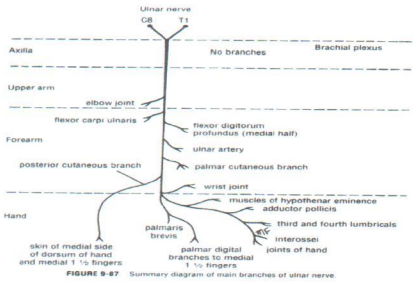


FIGURE 9-87 Summary diagram of main branches of ulnar nerve.

History

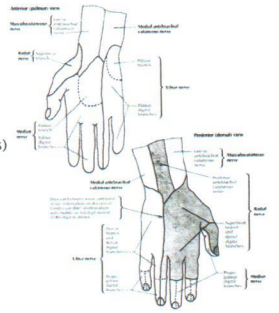
- ID:
  - Hand dominance
  - Occupation
  - Hobbies
- HPI
  - Main complaint
    - Sensory deficit
      - Ulnar nerve distribution
    - Motor deficit
      - Hand weakness
    - Pain
- Main complaint
  - When (time of onset)
  - Where (site of Numbness/ pain)
  - Why (Mechanism of the injury)
  - How long (duration)
  - Symptoms Progression
  - What has been done so far

History

- HPI
  - Risk factors
    - Anatomical (compression)
    - Pathological(trauma)
- PMH
- PSH
- Meds.
- Social Hx (smoking)
- Allergy Hx

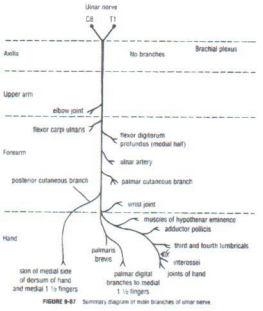
Physical Exam

- Sensory deficit
- Motor deficit
  - Inability to extend
- Tests (e.g tinel/phalen signs)



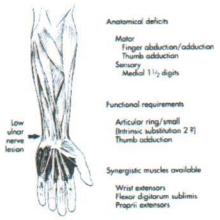
Physical Exam

- Sensory deficit
- Motor deficit
  - HIGH MN injury (arm/proximal forearm)
  - LOW MN injury (Distal forearm/wrist)
- Tests (e.g tinel sign)



Ulnar Nerve

Motor Deficit
Same as low palsy; Plus FDP D4,5; Power grip weakening, FCU (not usually a problem as FCR flexes wrist and ECU deviates ulnarly), Claw hand less likely a problem
Sensory Deficit
Same as low palsy with the addition of the dorsal-ulnar aspect of palm and dorsal side of D5



Anatomical deficits
Motor
Finger abduction/adduction
Thumb adduction
Sensory
Medial 1½ digits

Functional requirements
Articular ring/small
(Intrinsic substitution 2°)
Thumb adduction

Synergistic muscles available
Wrist extensors
Flexor digitorum sublimis
Propris extensors

High UN palsy | Low UN palsy

Investigation

- NCS/EMG
- MRI (SOL)

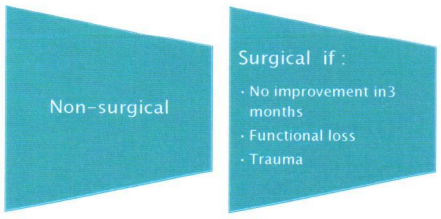
Consultation

- OT (splinting)
- PT(ROM)

Treatment (UN Compression)

- Non-surgical
  - Splint(night)
  - Physiotherapy
  - NSAID
  - Rest
- Surgical (for N compression)
  - Nerve Decompression
  - Nerve transposition
  - Tendon transfer

Treatment Algorithm



Treatment (UN laceration)

- Surgical
  - Nerve repair
  - Nerve graft
  - Nerve transfer
  - Tendon transfer

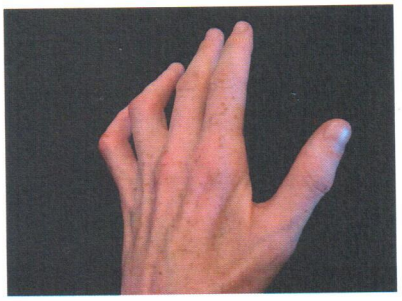
Cubital Tunnel Syndrome

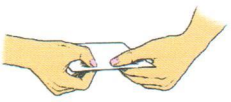
- Def:Compression of the ulnar nerve in the cubital tunnel (medial aspect of the distal arm/proximal forearm around the elbow)
- **High MN palsy**

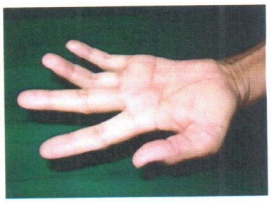
Cubital Tunnel Syndrome Rx

- Non-surgical
  - Splint(night)
  - Physiotherapy
  - NSAID
  - Rest
- Surgical (for N compression)
  - Nerve Decompression
  - +/- Nerve transposition

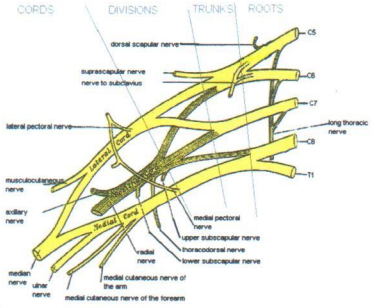
Case 3





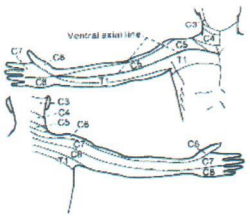


- Brachial Plexus



Dermatomes

- C5 → lateral (radial) side of the anticubital fossa proximal to theelbow
- C6 → dorsal surface of the proximal phalanx of the thumb
- C7 → dorsal surface of the proximal phalanx of the middle finger
- C8 → dorsal surface of the proximal phalanx of the little finger
- T1 → medial (ulnar) side of the anticubital fossa to the medial condyle of the heumerus



Brachial Plexus Injuries

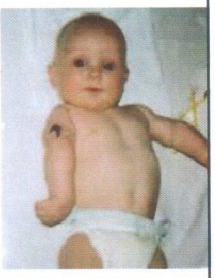
- Obstetrical brachial plexus palsy
  - Risk factors
    - Diabetic mother
    - High birth wt
    - Difficult deliver
    - Breech presentation
    - Instrumental delivery (forceps, suction …)
- Traumatic brachial plexus injuries

Brachial Plexus Palsy

- Erb's palsy (C5,6,+/- 7)
- Klumpke's (C8, T1)
- Total (C5,6,7,8 &T1)

Erb's Palsy

- Waiter's tip position
- Loss of shoulder abduction/ external rotation
- Loss of elbow flexion
- Loss of wrist extension
- Good hand function



Klumpke's Palsy

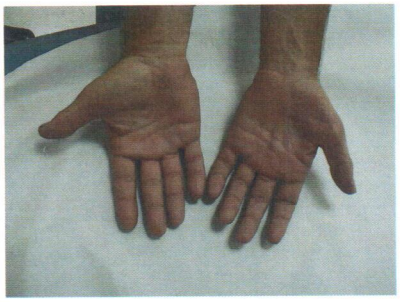
- Good shoulder and elbow
- Loss of hand/ finger flexion/extension

Management

- Observation and stretching exercises of the shoulder for the first 3 months
- Surgical exploration if no recovery by 3-6 month
- Surgery:
  - Exploration and nerve graft or nerve transfer

Case 1

Case 2



Case 3