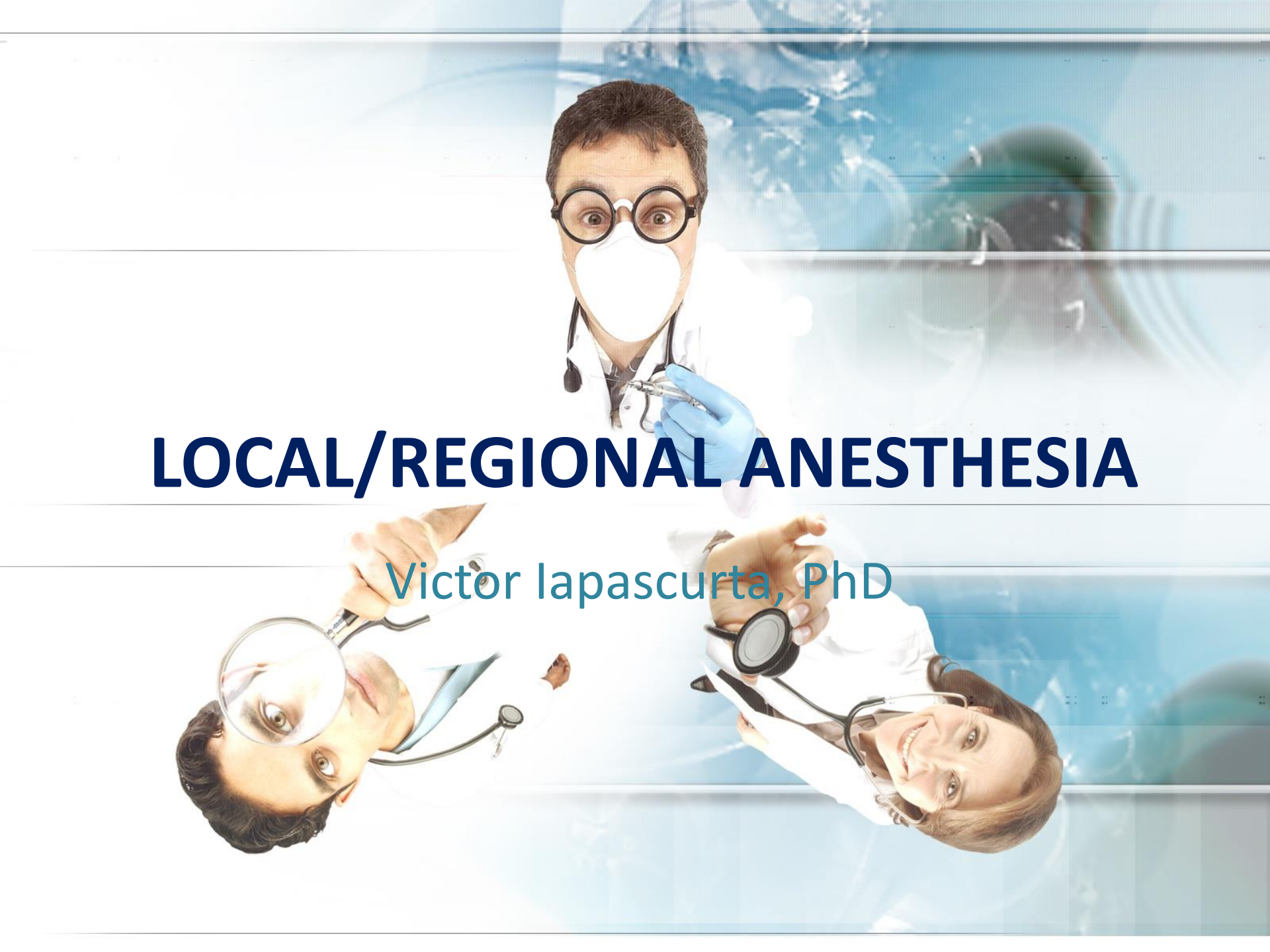


LOCAL/REGIONAL ANESTHESIA

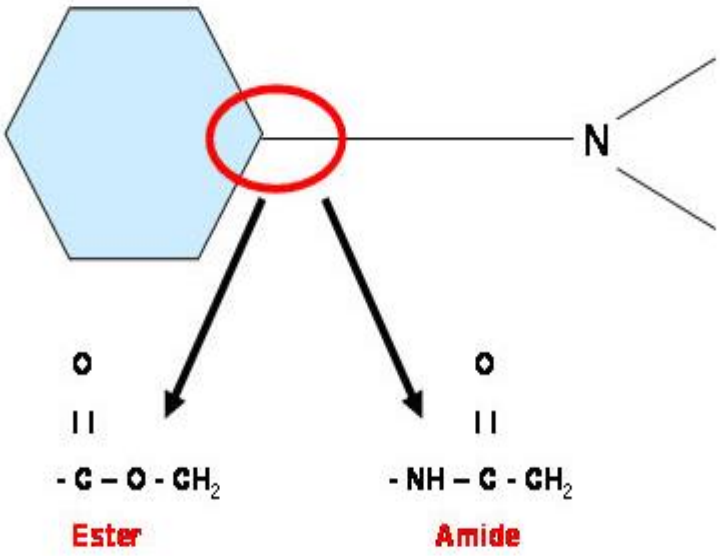
Victor Iapascurta, PhD

Local/Regional Anesthesia

A. Peripheral nerve block (21;22;28;29)

B. Spinal & epidural (35)

Local Anesthetics



Local Anesthetics Classification

Esters

Contain ester linkage. They are hydrolysed in the body by plasma esterases. They are more likely to produce hypersensitivity reaction

Examples:

- Cocaine,
- Procaine
- Amethocaine
- Tetracaine
- Benzocaine

Local Anesthetics Classification

Amides

Contain amide linkage. They are metabolised by amidases in liver. Hypersensitivity reaction to amides are very rare.

Examples:

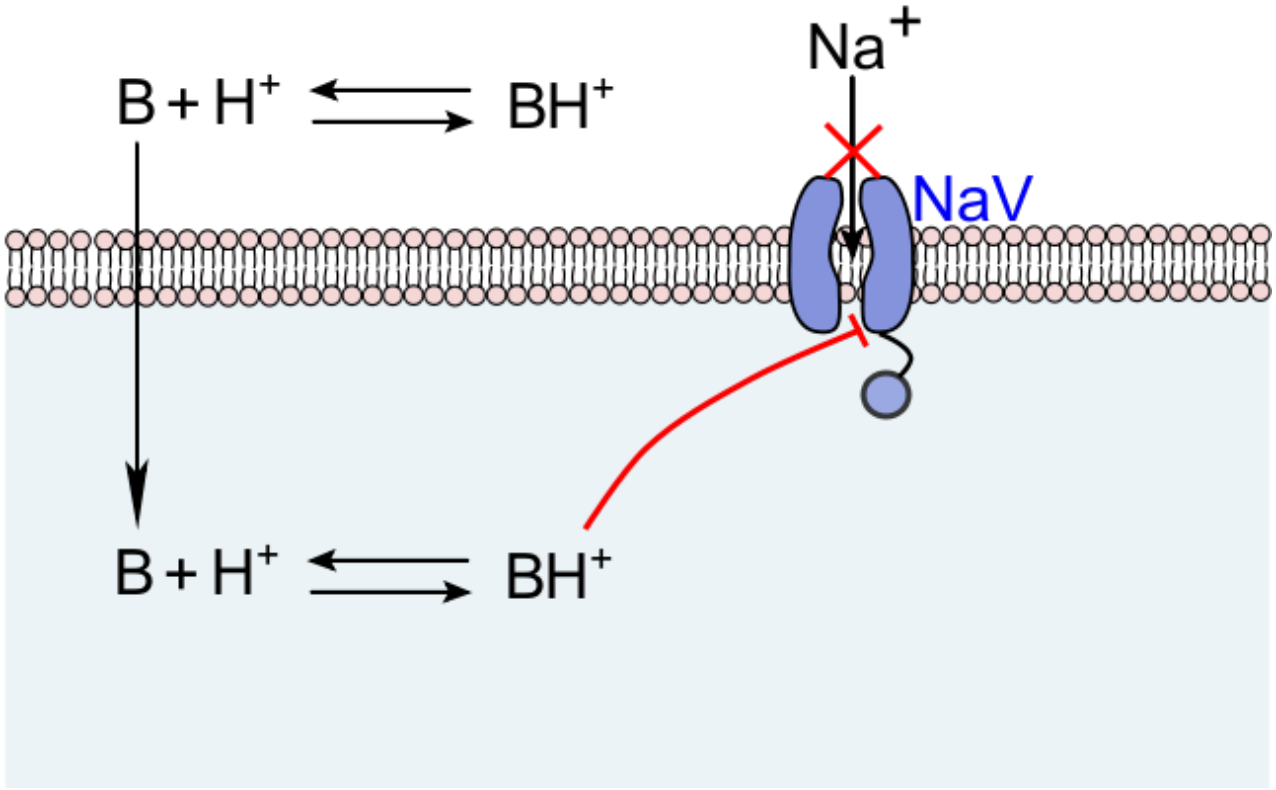
- Lidocaine
- Lignocaine,
- Prilocaine,
- Bupivacaine
- Ropivacaine.

Local Anesthetics

Drug	Concen-tration (%)	Clinical Uses	Maximum Dose (mg)	Potency (units)**	Toxicity (units)**	Onset Latency (minutes)	Duration of action (hours)
Procaine (Novocaine)	0,25 – 0,5	Infiltration PNB Epidural Spinal	180 – 600-1400*	1	1	8-15	0,5 – 1,5*
Lidocaine	0,25 - 5	Topical Infiltration PNB Epidural Spinal	100 – 600*	3 - 5	1,5	5 - 10	0.5 - 4
Ropivacaine	0,75 - 1	Infiltration PNB Epidural	200 - 300	6 - 7	1	10 - 20	2 - 10
Bupivacaine	0.25 – 0,75	Infiltration PNB Epidural Spinal	25 – 200*	7 - 8	2	5 - 20	2-9
Levobupivacaine	0,25 – 0,5	Epidural Spinal	25 - 150	7	2	15 - 20	3 - 9
Mepivacaine	0,25 - 4	Infiltration Epidural Spinal	100–600*	3 -5	1 – 1,5	5 - 10	1 – 1,5

*- with Epinephrine 1:200000; **- compared with Procaine = 1 unit; PNB – peripheral nerve block

Local Anesthetics Mechanism of Action



Local Anesthetics

Local Anesthetics (LA)

- Provide anesthesia and analgesia by disrupting the conduction of impulses along nerve fibers
- LAs block voltage-gated sodium channels
- Reversibly bind intracellular alpha subunit
- Inhibit the influx of sodium, thus preventing an action potential from being reached
- LAs are less effective in inflammation because of impaired dissociation and delayed penetration trough cellular membrane

Local Anesthetics Clinical Use

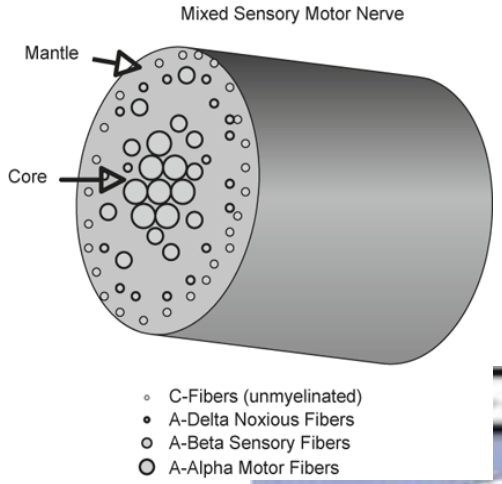
Clinical Usage

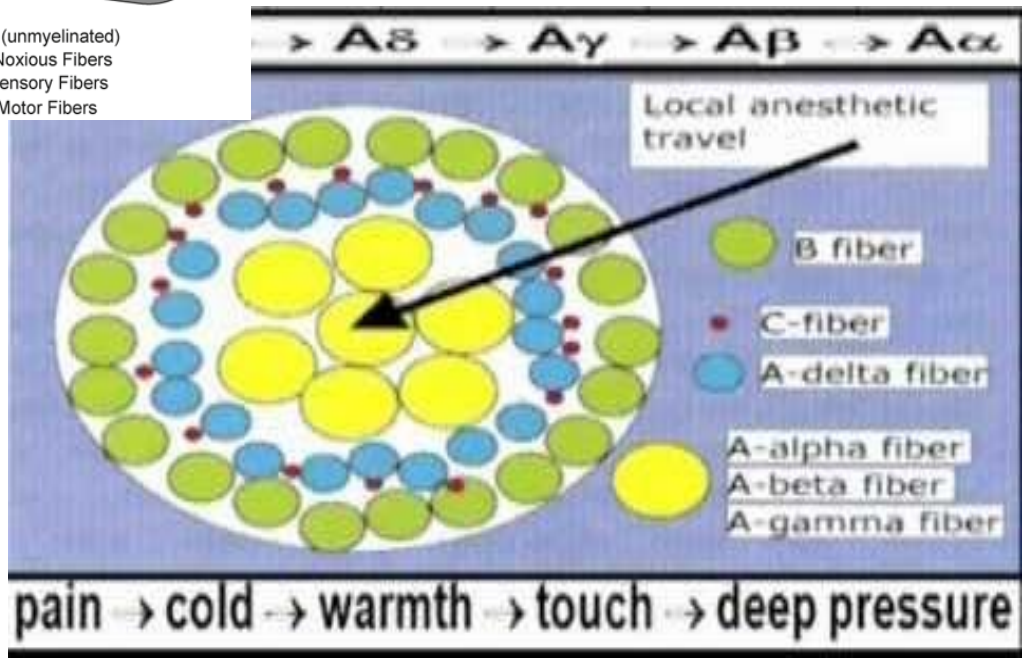
Provide anesthesia and analgesia throughseveral routes of delivery

- Topical
- Infiltration
- IV
- Epidural
- Intrathecal (Spinal)
- Perineural (Regional)

Differential Block : Small diameter (A delta) and myelinated nerves are most susceptible, thus sensory loss precedes motor weakness

LA: Differential Block





Local Anesthetics
Clinical Use

Effects of Epinephrine Added to the LA Solution:

- Prolongs duration of anesthesia
- Reduces systemic absorbtion
- Increases intencity of blockade
- Reduces surgical bleeding
- Signals intravascular injection
- Decreases the latency to onset of anesthesia

Factors influencing LA tissue uptake (absorbtion):

- Anesthetic concentration
- Tissue blood flow (vascularisation)
- **LA** Tissue solubility

Local Anesthetics
Clinical Use: Toxicity

LA Toxicity

- **CNS toxicity**

· Local anesthetics readily cross the blood brain barrier

· Clinical manifestations: Lightheadedness, tinnitus, tongue numbness > CNS depression, seizure > coma

- **Cardiovascular toxicity**

· Dose dependent blockade of Na channels > disruptions of cardiac conduction system > bradycardia, ventricular dysrhythmias, decreased contractility, cardiovascular collapse/ circulatory arrest

· Bupivacaine especially has severe CV side effects

· Approximately 3x the amount of local anesthetics are required to produce cardiovascular toxicity than CNS toxicity

· Addition of Epinephrine allows for early detection of intravascular injection and also increases the max allowable dose

Local Anesthetics
Clinical Use: Toxicity

Treatment of LA toxicity

- **Initial management:**

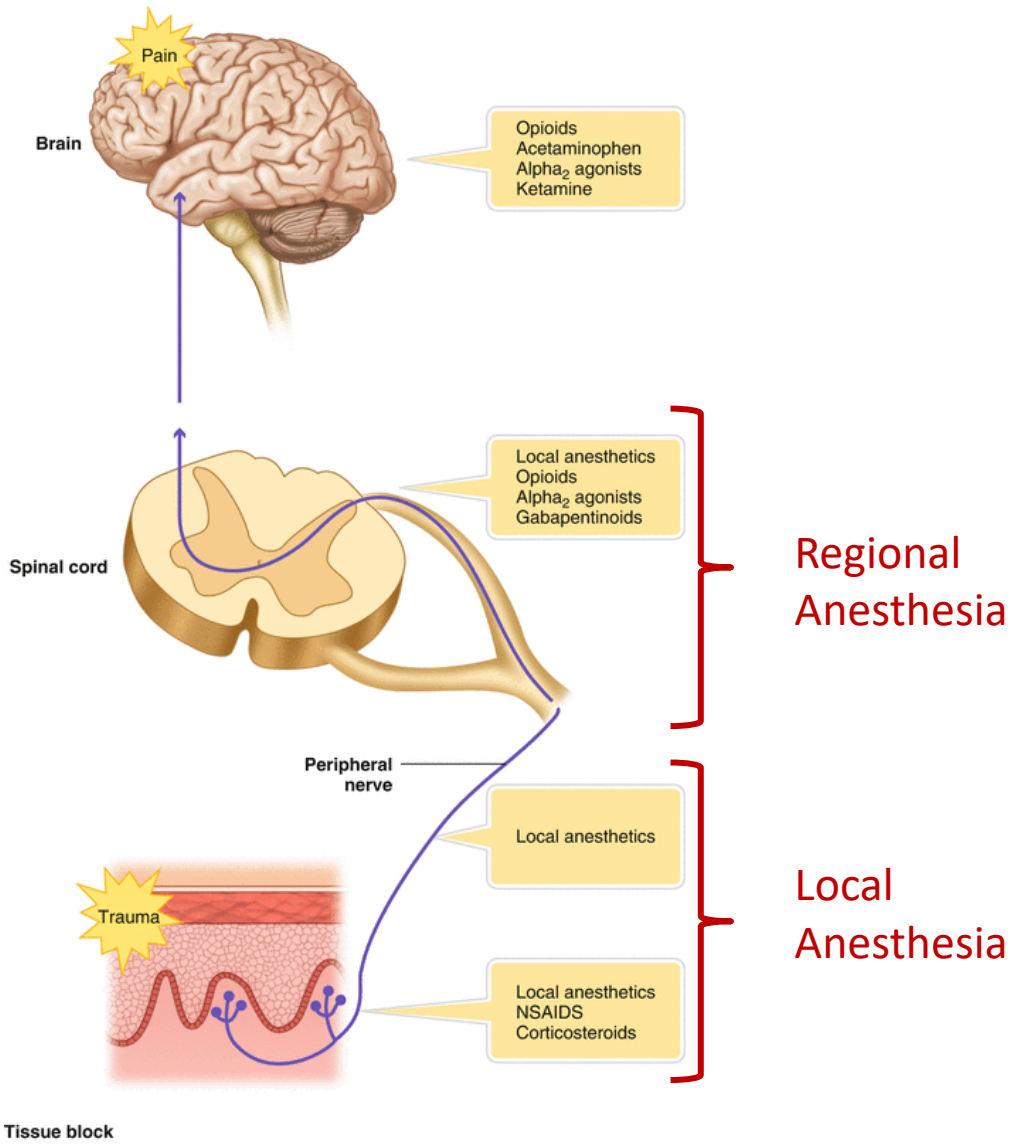
- Stop local anesthetic
- Give ***benzodiazepines for seizure***, avoid propofol when there are signs of CV instability.
- Begin ACLS: CPR, securing airway.
- Reducing individual epinephrine doses to <1 mcg/kg.

AVOID: vasopressin, Ca channel blockers, Beta blockers, and local anesthetics

- **Initiate early intralipid (IL) therapy**

- Bolus IL 20% 1.5 ml/kg, followed by infusion of 0.25 ml/kg/min
- May repeat loading doses (max 3 total doses)
- May increase infusion rate to 0.5 ml/kg/min if BP is still low. Not to exceed 10 ml/kg in the first 30 mins.
- Consider early initiation of cardiopulmonary bypass

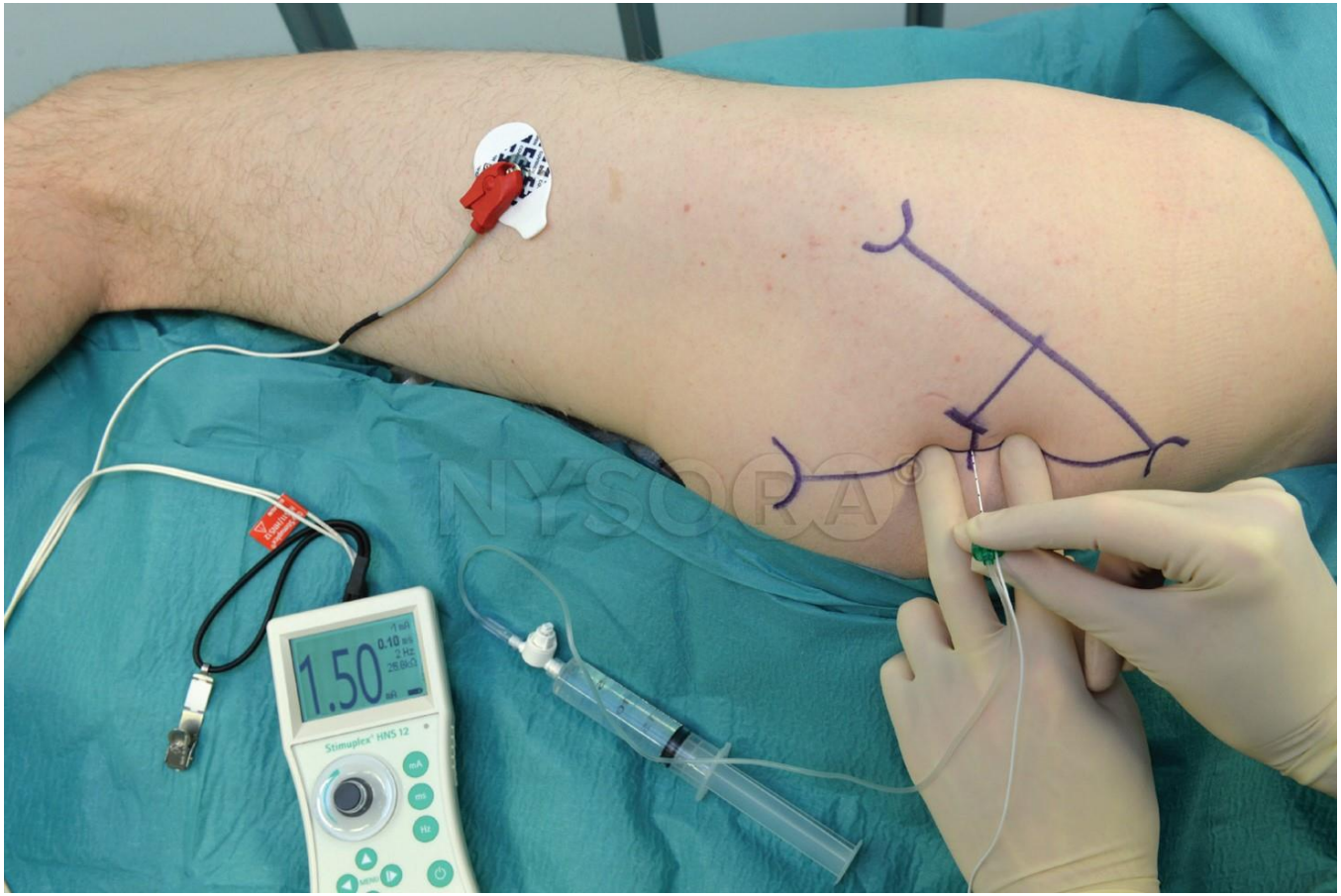
Local/Regional Anesthesia



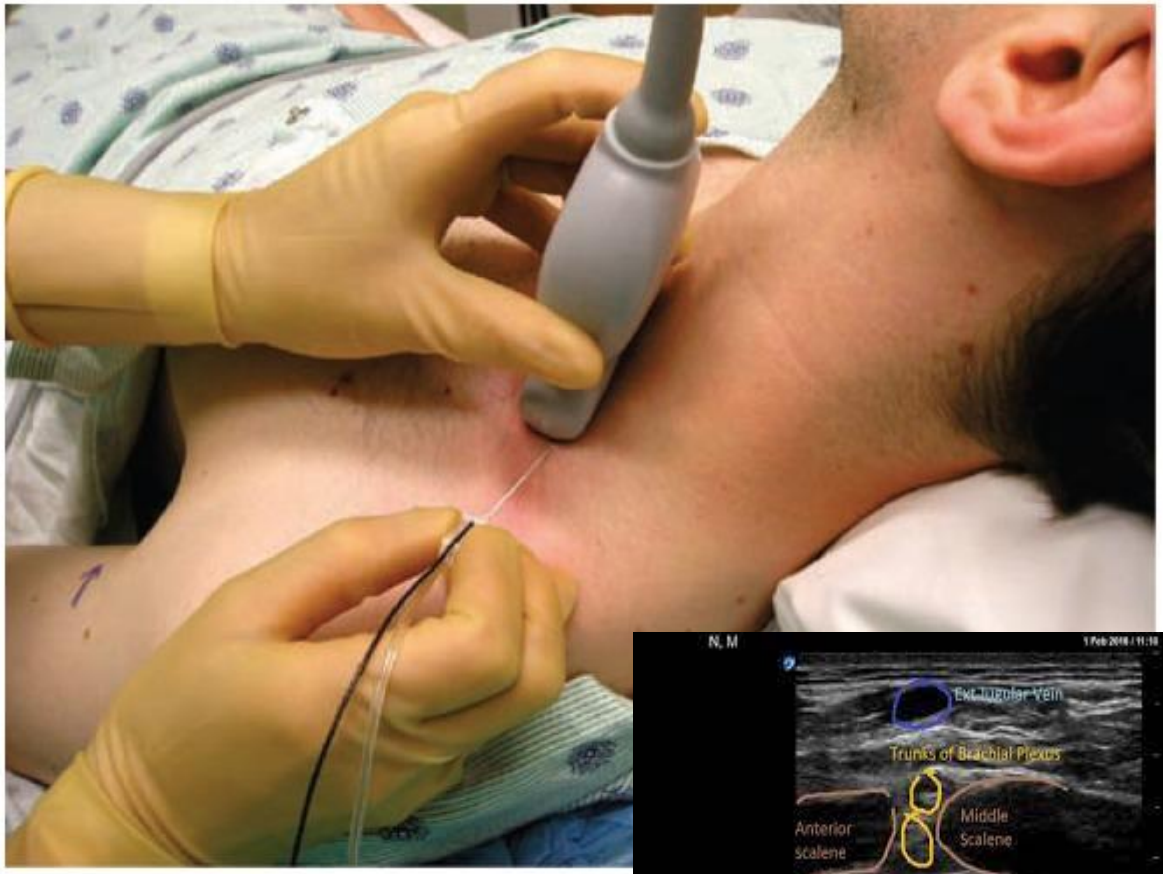
Regional Anesthesia

Local Anesthesia

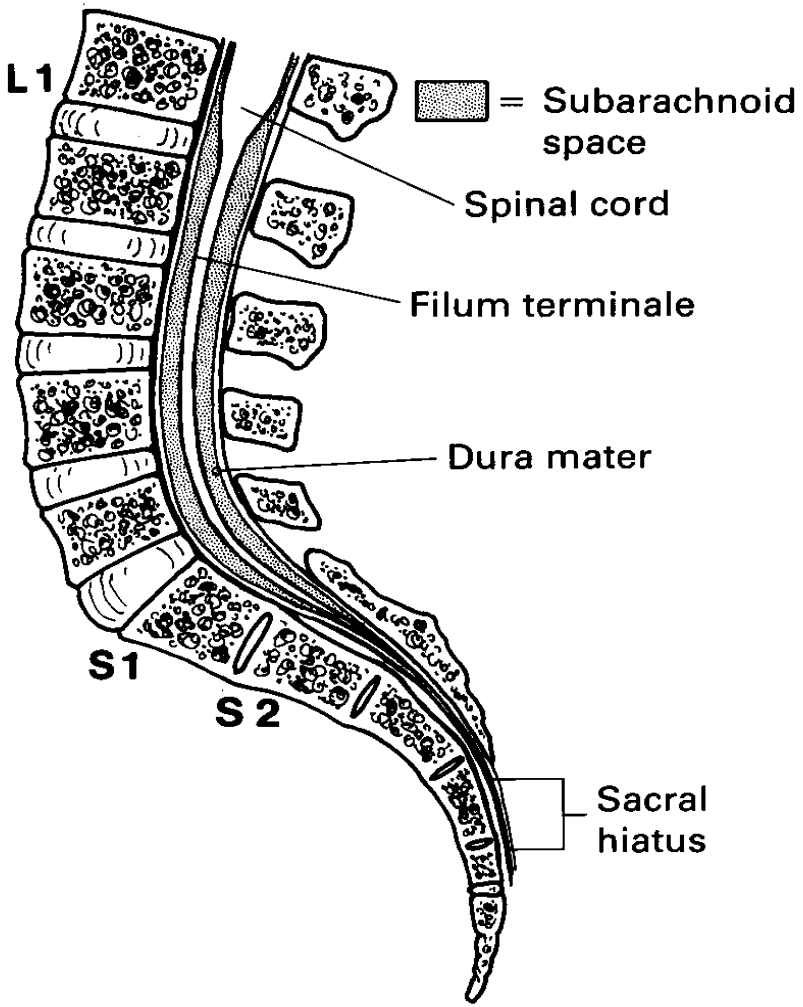
Local/Regional Anesthesia
Sciatic Nerve Block



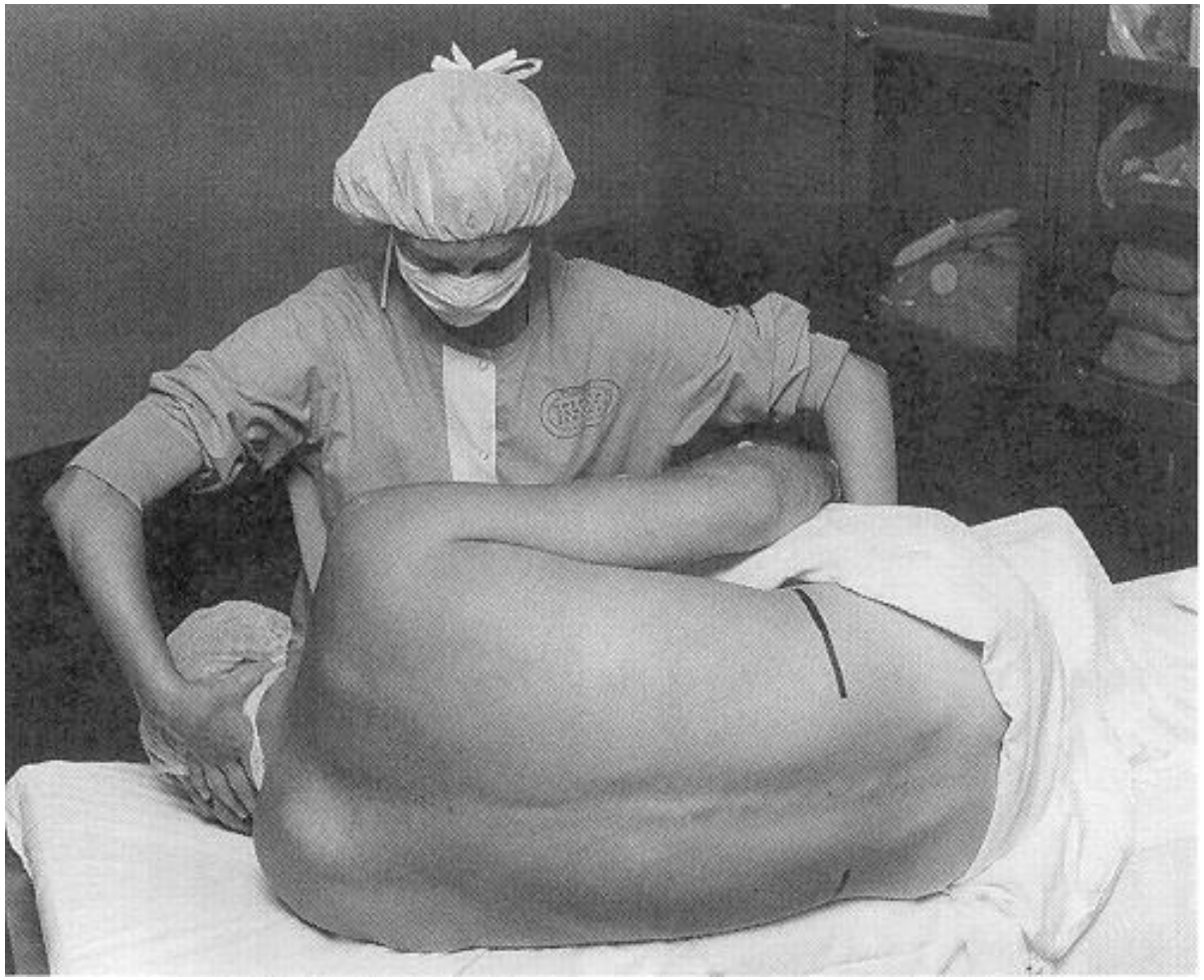
Local/Regional Anesthesia
Brachial Plexus Block



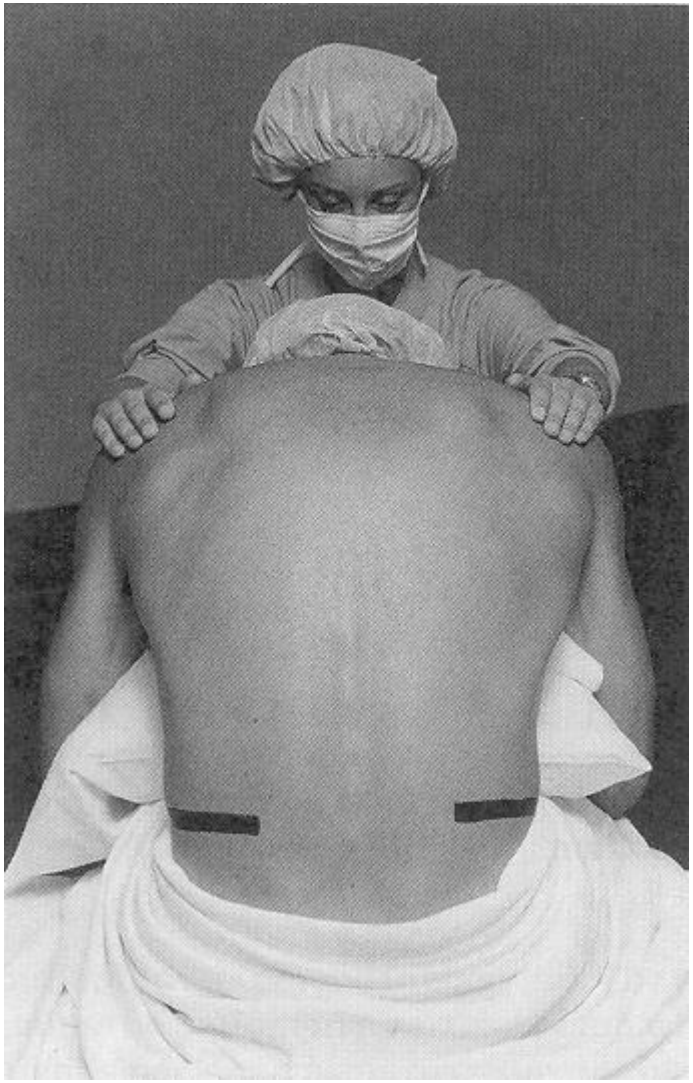
Spinal & Epidural Anesthesia
Anatomical Aspects (6;31;32)



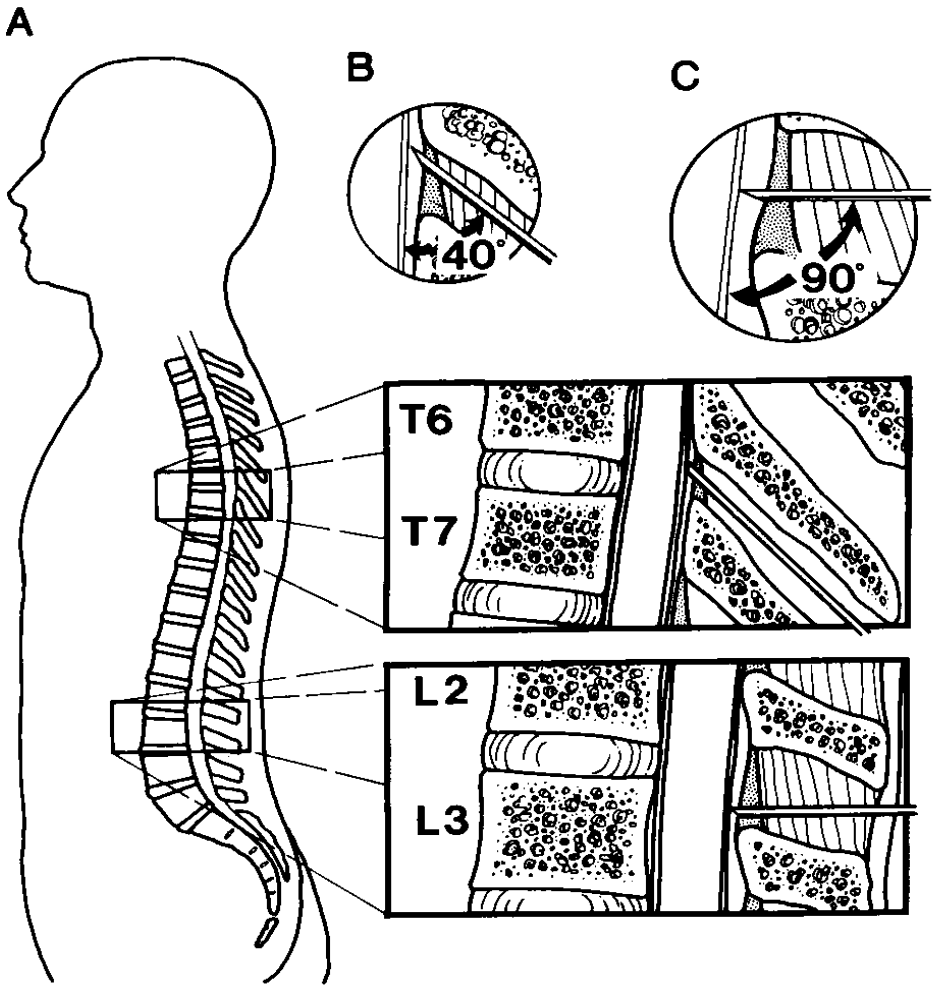
Spinal & Epidural Anesthesia Patient Positioning



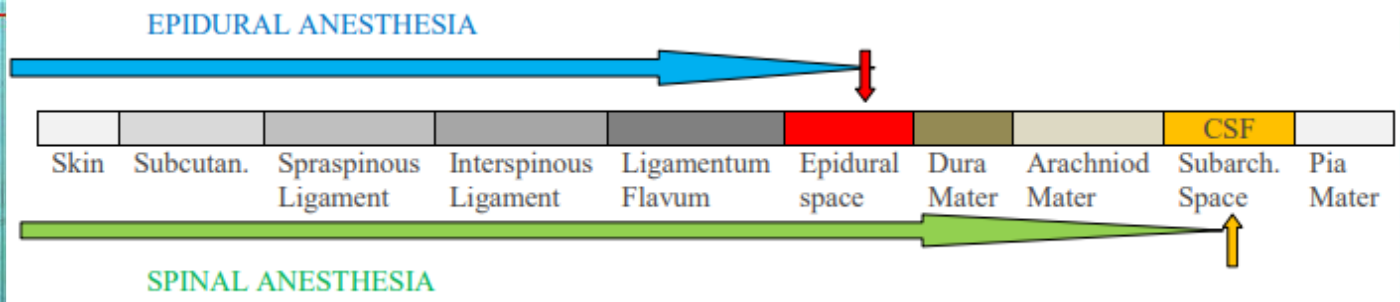
Spinal & Epidural Anesthesia Patient Positioning

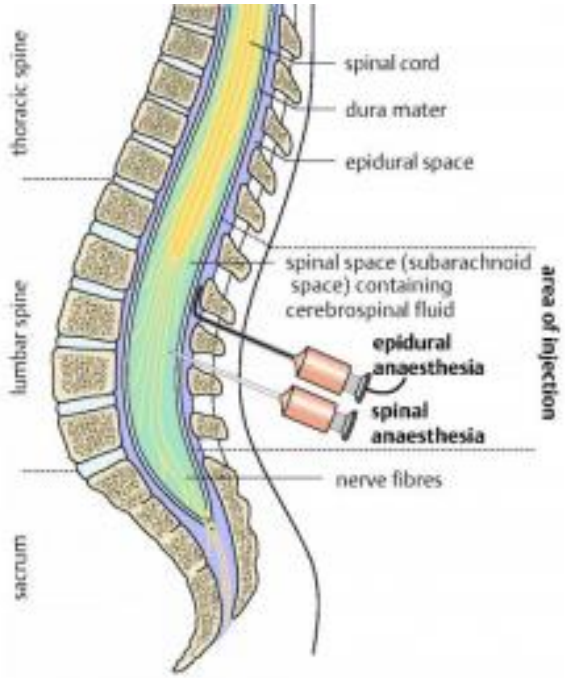


Spinal & Epidural Anesthesia
Anatomical Aspects

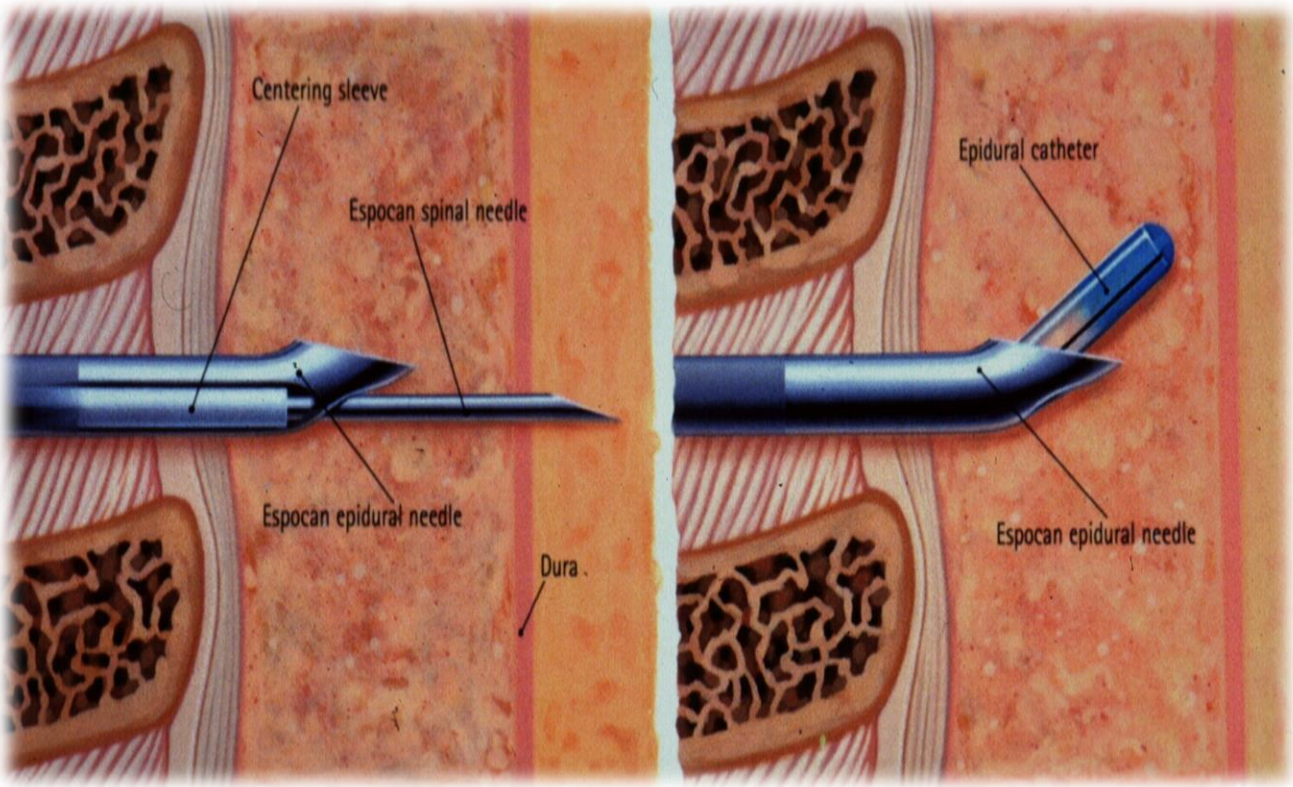


Spinal & Epidural Anesthesia





Combined Spinal - Epidural

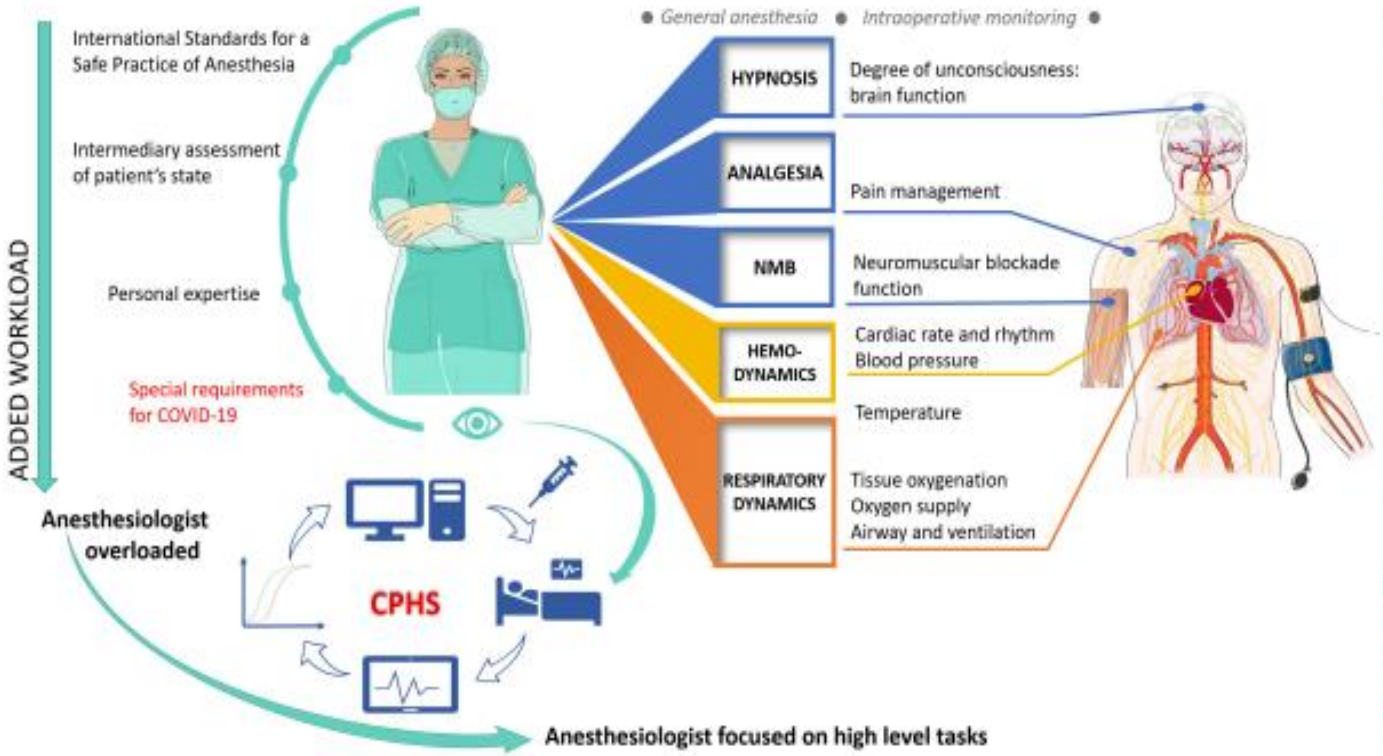


Regional Anesthesia: awake or asleep?

- Anesthetized or heavily sedated patients are not able to respond to paresthesia, intraneural injection, which may precede neurological trauma/damage
- Pediatric regional anesthesia is almost exclusively performed under a general anesthetic
- The majority of regional techniques can be performed on awake or lightly sedated adult with minimal discomfort
- Continuing verbal contact with patients has distinctive advantages in the likelihood of paresthesia, intrathecal or intraneural injection, both for recognition and management

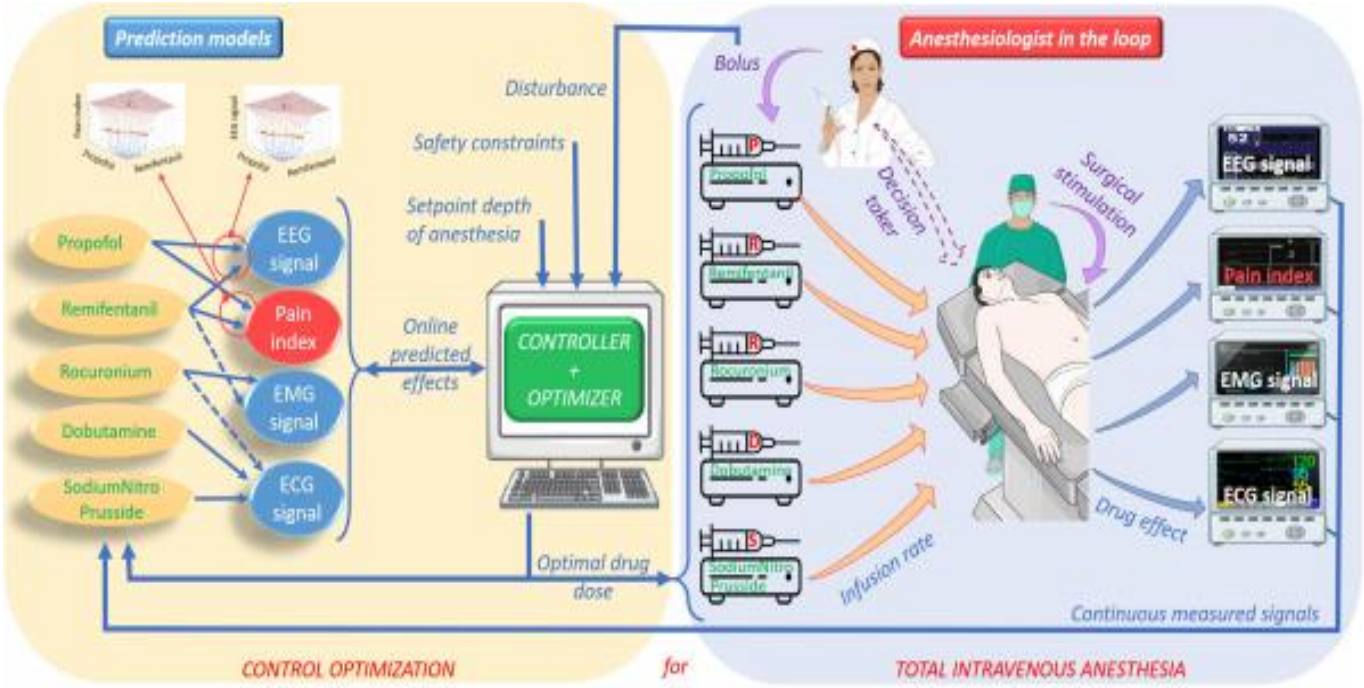
NB: Perform blocks on awake patient whenever possible. Judicious doses of analgesics/sedatives (Fentanyl 50-100 mcg with midazolam 1-2 mg) will improve patient tolerance

Modern Anesthesia: challenges & perspectives



Clinical care paradigm for patient state monitoring during general anesthesia and the potential of a hybrid CPHS with medical human in the loop

Modern Anesthesia: challenges & perspectives

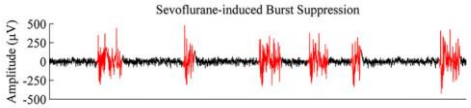


Closed-loop scheme for complete anesthesia paradigm automation in clinical practice

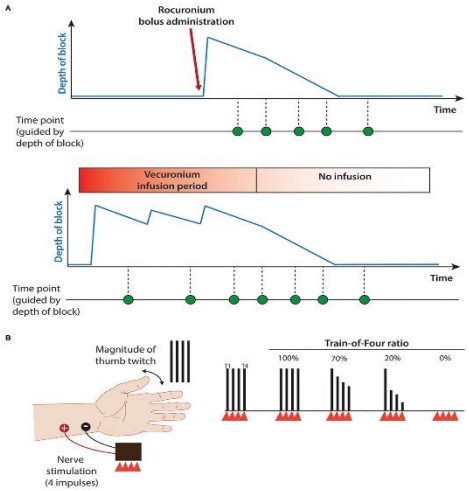
Modern Anesthesia: challenges & perspectives

EEG Signal / Anesthesia Depth

- Bispectral Index monitor (BIS)
- Auditory Evoked Potential monitor (AEP)
- Patient State Analyser (PSA)
- Cerebral state monitor (CSM)
- Index of Consciousness monitor (IoC)
- Entropy monitor



EMG Signal / Neuromuscular Block Level



Nociception/ Pain Indexes

- Surgical Pleth Index (SPI)
- Analgesia Nociception Index (ANI)
- Pupillometry monitoring methods

Hemodynamic monitoring

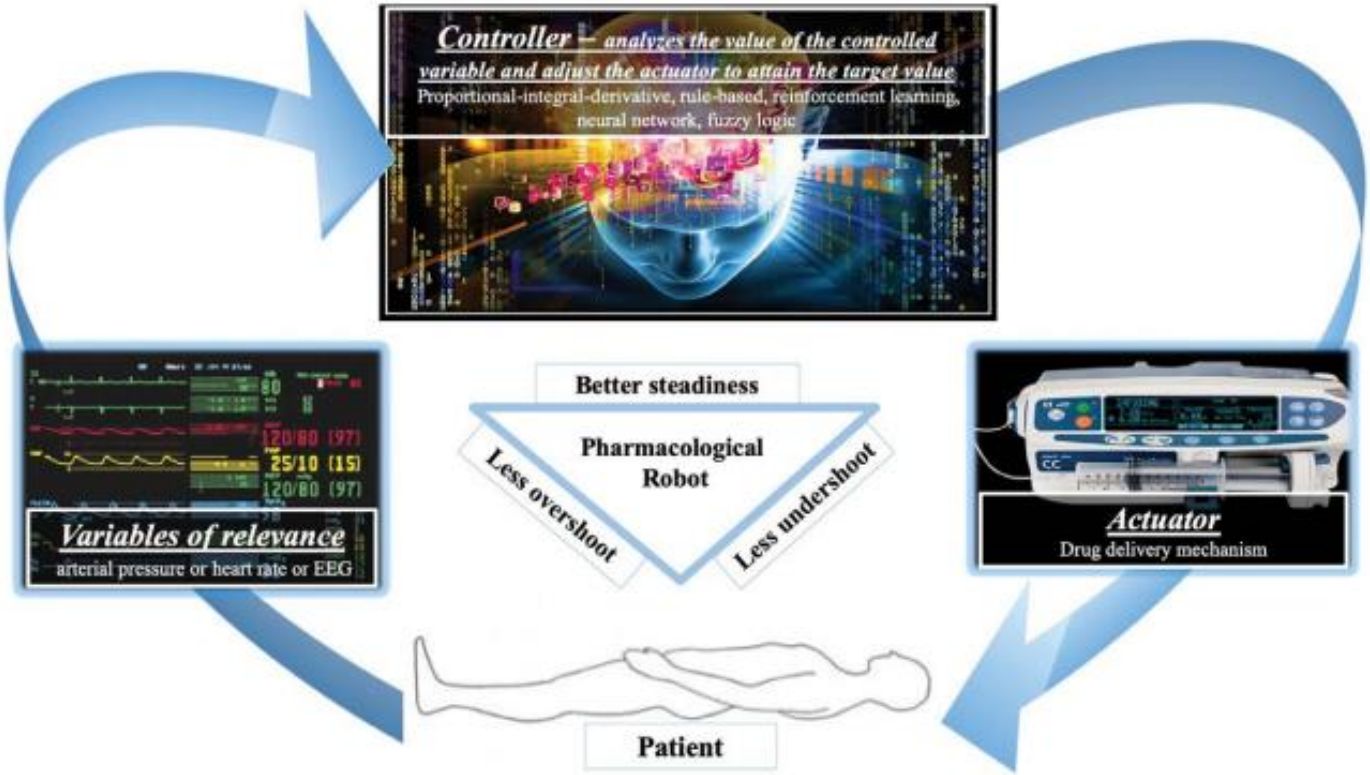
- ECG
- Other hemodynamic parameters

"If you can't measure it, you can't manage it."

Peter Druker

Modern Anesthesia: challenges & perspectives

Figure 1. Description of a closed-loop system. EEG indicates electroencephalogram.



Closed-loop system. EEG indicates electroencephalogram

Modern Anesthesia: challenges & perspectives

McSleepy

Modern Anesthesia: challenges & perspectives

Kepler Intubation System (KIS)

Modern Anesthesia: challenges & perspectives

Magellan System: popliteal nerve block
via a posterior approach

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