



# **LOCAL ANESTHETICS AND REGIONAL ANESTHESIA**

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# Anesthesia

## Locoregional Anesthesia

Local infiltration

Single nerve block

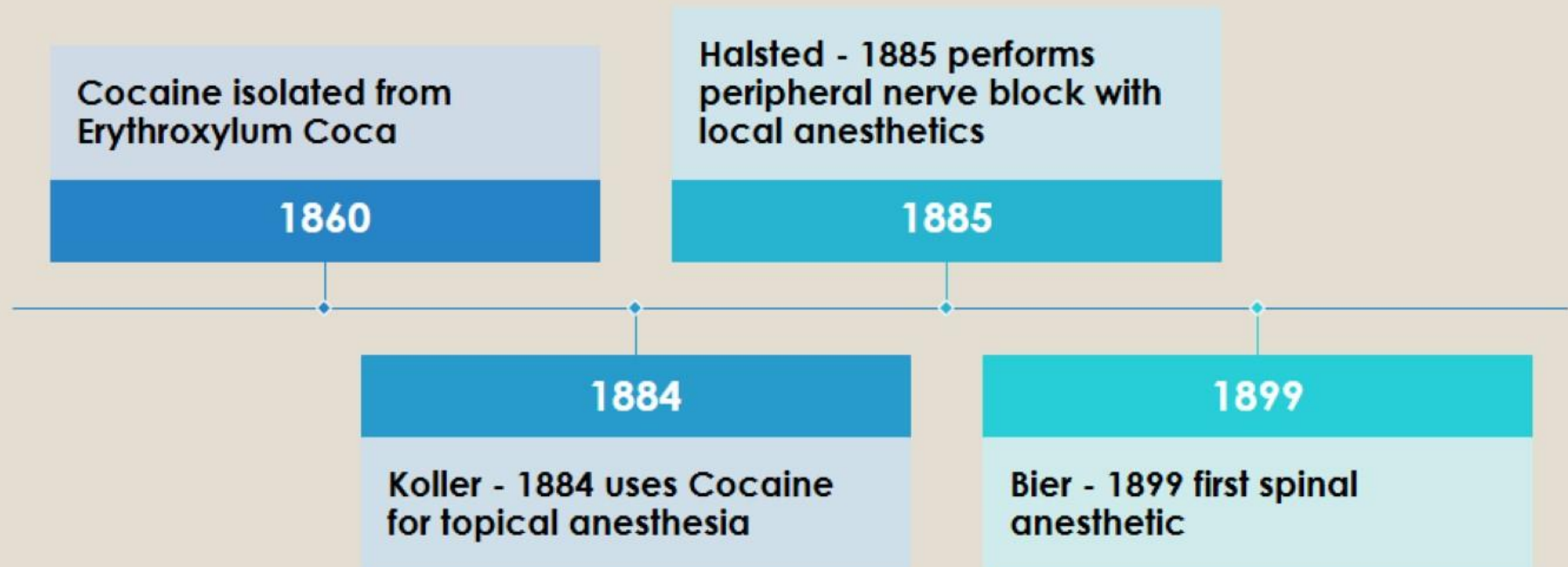
Plexus block

Neuraxial block

## General Anesthesia

Reversible and controlled loss of consciousness

# Local Anesthetics- History

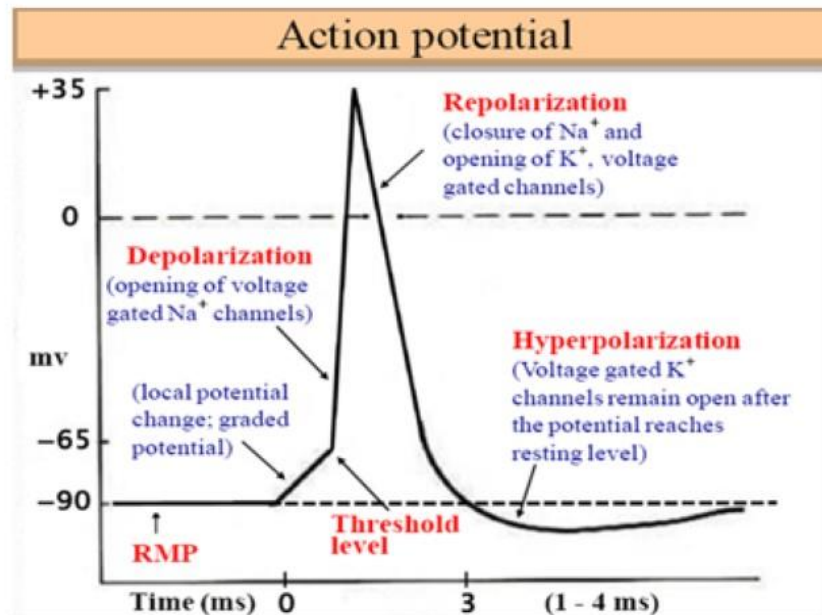


# **Local Anesthetics - Definition**

A substance which reversibly inhibits nerve conduction when applied directly to tissues at therapeutic concentrations.

Locally block afferent and efferent nerve input.

## PHARMACOLOGY AND PHARMACODYNAMICS



Local anesthetics block generation and propagation of electrical impulses in electrically excitable tissue.

Mainly by acting on Na channels.

## PHARMACOLOGY AND PHARMACODYNAMICS

### Chemical structure of local anesthetics

Aromatic lipophilic portion - Intermediate chain - Amine hydrophilic portion



Clinically used local anesthetics consist of lipid-soluble, substituted benzene ring linked to amine group via alkyl chain containing either an amide or ester linkage.

# Local anesthetics - Classes

## Esters

Cocaine

Chlorprocaine

Procaine

Tetracaine

## Amides

Bupivacaine

Lidocaine

Ropivacaine

Etidocaine

Mepivacaine

# Local anesthetics - Formulation

Biologically active substances are frequently administered as very dilute solutions which can be expressed as *parts of active drug per 100 parts of solution (grams percent)*



Ex.: 2% solution

$$\frac{2 \text{ grams}}{100\text{ml}} = \frac{2000\text{mg}}{100\text{ml}} = \frac{20\text{mg}}{1\text{ml}}$$



# Local anesthetics - vasoconstrictors

*Epinephrine* is added to local anesthetics in extremely dilute concentrations, best expressed as

**a ratio of grams of drug:total ml's of solution**

Expressed numerically, a 1:1000 preparation of epinephrine would be

$$\frac{1 \text{ gram epi}}{1000 \text{ ml solution}} = \frac{1000 \text{ mg epi}}{1000 \text{ ml solution}} = \frac{1 \text{ mg epi}}{1 \text{ ml}}$$

# Local anesthetics - vasoconstrictors

Therefore, a 1 : 200,000 solution of epinephrine would be

$$\frac{1 \text{ gram epi}}{200,000 \text{ ml solution}} = \frac{1000 \text{ mg epi}}{200,000 \text{ ml solution}}$$

or

$$\frac{5 \text{ mcg epi}}{1 \text{ ml solution}}$$

# Bupivacaine

## Amide

- Infiltration: Max dose: 2mg/kg
- Concentration : 0.25 % or 0.5 %
- Slow onset, potent, 4 to 8 hrs duration

## Example

In 50 kg patient, how much 0.25 % Bupivacaine can I use for infiltration to excise lipoma in the forearm?

# Bupivacaine

50 Kg .....max 2mg/Kg

$$50 \times 2 = 100 \text{ mg}$$

0.25% .....2.5 mg/ml

So maximum mls for infiltration is  $100/2.5 = 40 \text{ ml}$

# Bupivacaine

## **Epidural anesthesia:**

Use 0.5-0.75%, moderate onset, 2- to 5-hr duration,  
max dose 175 mg (225 mg with epinephrine)

## **Spinal anesthesia:**

Use 0.5-0.75%, fast onset, 1- to 4-hr duration, max dose  
20 mg

# Lidocaine

## Amide

- Infiltration: Max dose:      5 mg/Kg      without Epinephrine  
   7 mg/Kg      with Epinephrine
- Concentration: 1% or 2 %
- fast onset, 1 to 3 hrs duration
- **Why Epinephrine increase safety margin ?**

# Lidocaine

## **Epidural anesthesia:**

use 1.5-2%, fast onset, 1- to 2-hr duration, max dose 300 mg  
(500 mg with epinephrine)

## **Spinal anesthesia:**

use 1.5-2%, fast onset, 0.5- to 1-hr duration, max dose 100 mg

## **Topical anesthesia:**

use 4%, fast onset, 0.5- to 1-hr duration, max dose 300 mg

## **IV regional:**

Use 0.25-0.5%, fast onset, 0.5-1 hr duration, max dose 300 mg

# Local Anesthetics - Allergy

- True allergy is very rare
- Most reactions are from ester class - ester hydrolysis (normal metabolism) leads to formation of PABA - like compounds
- Patient reports of “allergy” are frequently due to previous intravascular injections



# Local Anesthetics - Allergy

## Tissue toxicity - Rare

- Can occur if administered in high enough concentrations (greater than those used clinically)
- Usually related to preservatives added to solution

## Systemic toxicity - Rare

- Related to blood level of drug secondary to absorption from site of injection.
- Range from lightheadedness, tinnitus to seizures and CNS/cardiovascular collapse

# **Local anesthetics - vasoconstrictors**

Vasoconstrictors should not be used in the following locations

- Fingers
- Toes
- Nose
- Ear lobes
- Penis

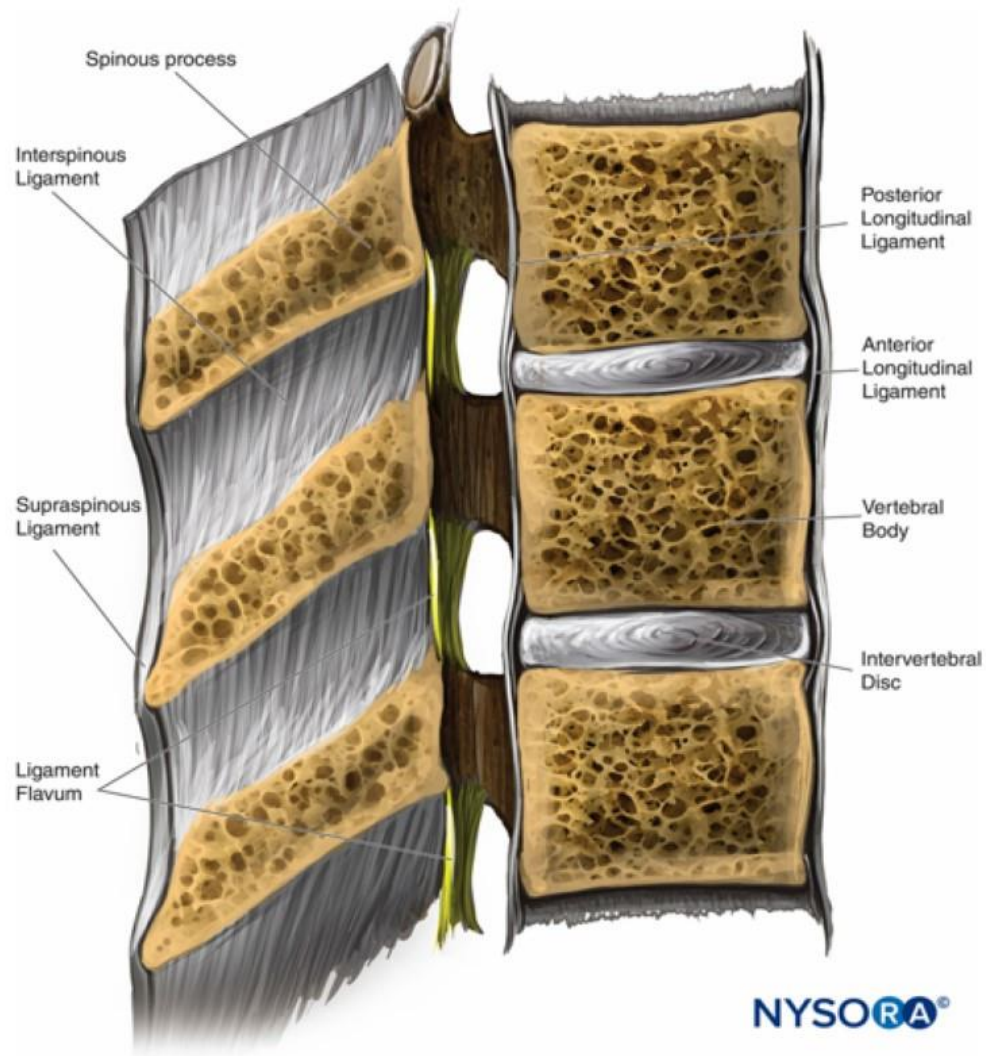


**SPINALS, EPIDURALS**

**AND CAUDALS**

# Introduction

- Indications
- Contraindications
- Equipment
- Technique
- Complications



# Anatomy of the spine

# Definitions

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**Regional anaesthesia** – The use of local anaesthetic either alone or to supplement general anaesthesia aiming to prevent or reduce nerve conduction of painful impulses to higher centres.

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**Spinal anaesthesia** – Injection of a local anaesthetic directly into the CSF within the sub-arachnoid space.

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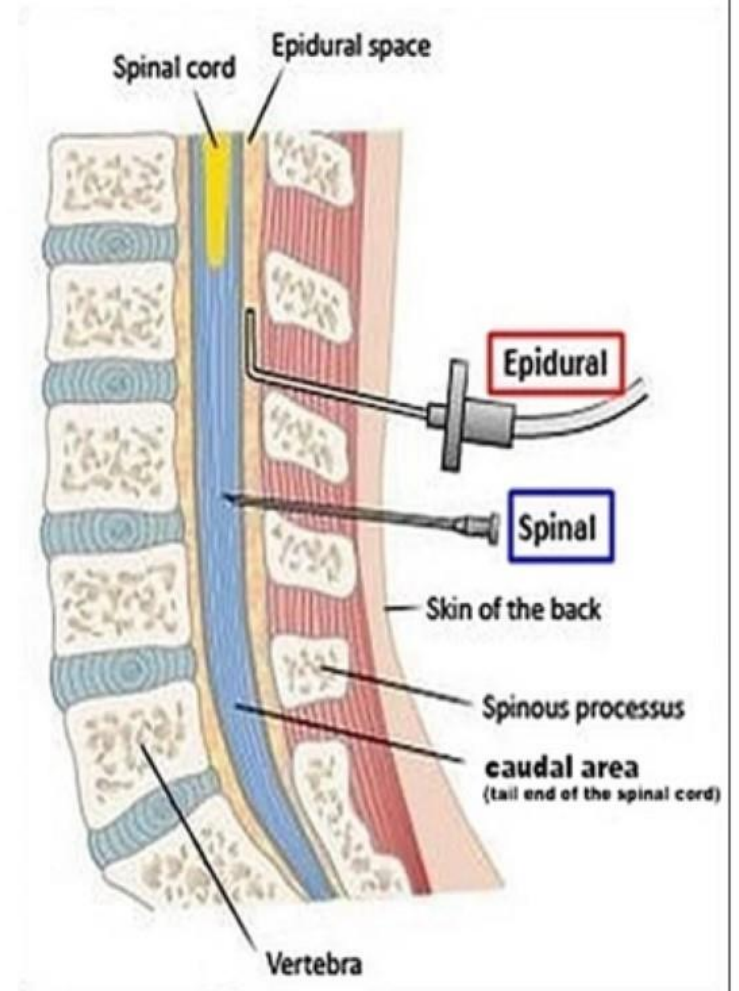
**Epidural anaesthesia** – Injection of a local anaesthetic into the potential space *outside* the dura.

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**Caudal anaesthesia** – Injection of local anaesthetic into the caudal canal producing block of the sacral and lumbar nerve roots.

## What is the difference between spinal anesthesia and epidural anesthesia

- Site of insertion
- Level of insertion
- Catheter use
- Onset of action
- Nature of effect (sensory, motor, sympathetic )
- Type of surgery
- .....



# Contraindications to regional techniques

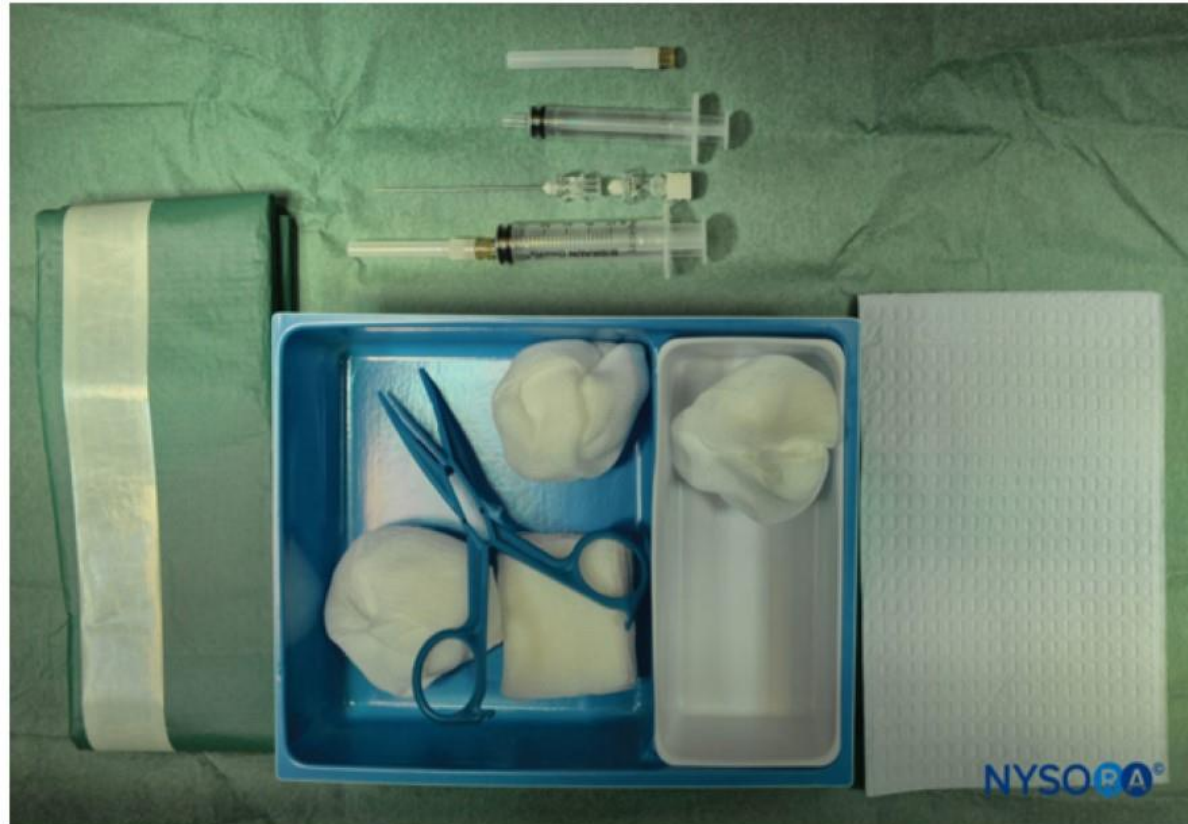
## Absolute Contraindications

- Patient refusal
- Infection at the site of injection
- Anticoagulation / coagulopathy
- Uncorrected hypovolemia
- Allergy
- Increased ICP
- Fixed cardiac output states

## Relative Contraindications

- Uncooperative patient
- Sepsis
- Indeterminate neurological disease
- Skeletal anomalies
- Previous local surgery





# SPINAL NEEDLE

# EPIDURAL NEEDLE



Weiss winged needle



Standard Tuohy needle



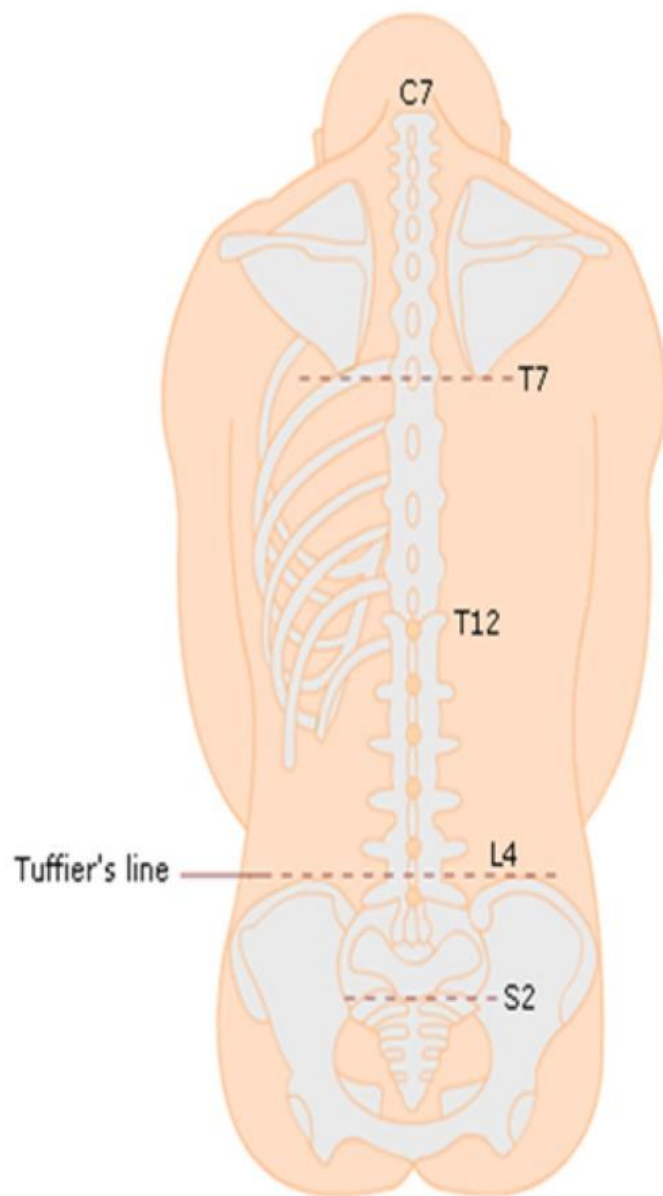
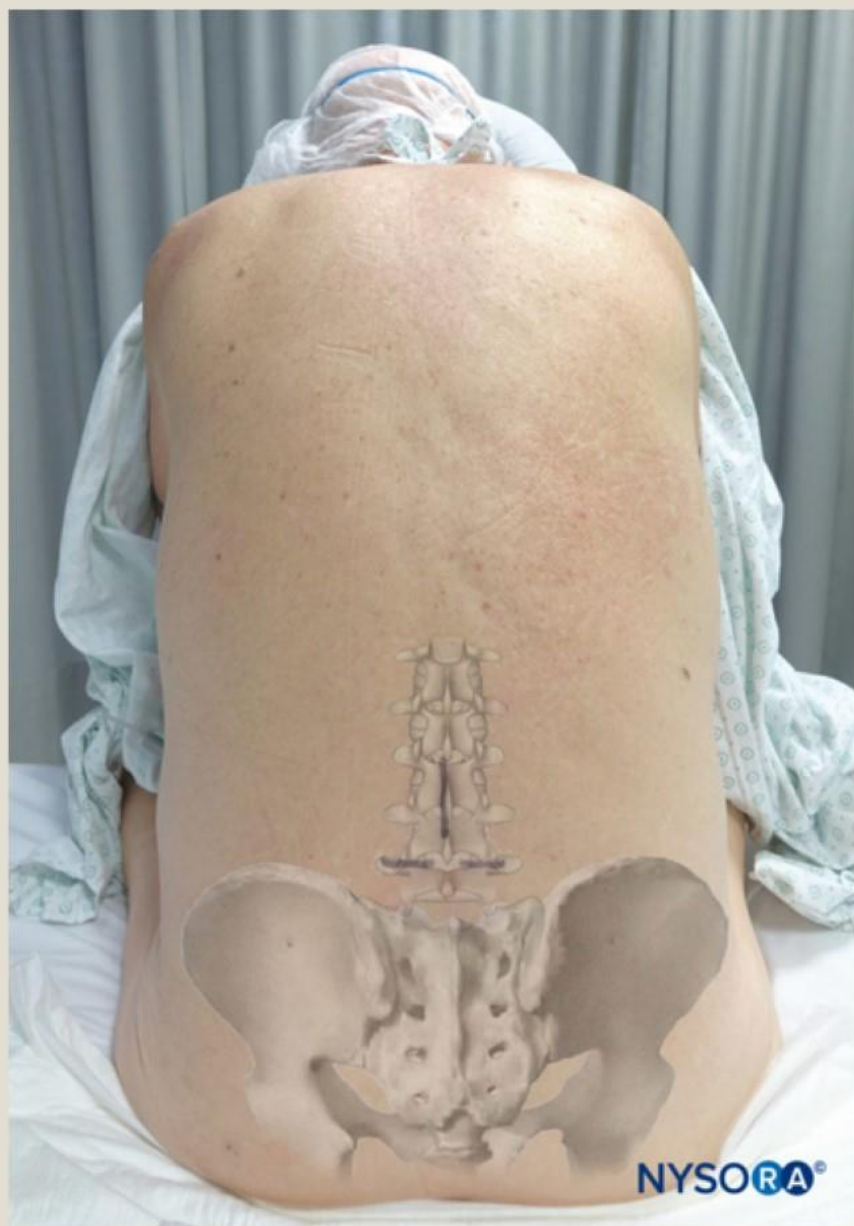
Blunt tip



Crawford needle (thin walled)



NTSOCA



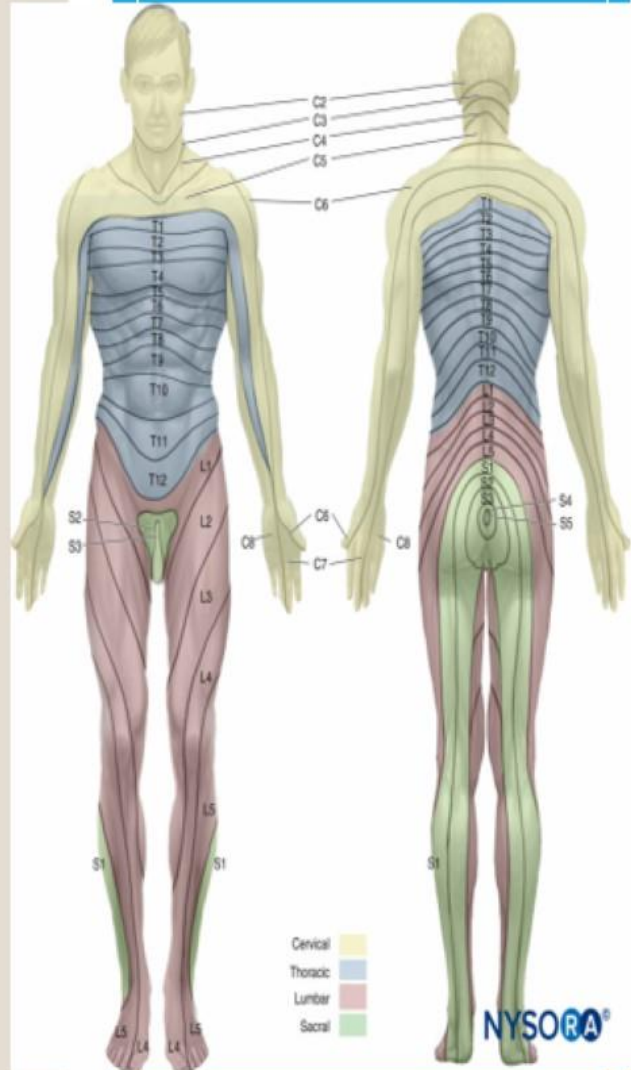
# IDENTIFICATION OF EPIDURAL SPACE



**Loss of resistance  
technique**

**Role of U/S**

Procedure	Dermatomal Level
Upper abdominal surgery	T4
Intestinal, gynecologic, and urologic surgery	T6
Transurethral resection of the prostate	T10
Vaginal delivery of a fetus and hip surgery	T10
Thigh surgery and lower leg amputations	L1
Foot and ankle surgery	L2
Perineal and anal surgery	S2 to S5 (saddle block)



# Complications of neuroaxial anesthesia

## Minor

- Nausea and vomiting
  - Shivering
  - Itching
- Urinary retention

## Moderate

- Failed spinal
- Postdural puncture headache
- Hypotension

## Major

- Direct needle trauma
- Infection (abscess, meningitis)
- Vertebral canal hematoma
  - Spinal cord ischemia
  - Peripheral nerve injury
  - Total spinal anesthesia
- Cardiovascular collapse
  - Drug error
  - Systemic toxicity

CSF

**Production**

**Volume**

# Postdural puncture headache PDPH

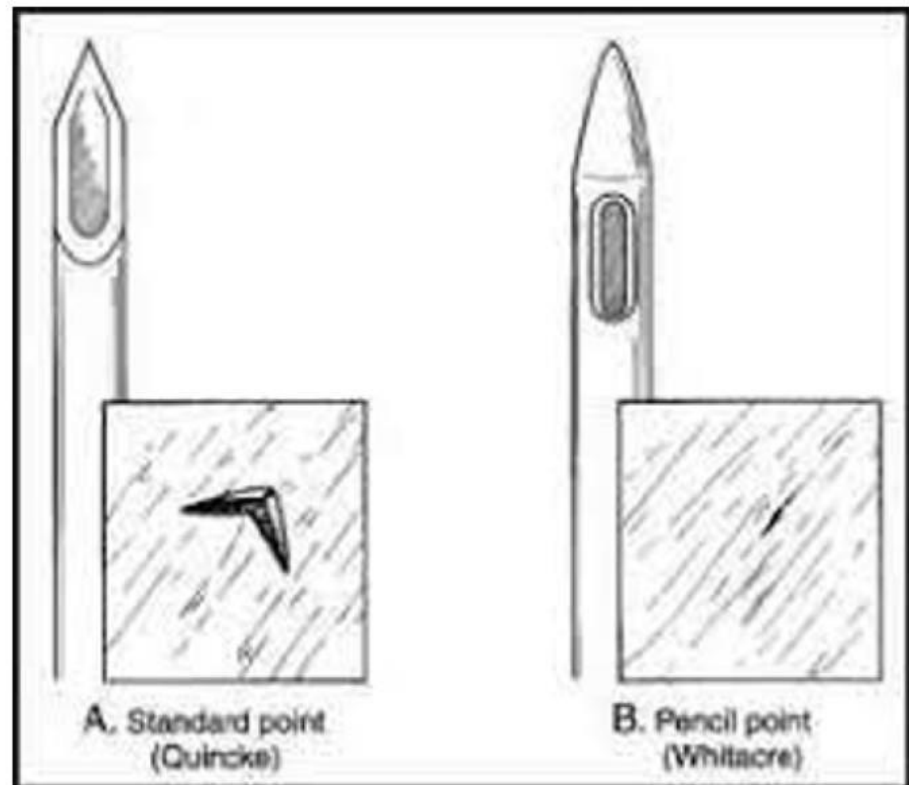
- Cause
- Mechanism
- Symptoms
- Management





# Factors affect the incidence of PDPH

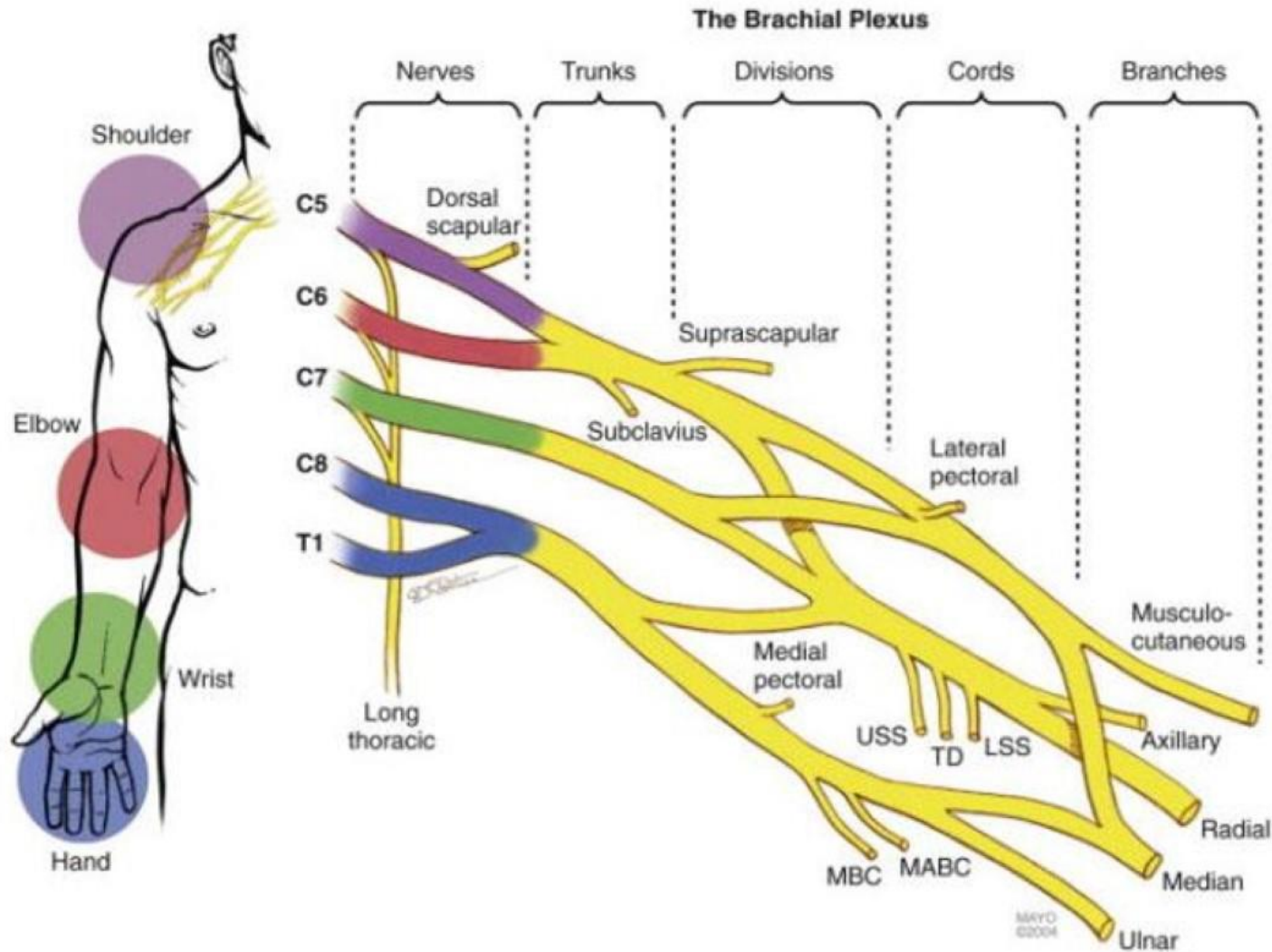
- Age
- Gender
- Length
- Type of needle
- Size of needle
- Experience
- .....



# PERIPHERAL NERVE BLOCL

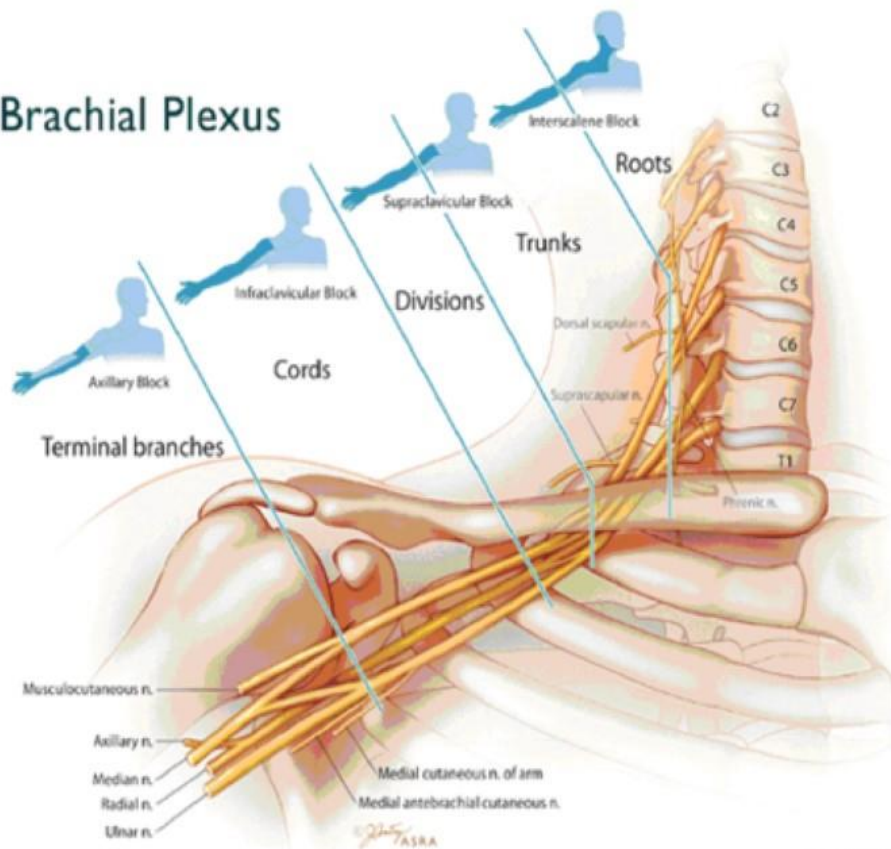
**Plexuses**  
( Brachial or  
Lumber )

**Nerves**  
( Median, Ulnar,  
femoral, ...)



# ANATOMY of BRACHIAL PLEXUS

# Brachial Plexus



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**LEVELS TO  
BLOCK IN  
UPPER LIMB**

# TECHNIQUES

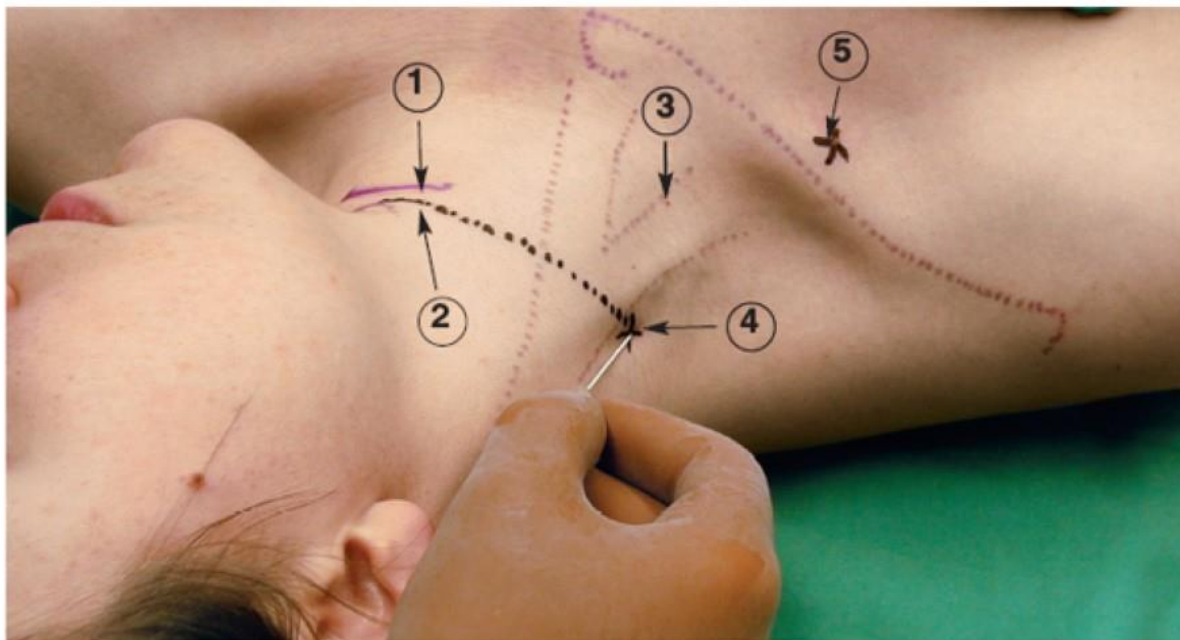
**Blind**

**Nerve stimulator**

**Ultrasound**

## Anatomical landmarks

Superior thyroid notch, sternocleidomastoid muscle (posterior scalene gap)



**Fig. 11: Interscalene nerve block: Modification according to G. Meier**

1. Cricoid
2. Superior thyroid notch
3. Sternocleidomastoid muscle
4. Puncture site for anterior access
5. Vertical, infraclavicular puncture site

PUNCTURE  
SITE,  
TECHNIQUE

ANT.  
APPROACH



Fig. 6: Nerve stimulator:  
Stimuplex® HNS 12  
(B. Braun Melsungen AG)



Fig. 7/8: Stimulation needles:  
Stimuplex® D / Contiplex® D / Contiplex® Tuohy  
(B. Braun Melsungen AG)

Completely insulated, except for the tip.  
Have no sharp edges.  
The electrical current has a very small exit opening.  
Higher current density at the tip of the needle.

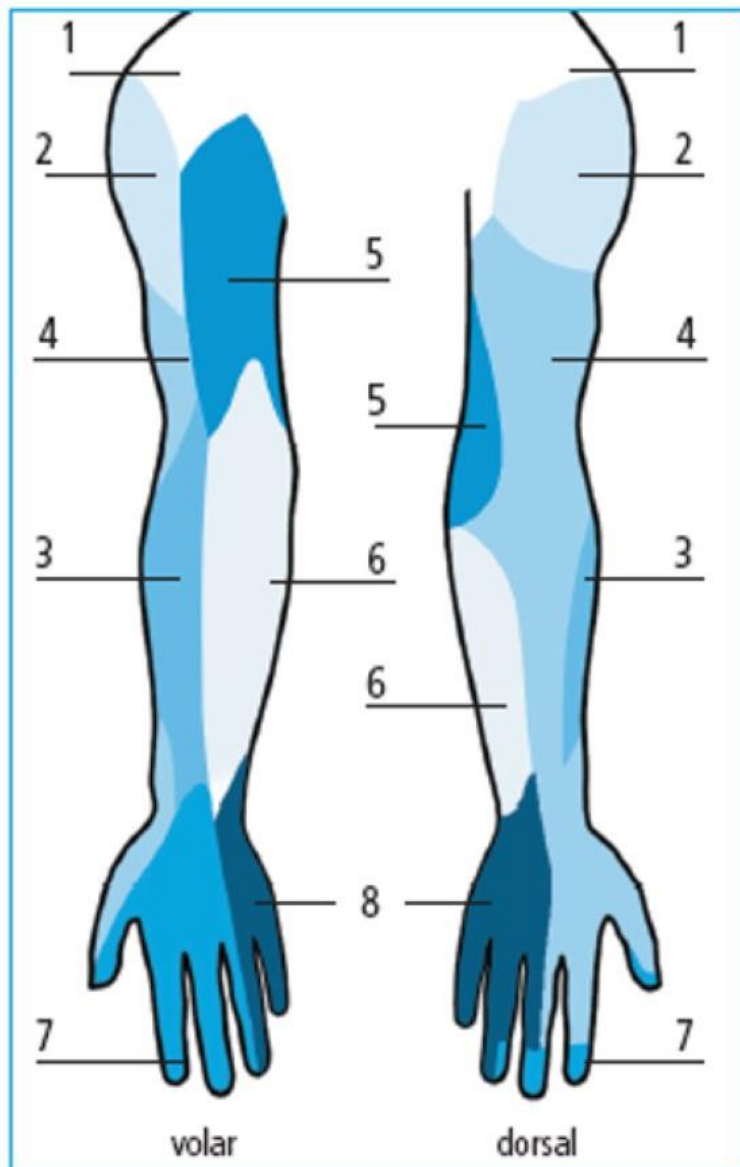
**Exact localization, risk of injury at a minimum.**

# STIMULATION NEEDLE AND NERVE STIMULATOR

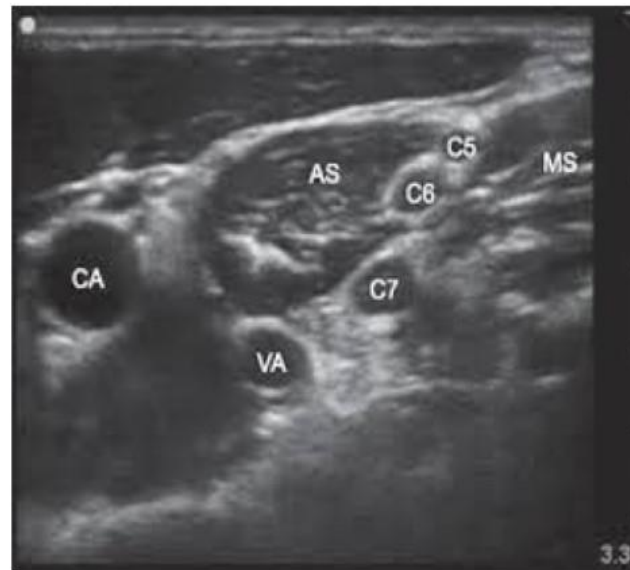
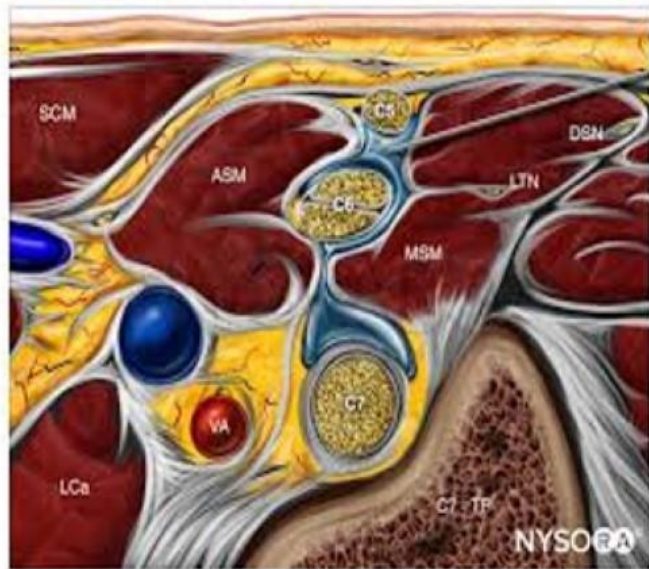
## Motor supply areas

Peripheral nerve	Muscle	Function
Suprascapular nerve	Supraspinatus/ infraspinatus muscles	Forms parts of the rotator muscles
Axillary nerve	Deltoid muscle	Abduction of the arm in the shoulder joint
Musculocutaneous nerve	Biceps brachii muscle Brachial muscle Flexor pollicis brevis muscle	Bends the elbow in supination  Pronates the forearm (flexes proximal phalanx of thumb)
Median nerve	Flexor carpi radialis muscle Flexor digitorum profundus muscle (I-III)	Flexes and abducts wrist radialward Flexes and adducts the thumb, flexes fingers I-III
Radial nerve	Triceps brachii muscle Extensor carpi radialis (brevis) muscle Extensor digitorum muscle	Extends elbow Extends and abducts wrist radialward Extends and flexes the hand dorsally Extends and spreads the fingers
Ulnar nerve	Flexor carpi ulnaris muscle Flexor digitorum profundus muscle (IV-V)	Flexes and abducts wrist ulnarward Flexes fingers (IV-V)

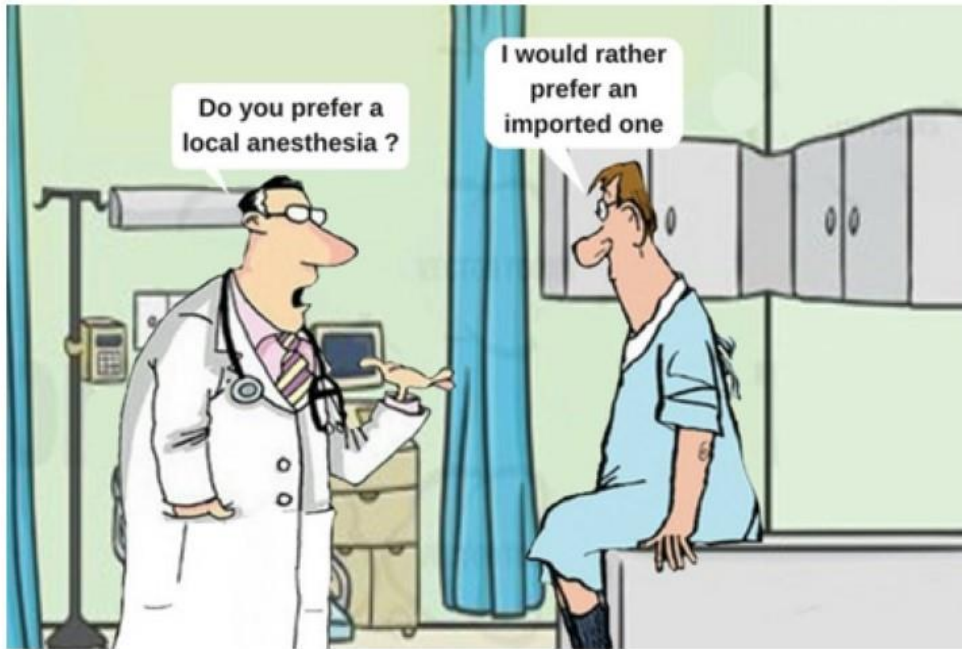




- 1 Supraclavicular nerves (from the superficial cervical plexus)
- 2 Axillary nerve
- 3 Musculocutaneous nerve
- 4 Radial nerve
- 5 Medial cutaneous nerve of the arm
- 6 Medial cutaneous nerve of the forearm
- 7 Median nerve
- 8 Ulnar nerve



ULTRASOUND



**THANK  
YOU**