

Peripheral nerve injuries

Summary + MCQs

Surgery Team

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Nerve	properties	Clinical feature	summary
Axillary nerve	<ul style="list-style-type: none"> -Isolated injuries to the Axillary nerve most commonly happens with shoulder dislocation -Supplies the Deltoid and Teres minor muscle 	<p>-Motor: To the deltoid muscle so the patient will <u>not be able to abduct his shoulder</u> The patient can still initiate abduction (action of supraspinatus). It also supplies teres minor that does external rotation which is the same action of infraspinatus, so the <u>patient can</u> still externally rotate his arm</p> <p>-Sensory: loss of sensation over the skin of the <u>lateral arm on lower half of the deltoid</u></p>	loss of abduction and sensation over the lateral arm
Musculocutaneous	<ul style="list-style-type: none"> -Isolated injuries usually happen with stab wounds or gunshots -Supplies coracobrachialis, <u>biceps</u>, brachialis muscles 	<p>-Motor: Coracobrachialis and brachialis are not important clinically *Biceps: -Weak supination (because the supinator muscle can compensate) -Loss of flexion</p> <p>-Sensory: loss of sensation over the lateral forearm and the thumb</p>	loss of elbow flexion + weak supination and sensation over the lateral forearm
Radial nerve	<ul style="list-style-type: none"> -Runs in the spiral groove so injuries happen in humerus bone fractures -Distribution: <ul style="list-style-type: none"> -Upper arm (axilla): supplies the triceps -strong extensor of the elbow -Lower arm (above the elbow): - Forearm: 	<p>-Humerus fracture in spiral groove with radial nerve injury: -Normal elbow (triceps is supplied higher spared) -No wrist extension (drop wrist) -No thumb and finger extension -Numbness</p> <p>-Posterior interosseous nerve injury: -Stab wound in the forearm -Elbow and wrist are normal -Thumb and finger extension are lost -No sensory symptoms!!! Pure motor nerve</p>	<ul style="list-style-type: none"> -Remember where the lesion happened -Injury to the radial nerve in the axilla: all motor and sensory functions are lost -Injury to the nerve in the spiral groove: triceps is spared and everything else is lost -Injury in the forearm to the posterior interosseous nerve: elbow, wrist and sensation is normal .

	<p>"Sensory branch: sensation over the three and a half fingers laterally on the dorsal side</p> <p>"Motor branch called the posterior interosseous nerve: thumb and finger extension</p> <p>-Finger muscles:</p> <ul style="list-style-type: none"> - metacarpophalangeal (MP) joints: <p>"Extension by radial nerve</p> <p>"Flexion by the interossei and lumbrical (ulnar nerve)</p> <ul style="list-style-type: none"> - Intrapalangeal joints (IP): <p>"Extension by the interossei and lumbrical muscles (ulnar nerve)</p> <p>"Flexion by the long flexors of the forearm</p>	<p>-Saturday night palsy:</p> <p>Very high injury of the radial nerve due to compression of the nerve in the axilla. Everything is affected (wrist, elbow, fingers, thumb and sensation). Called like this because drunk people sleep with an arm behind the chair that causes the compression.</p>	
<ul style="list-style-type: none"> • First we must know the supply of the forearm flexors before studying the median and ulnar nerves: <ul style="list-style-type: none"> ○ Muscle grouping: <ul style="list-style-type: none"> ▪ 5 superficial muscles: <ul style="list-style-type: none"> • Pronator teres → pronation of the forearm • Flexor carpi radialis → wrist flexion • Palmaris longus → wrist flexion • Flexor carpi ulnaris → wrist flexion 			

<ul style="list-style-type: none"> • Flexor digitorum superficialis → flexion of the proximal Intrapalangeal joints (PIP) so flexes the middle phalynx ▪ 3 deep <ul style="list-style-type: none"> • Flexor digitorum profundus • Flexor pollicis longus • Pronator quadrates ▪ Nerve supply: <ul style="list-style-type: none"> • All of these muscles are supplied by the median nerve except 1 and a half are supplied by the ulnar nerve: <ul style="list-style-type: none"> ✓ Flexor carpi ulnaris ✓ Half of flexor digitorum profundus to the little and ring finger • The median nerve has 2 branches <ul style="list-style-type: none"> ✓ Superficial which supplies the superficial group ✓ Deep (anterior interosseous nerve) which supplies the deep 2 and a half muscles (PURE MOTOR BRANCH) • Hand muscles: <ul style="list-style-type: none"> ○ Muscle grouping: <ul style="list-style-type: none"> ▪ Hypothenar: opposition of the little finger ▪ Thenar: opposition of thumb + adduction of the thumb (adductor pollicis) ▪ Interossei: abduction and adduction of the fingers + MP flexion + IP extension ▪ Lumbricals: MP flexion + IP extension ○ Nerve supply: <ul style="list-style-type: none"> ▪ All the actions are from the ulnar nerve except 2 are from the median nerve: <ul style="list-style-type: none"> • Opposition of the thumb • Index and middle lumbricals 			
Median nerve	-Motor: -Superficial flexors except flexor carpi ulnaris -Deep flexors except half of flexor digitorum profundus to little and ring finger (by anterior interosseous branch):	-Anterior interosseous nerve injury: -Sign: the patient “cannot make a perfect O” with the thumb, index and middle fingers because he can’t flex the tips of the index and middle finger -Median nerve injury at level of wrist: "Common in patients who attempt suicide" "Loss of opposition" "Loss of sensation 3 and a half lateral	-Injury to median nerve at level of the wrist: loss of opposition and loss of sensation -Injury to anterior interosseous branch of median nerve: patient cannot make an O + normal sensation.

	"Thenar muscles "Index and middle lumbricals -Sensory: lateral 3 and a half fingers on the palmar side.	"Lumbricals are lost but interossei do the job "They still can make an "O", bend the wrist and flex the PIP "Carpal tunnel syndrome: *Loss of sensation first*If untreated:weakness of opposition	
Ulnar Nerve	-Motor: -Flexor carpi ulnaris -Medial half of flexor digitorum profundus -Lumbricals + interossei + hypothenar + adductor pollicis -Sensory: medial 1 and a half fingers front and back of the hand	-Ulnar nerve injury: -loss of flexor carpi ulnaris and half of flexor digitorum profundus -loss of sensation -all of the hand muscles "cannot oppose the little finger "atrophy of hypothenar muscles -Ends up with ulnar claw hand -Ulnar nerve injury at the wrist: -Sensation is lost -Hypothenar atrophy -No opposition of the little finger -Loss of thumb adduction resulting in froment's sign -Froment's sign: you ask the patient to hold a pen with his thumb but he cannot so he contracts the flexor pollicis longus because the adductor pollicis is lost	-Ulnar claw -Loss of sensation -Hypothenar atrophy -Positive froment's sign: Cannot adduct or abduct the fingers
-Median and ulnar nerve injury at the wrist: <ul style="list-style-type: none"> ○ Loss of intrinsic muscles ○ Loss of sensation ○ Clawing of all the fingers = ape hand (semian hand) 			

Types of closed brachial plexus injuries:

○ Upper brachial plexus lesion:

- Called Erb's palsy (**Erb-Duchenne Palsy**)
- **Injury to C5, C6 and C7**
 - C5: loses the ability to abduct the shoulder and external rotation
 - C6: loses the ability to flex elbow
 - C7: loses the ability to extend the wrist
- **Clinically :**
 - The patient will have (opposite to the normal function of the damaged nerves):
 - shoulder adduction
 - internal rotation
 - extension of the elbow
 - wrist flexion
 - this is called waiter's tip position
- **associated injuries:**
 - injury to the phrenic nerve which arises from the 3rd, 4th, and 5th cervical roots
 - so half of the diaphragm will be paralyzed
 - in adults X-ray will show elevated hemi diaphragm

in children the intercostals are not strong enough to compensate so the baby will have breathing problems (obstetric palsy)

○ Lower brachial plexus lesion:

- Called Klumpke's palsy
- **Injury to C8 and T1**
 - C8: loses the ability to make a fist
 - T1: loses the ability to cross fingers
- **Clinically:** The patient will have simian hand and clawing of all fingers
- **Associated injuries:**
 - Sympathetic nerves to the face come from a branch of the first thoracic nerve T1

Quick clinical hints:

- Upper lesion (C5,C6,C7) → Erb's palsy and phrenic nerve symptoms
- Lower lesion (C8, T1)→ Klumpke's palsy and sympathetic symptoms
- Total lesion(C5,C6,C7,C8,T1)→ flail limb and both phrenic and sympathetic symptoms

- If T1 is injured then sympathetic to the face are lost on one side and that will result in Horner syndrome, which is:
 - Ptosis (dropping of the upper eyelid)
 - Miosis (constricted pupil)
 - Anhydrosis (inability to sweat)

- **Total Palsy:**

- Injury to all roots C5, C6, C7, C8, T1
- Patient is unable to move entire limb: flail limb

PART I **ANSWERS**

MULTIPLE CHOICE QUESTIONS FROM PREVIOUS TESTS: SELECT THE BEST

- 1) Erb's palsy:
 - a) C5 and C6
 - b) C7 alone
 - c) C8 and T1
 - d) Total palsy
 - e) Lower brachial plexus injury
- 2) The abductor pollicis longus muscle is supplied by:
 - a) Median nerve
 - b) Ulnar nerve
 - c) Anterior interosseous nerve
 - d) Radial nerve
 - e) Axillary nerve
- 3) The main action of the C6 root of the brachial plexus is:
 - a) Making a fist
 - b) Crossing the fingers
 - c) Elbow flexion
 - d) Wrist extension
 - e) Elbow extension
- 4) The intrinsic muscles of the hand are supplied by:
 - a) C5
 - b) C6
 - c) C7
 - d) C8
 - e) T1
- 5) Klumpke's palsy has all the followings characteristics EXCEPT:
 - a) Can result from motor cycle injury
 - b) Anhidrosis
 - c) Loss of dermatomes
 - d) Phrenic nerve palsy
 - e) Miosis
- 6) A patient with Posterior interosseous nerve palsy:
 - a) Unable to extend his wrist
 - b) Can extend the IPJs of the fingers

- c) Can extend the MPJs of the fingers
- d) The sensation over the radial half of the hand is lost
- e) None of the above

- 7) Lateral cutaneous nerve of the forearm is a branch of which nerve?
 - a) Axillary
 - b) Radial
 - c) Musculocutaneous
 - d) Ulnar
 - e) None of the above
- 8) In a patient with anterior interosseous nerve palsy, what is false?
 - a) Can pronate the forearm
 - b) Can flex the PIPJ of the index
 - c) Have positive "O" sign
 - d) Can flex the IPJ of the thumb
 - e) All of the above are true
- 9) After nerve injury, nerve recovery is at a rate of:
 - a) 1 mm/day
 - b) 2 mm/day
 - c) 3 mm/day
 - d) 4 mm/day
 - e) 5 mm/day

*Question 9 was not covered in the lecture but included here just in case.

Parts II and III are questions that were asked during the lecture. Those with (*) indicate important questions.

PART II. ANSWER YES OR NO.

1. *A patient cut his median nerve at the wrist:
 - a. Has he lost opposition of the thumb?
 - b. Has he lost any sensation?
 - c. Can he flex the tip of the index finger?
2. A patient is known to have "Saturday Night Palsy". Is there loss of supination?
3. *Can a patient with Erb's palsy also have phrenic nerve palsy?
4. A patient has Klumpke's palsy:
 - a. C5, C6, and C7 are completely intact.
 - b. Only C8 or T1 is injured.
 - c. Can move the shoulder, the elbow and the wrist.

- h. Can't make a fist.
- i. Can use his intrinsic muscles of the hand.
- j. Will have clawing of all fingers - simian hand.
- g. *Can have phrenic nerve palsy.
- h. *Can have Horner's syndrome.

patient has a cut median nerve at the level of his arm.

- a. Can he flex his wrist?
- b. The patient will flex more in the radial deviation.
- c. Is the flexor digitorum superficialis completely paralyzed?
- d. Is the flexor digitorum profundus completely paralyzed?
- e. Is there sensory loss?
- f. Can he still oppose his thumb?
- g. Can he flex the tip of the thumb?
- h. Can he flex the tip of the index finger?
- i. Can he flex the tip of the little finger?
- j. Can he flex the PIP of the little finger?
- k. Does he have sensation on the volar aspect of the little finger?
- l. Does he have sensation on the volar aspect of the thumb?
- m. Can he flex the tip of the ring finger?
- n. Can he flex the PIP joint of the ring finger?
- o. Can he flex the PIP joint of the index finger?

Can a patient with Erb's palsy also have Horner's syndrome?

patient comes with a stab wound to the axilla which cut his radial nerve:

- a. He is unable to extend his elbow.
- b. He can extend the wrist.
- c. He is unable to extend and radially abduct the thumb.
- d. He is able to extend the MP joints of the fingers.
- e. He will have wrist drop.
- f. Can he extend the IP joints of the fingers?

atient presents with superficial radial nerve injury (cut in the mid-forearm) will only have sensory loss.

patient presents with posterior interosseous nerve injury.

- a. His triceps is paralyzed.
- b. He has loss of sensation over the dorsum of the thumb.
- c. He is unable to extend the elbow.
- d. Can he extend the wrist?
- e. Can he extend the thumb?
- f. His supinator muscle is paralyzed.
- g. Can he supinate the forearm?

- h. Will thumb radial abduction be lost?
- i. Will MP joint extension be lost?
- j. Will IP joint extension of the fingers be lost?
- k. Can he extend the IP joint of the little finger?
- l. Is there loss of sensation?

10. *Can a patient with Erb's palsy can make a good fist.

11. *A patient comes to the clinic with an isolated axillary nerve injury.
- a. Clinical examination is mainly of the teres minor.
 - b. He will not be able to initiate abduction.
 - c. He will not be able to externally rotate.

12. Patient has paralysis of the extensor digitorum.

- a. Can he extend the IP joint of the thumb?
- b. Can he extend the IP joint of the index?

13. *Clinically, only two things are important when it comes to musculocutaneous nerve injury: Biceps and the lateral cutaneous nerve of the forearm.

14. A patient with injury to roots C5, C6, and C7:

- a. Can't abduct or external rotate, so he will go into adduction and internal rotation.
- b. Can't flex the elbow, so he will go into elbow extension.
- c. Can extend the wrist.
- d. Will have complete claw hand.

PART III. STATE TRUE OR FALSE.

1. Patient presents with injury to the anterior interosseous nerve:

- a. Patient lost sensation at the tip of the thumb.
- b. Patient lost sensation in the palm at the thumb.
- c. Patient's sensation is normal.
- d. Patient's pronation is normal.
- e. Patient cannot flex his wrist.
- f. Patient cannot oppose the thumb.
- g. Patient can flex the MP joint of the thumb.
- h. Patient can flex the IP joint of the thumb.
- i. Patient can flex the tip of the index.
- j. Patient can adduct the thumb.
- k. Patient can flex the PIP joint of the index.
- l. Patient can flex the tip of the thumb.
- m. Patient can pronate the forearm.
- n. Patient can't make a perfect O.

- q. Patient has no sensory loss in the hand.
- r. Patient cannot flex the little finger.
- s. Patient can flex the MP joint of the index finger.
- t. Patient cannot flex the PIP joint of the index finger.
- u. Patient can flex the tips of the index and middle fingers.

patient who has cut his posterior interosseous nerve cannot supinate.

patient cut his ulnar nerve at the wrist.

- a. He can feel the back of his little finger.
- b. He can flex his wrist.
- c. He can flex the wrist in ulnar and radial deviation.
- d. He cannot flex the tip of the index finger.
- e. He can flex the tip of the little finger.
- f. He can flex the PIP joint of the little finger.
- g. He can feel the palmar surface of the little finger.
- h. He can feel the dorsal surface of the little finger.

patient cut his median nerve at the level of his elbow.

- a. He has lost the ability to oppose his thumb.
- b. He has sensory loss.
- c. He is still able to flex his wrist.
- d. Thumb tip flexion is normal.
- e. Pronation is lost.

Complete loss of the ulnar nerve:

- a. Is caused by cutting the ulnar nerve at the wrist.
- b. Is caused by cutting the ulnar nerve in the arm.
- c. Loss of wrist flexion.
- d. Can't flex the wrist in ulnar deviation.
- e. Can flex the tips of the fingers.
- f. Inability to flex the tips of the ring and little fingers.
- g. Able to flex the IP joints of the fingers.
- h. There is no sensory loss.
- i. Can feel the back of the hand.
- j. Can't feel the front of the hand.
- k. Able to oppose the thumb and the little finger.
- l. Is able to adduct and oppose the little finger.
- m. Will have Froment's sign.
- n. Is able to adduct and abduct the fingers.
- o. Is able to flex the PIP joint of the little finger.

A patient cut his ulnar nerve in the mid-forearm.

- a. He can feel the back of his hand.
- b. He can feel the front of his hand.
- c. He can adduct and abduct the fingers.
- d. He can adduct the thumb.
- e. He has Froment's sign.
- f. He cannot oppose the little finger.
- g. He cannot oppose the thumb.

ANSWER KEY:

PART I. MULTIPLE CHOICE QUESTIONS FROM PREVIOUS TESTS

- 1) Erb's palsy:
a. C5 and C6
- 2) The abductor pollicis longus muscle is supplied by:
d. Radial nerve

The main action of the C6 root of the brachial plexus is:
Elbow flexion

The intrinsic muscles of the hand are supplied by:
T1

Klumpke's palsy has all the followings characteristics EXCEPT:
Phrenic nerve palsy

A patient with Posterior Interosseous nerve palsy:
Can extend the IPJ

The lateral cutaneous nerve of the forearm is a branch of which nerve?
Musculocutaneous

In a patient with anterior interosseous nerve palsy, what is false?
d. Can flex the IPJ of the thumb

After nerve injury, nerve recovery is at a rate of:
1 mm/day

II. ANSWER YES OR NO.

A patient cut his median nerve at the wrist:

- a. Yes
- b. Yes
- c. Yes

A patient is known to have "Saturday Night Palsy". Is there loss of supination? No

Can a patient with Erb's palsy also have phrenic nerve palsy? Yes
A patient has Klumpke's palsy:

- a. Yes
- b. No
- c. Yes
- d. Yes
- e. No
- f. Yes
- g. *No
- h. *Yes

A patient has a cut median nerve at the level of his arm.

- a. Yes
- b. No
- c. Yes
- d. No

- e. Yes
- f. No
- g. No
- h. No
- i. Yes
- j. Yes
- k. Yes
- l. No
- m. Yes
- n. Yes
- o. No

6) *Can a patient with Erb's palsy also have Horner's syndrome? No

7) A patient comes with a stab wound to the axilla which cut his radial nerve:

- a. Yes
- b. No
- c. Yes
- d. No
- e. Yes
- f. Yes

8) A patient presents with superficial radial nerve injury (cut in the mid-forearm) will only have sensory loss. Yes

9) A patient presents with posterior interosseous nerve injury.

- a. No
- b. No
- c. No
- d. Yes
- e. No
- f. Yes
- g. Yes
- h. Yes
- i. Yes
- j. No
- k. Yes
- l. No

10) *Can a patient with Erb's palsy can make a good fist. Yes

11) *A patient comes to the clinic with an isolated axillary nerve injury.

- a. No
- b. No, he will be able to initiate abduction.
- c. No, he will be able to externally rotate the arm.

12) Patient has paralysis of the extensor digitorum.

- a. Yes
- b. Yes

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Typically, only two things are important when it comes to ulocutaneous nerve injury: Biceps and the lateral cutaneous nerve of forearm. Yes

patient with injury to roots C5, C6, and C7:

- a. Yes
- b. Yes
- c. No
- d. No

I. STATE TRUE OR FALSE.

patient presents with injury to the anterior interosseous nerve:

- a. False
- b. False
- c. True
- d. True
- e. False
- f. False
- g. True
- h. False
- i. False
- j. True
- k. True
- l. False
- m. True
- n. True
- o. True
- p. False
- q. True
- r. False
- s. False

patient who has cut his posterior interosseous nerve cannot supinate.

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patient cut his ulnar nerve at the wrist.

- a. True
- b. True
- c. True

- d. False
- e. True
- f. True
- g. False
- h. True

4) A patient cut his median nerve at the level of his elbow.

- a. True
- b. True
- c. True
- d. False
- e. True

5) Complete loss of the ulnar nerve:

- a. False
- b. True
- c. False
- d. True
- e. False
- f. True
- g. False
- h. False
- i. False
- j. True
- k. False
- l. False
- m. True
- n. False
- o. True

6) A patient cut his ulnar nerve in the mid-forearm.

- a. False
- b. False
- c. False
- d. False
- e. True
- f. True
- g. False