

BRACHIAL PLEXUS

Spinal Nerves - Foundation of the Brachial Plexus

◆ Number of Spinal Nerves

There are 31 pairs of spinal nerves attached to the spinal cord:

- 8 Cervical
- 12 Thoracic
- 5 Lumbar
- 5 Sacral
- 1 Coccygeal

Important Concept

Each spinal nerve is a mixed nerve (motor + sensory) and divides into:

Spinal nerve

- Dorsal (posterior) ramus
- Ventral (anterior) ramus

Functional Significance

Branch	Supplies
Dorsal ramus	Intrinsic back muscles + skin of back
Ventral ramus	Limbs + anterolateral trunk

 The brachial plexus is formed from ventral (anterior) rami, NOT dorsal rami — very common exam trap.

Brachial Plexus – Overview

◆ Definition

The brachial plexus is a network of nerves formed by the union of the anterior rami of C5, C6, C7, C8, and T1 spinal nerves.

Mnemonic for roots:

"C5 to T1 keeps the arm fine" ✨

- ◆ Extent & Course

Formation and course:

Anterior rami of C5-T1 → Emerge between anterior & middle scalene muscles → Pass laterally in posterior triangle of neck → Cross superior surface of 1st rib → Pass posterior to clavicle → Enter axilla

 Key Regions

Region	Plexus Parts Located
Posterior triangle of neck	Roots & Trunks

Behind clavicle	Divisions
Axilla	Cords & Branches

 Very important in clinical localization of injuries.

Structural Organization of the Brachial Plexus

The plexus is divided into:

ROOTS → TRUNKS → DIVISIONS → CORDS → BRANCHES

Mnemonic:

"Robert Trucker Drinks Cold Beer" 

ROOTS (C5-T1)

These are the anterior rami of:

- C5
- C6

- C7
- C8
- T1

TRUNKS

Formation:

C5 + C6 → Upper trunk

C7 → Middle trunk

C8 + T1 → Lower trunk

Table Summary

Roots	Trunk Formed
C5 + C6	Upper
C7	Middle

C8 + T1	Lower
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DIVISIONS

Each trunk divides into:

Upper trunk

- Anterior division
- Posterior division

Middle trunk

- Anterior division
- Posterior division

Lower trunk

- Anterior division
- Posterior division

 Total divisions = 6

 Functional Principle

- Anterior divisions → Supply flexor compartments
- Posterior divisions → Supply extensor compartments

⚠ This concept is extremely important in viva.

CORDS

Named according to their relationship with the 2nd part of the axillary artery.

Formation:

- Anterior division of Upper trunk + anterior division of Middle trunk → Lateral cord
 - Anterior division of Lower trunk → Medial cord
 - Posterior divisions of all three trunks → Posterior cord
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Table: Formation of Cords

Cord	Formation
Lateral	Anterior divisions of Upper + Middle trunks
Medial	Anterior division of Lower trunk
Posterior	All three posterior divisions

Major Terminal Branches (End Branches)

From the cords arise the 5 major nerves of the upper limb:

- Musculocutaneous
- Axillary
- Radial
- Median
- Ulnar

Mnemonic: "MARMU"

Musculocutaneous

Axillary

Radial

Median

Ulnar

Branches from ROOTS

These arise before trunk formation.

- ◆ Dorsal Scapular Nerve (C5)
 - Supplies: Rhomboids + Levator scapulae
- ◆ Long Thoracic Nerve (C5-C7)
 - Supplies: Serratus anterior
 - Injury → Winged scapula ⚠
- ◆ Nerve to Subclavius (C5-C6)

- Supplies: Subclavius muscle
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Branch from TRUNK

- ◆ Suprascapular Nerve (from Upper Trunk)

Supplies:

- Supraspinatus
- Infraspinatus

Important for shoulder abduction initiation (first 15°).

Branches from CORDS

- ◆ Lateral Cord
 - Lateral pectoral nerve
 - Musculocutaneous nerve
 - Lateral root of median nerve

◆ Medial Cord

- Ulnar nerve
- Medial pectoral nerve
- Medial root of median nerve
- Medial cutaneous nerve of arm
- Medial cutaneous nerve of forearm

◆ Posterior Cord

- Upper subscapular nerve
- Lower subscapular nerve
- Thoracodorsal nerve
- Axillary nerve
- Radial nerve

Mnemonic for posterior cord branches: "ULTRA"

Upper subscapular

Lower subscapular

Thoracodorsal

Radial

Axillary

Complete Flowchart

C5, C6, C7, C8, T1 → ROOTS → Form TRUNKS i.e. Upper (C5-C6), Middle (C7), Lower (C8-T1) → Each divides into anterior & posterior divisions → DIVISIONS → Form CORDS i.e. Lateral, Medial and Posterior → Terminal BRANCHES (MARMU)

Viva Pearls

- Plexus formed by anterior rami, not spinal nerves directly.
- Cords named according to axillary artery.
- Posterior divisions → extensors.
- Total divisions = 6.

- Roots and trunks lie in posterior triangle of neck.
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CLINICAL CORRELATION

Summary:

Level of Injury	Example
Roots (C5-C6)	Erb's palsy
Lower roots (C8-T1)	Klumpke's palsy
Posterior cord	Wrist drop
Long thoracic nerve	Winged scapula

Brachial Plexus Injuries - Overview

Injuries may occur due to:

- Difficult childbirth 🧒
 - Trauma (motorcycle accidents, falls)
 - Cervical rib
 - Tumors
 - Improper crutch use
 - Penetrating injuries
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Upper Brachial Plexus Injury

(Erb's Palsy)

- ◆ Level of Injury

C5-C6 roots (Upper trunk)

Common Causes:

- Excessive separation of head from shoulder
- Difficult delivery
- Fall on shoulder

◆ Muscles Paralyzed

Mainly muscles supplied by C5-C6:

- Deltoid
- Biceps brachii
- Brachialis
- Supraspinatus
- Infraspinatus

◆ Resulting Deformity

“Waiter’s Tip Position” 

Arm hangs by side

- Shoulder adducted
- Shoulder medially rotated
- Elbow extended
- Forearm pronated
- Wrist flexed

Why?

Loss of:

- Abductors (Deltoid, Supraspinatus)
- Lateral rotators (Infraspinatus)
- Elbow flexors (Biceps)
- Supinator

Unopposed:

- Adductors
- Medial rotators
- Extensors

◆ Additional Findings

- Muscle atrophy
- Shortened limb appearance
- Diminished growth in children
- Cervical scoliosis (chronic cases)

Lower Brachial Plexus Injury

(Klumpke's Palsy / Dejerine-Klumpke Palsy)

- ◆ Level of Injury

C8-T1 (Lower trunk)

- ◆ Causes

- Difficult breech delivery
 - Sudden upward pull of arm
 - Cervical rib
 - Abnormal insertion of scalene muscles
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- ◆ Muscles Affected

- Intrinsic muscles of hand
- Flexor carpi ulnaris
- Ulnar half of flexor digitorum profundus

◆ Deformity

"Claw Hand" 🖐️

Mechanism:

Paralysis of lumbricals + interossei

- Loss of MCP flexion
- Loss of IP extension
- Hyperextension at MCP
- Flexion at IP joints

Classic clawing of hand.

◆ Sensory Loss

- C8-T1 dermatome distribution
 - Medial forearm and hand
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- ◆ Association with Horner Syndrome

If T1 sympathetic fibers are involved:

Interruption of sympathetic supply

- Ptosis (drooping eyelid)
 - Miosis (constricted pupil)
 - Anhidrosis (loss of sweating)
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Winged Scapula

Due to injury to:

Long Thoracic Nerve (C5-C7)

Paralysis of Serratus Anterior

- Scapula not anchored to thoracic wall
- Medial border protrudes
- "Bird-winging" of scapula 

Common cause:

- Surgical injury (mastectomy)

Terminology in Nerve Injury

Term	Meaning
Anaesthesia	Complete loss of sensation
Paraesthesia	Abnormal sensation (tingling, burning)
Paralysis	Loss of motor function
Atrophy	Wasting of muscle

Terminal Nerves – Detailed Muscle Supply

Axillary Nerve

◆ Origin

Posterior cord (C5-C6)

- ◆ Muscles Supplied
 - Deltoid
 - Teres minor
- ◆ Function
 - Shoulder abduction (15-90°)
 - Lateral rotation
- ◆ Injury

Surgical neck fracture of humerus

- Deltoid paralysis
- Loss of shoulder contour
- Loss of abduction

Radial Nerve

- ◆ Origin

Posterior cord (C5-T1)

◆ Muscles Supplied

Arm:

- Triceps brachii
- Anconeus

Forearm:

- Brachioradialis
- Supinator
- Extensor carpi radialis longus
- Extensor carpi radialis brevis
- Extensor digitorum
- Extensor digiti minimi
- Extensor carpi ulnaris
- Extensor indicis
- Extensor pollicis longus & brevis
- Abductor pollicis longus

- ◆ Main Function

Radial nerve = Extensor nerve

Elbow extension

- Wrist extension
 - Finger extension
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- ◆ Injury

Midshaft humerus fracture

- Wrist drop 🖐️
 - Loss of extension
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● Musculocutaneous Nerve

- ◆ Origin

Lateral cord (C5-C7)

- ◆ Muscles Supplied

- Biceps brachii
 - Brachialis
 - Coracobrachialis
- ◆ Function
 - Elbow flexion
 - Supination
 - ◆ Injury

Rare (protected in arm) → Weak elbow flexion

● Ulnar Nerve

- ◆ Origin

Medial cord (C8-T1)

- ◆ Muscles Supplied

Forearm:

- Flexor carpi ulnaris

- Medial half of flexor digitorum profundus

Hand:

- Adductor pollicis
 - All interossei
 - Hypothenar muscles
 - Medial two lumbricals
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◆ Injury

At elbow (medial epicondyle fracture)

- Clawing (4th & 5th digits)
 - Loss of finger abduction/adduction
 - Positive Froment's sign
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● Median Nerve

◆ Origin

Lateral + Medial cords (C5-T1)

Formed by:

Lateral root + Medial root → Median nerve

◆ Muscles Supplied

Forearm Flexors:

- Pronator teres
- Flexor carpi radialis
- Palmaris longus
- Flexor digitorum superficialis
- Lateral half of flexor digitorum profundus
- Flexor pollicis longus
- Pronator quadratus

Hand:

- Thenar muscles
- Lateral two lumbricals

◆ Injury

At wrist (carpal tunnel syndrome)

- Thenar atrophy
- Loss of thumb opposition
- "Ape hand" deformity 🐒

🔥 Quick Comparison Table

Nerve	Main Action	Classic Injury
Axillary	Shoulder abduction	Deltoid paralysis
Radial	Extension	Wrist drop
Musculocutaneous	Flexion	Weak elbow flexion
Ulnar	Fine hand movements	Claw hand

Median	Opposition	Ape hand
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Viva Points

- Erb's palsy = C5-C6
 - Klumpke's palsy = C8-T1
 - Posterior cord → Extensors
 - Anterior divisions → Flexors
 - Horner syndrome → T1 involvement
 - Winged scapula → Long thoracic nerve
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Resources:

- i) Snell's Clinical Anatomy by Regions (Book by Lawrence E. Wineski)
- ii) BD Chaurasia's Human Anatomy: Regional and Applied Dissection and Clinical

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