

MINISTRY OF HEALTH OF UKRAINE
POLTAVA STATE MEDICAL UNIVERSITY
DEPARTMENT OF THE GENERAL SURGERY WITH PATIENT'S
CARE

Local anesthesia

Lecture for general surgery

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Poltava

☀ **Local anesthesia** characterized by the loss of pain's sensation **only in the area** of the body where an anesthetic drug is applied or injected.

☀ It is any technique to render part of the body insensitive to pain without affecting consciousness.





☀ **Local anesthetics:**

- (1) Local anesthetics act by blocking both sensory and motor nerve conduction to produce a temporary loss of sensation **without a loss of consciousness.**
- (2) Unlike general anesthetics, they normally do not cause central nervous system (CNS) depression.

General anesthetics act on the CNS or autonomic nervous system to produce analgesia, amnesia, or hypnosis.

Before the use of local anesthetics, to alleviate a patient's pain, surgeons must perform the operation very fast, for example:

Removing a patient's breast - half minute

Removing bladder stone - one minute

Modern development of the use of drugs to induce local anesthesia probably started in the mid-19th century. The earliest recorded use of hypothermia as a local anesthetic is believed to be by Larrey, Napoleon's chief surgeon during the retreat from Moscow. He reported that amputations carried out at subzero temperatures has a higher survival rate than those in warmer conditions.

In 1848, Arnott reported that he had used a pig's bladder filled with ice to alleviate pain.

Local anesthetics

Amides and Esters

- ☀ Lidocaine (Xylocaine)
- ☀ Bupivacaine (Marcaine)
- ☀ Etidocaine (Duranest)
- ☀ Mepivacaine (Carbocaine)
- ☀ Prilocaine (Citanest)
- ☀ Ropivacaine

- ☀ Chloroprocaine (Nesacaine)
- ☀ Cocaine (crack)
- ☀ Procaine
- ☀ Tetracaine (Pontocaine)

Local and Regional Anesthetic Agents

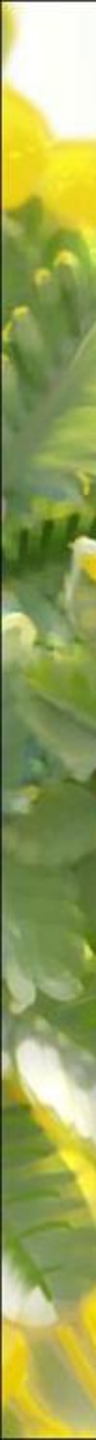
AMINO AMIDES	Type anesth.	Concent-	Duration(hr)	Maximum
	ration	Dosag		
Bupivacaine Marcaine	Local infiltration	0.25% to 0.50%	2 to 3	400mg
Lidocaine Xytocaine	Surgical epidural	0.75%		
	Topical	2% to 4%	1/2 to 2	200 mg
	Infiltration	0.5%		500 mg
	Peripheral nerves	1% to 2%		
Mepivacaine Carbocaine	Infiltration	0.5% to 1%	1/2 to 2	500 mg
Ropivacaine Naropin	nerve block	0.75%		
	Epidural	%	6 to 10	
AMINO ESTERS				
Chloroprocaine	Nerve block	2%	1/4 to 1/2	1000 mg
Cocaine	Topical	4% or 10%	72	200 mg or 4 mg/kg
Procaine Novocain	Infiltration	0.5%	1/4 to 1/2	1000 mg
Tetracaine Cetacaine	Topical	2%	2 to 4	20 mg

Clinical Uses

- ☀ **Benzocaine**- Topical, duration of 30 minutes to 1 hour
- ☀ **Chloroprocaine**- Epidural, infiltration and peripheral nerve block, max dose 12mg/kg, duration 30 minutes to 1 hour
- ☀ **Cocaine**- Topical, 3mg/kg max., 30 minutes to one hour
- ☀ **Tetracaine**- Spinal, topical, 3mg/kg max., 1.5-6 hours duration
- ☀ **Bupivacaine**- Epidural, spinal, infiltration, peripheral nerve block, 3mg/kg max., 1.5-8 hours duration

Clinical Uses (cont...)

- ☀ **Lidocaine**- Epidural, spinal, infiltration, peripheral nerve block, intravenous regional, topical, 4.5mg/kg or 7mg/kg with epi, 0.75-2 hours duration
- ☀ **Mepivacaine**- Epidural, infiltration, peripheral nerve block, 4.5mg/kg or 7mg/kg with epi, 1-2 hours
- ☀ **Prilocaine**- Peripheral nerve block (dental), 8mg/kg, 30 minutes to 1 hour duration
- ☀ **Ropivacaine**- Epidural, spinal, infiltration, peripheral nerve block, 3mg/kg, 1.5-8 hours duration



☀ Local anesthetic can block almost every nerve between the peripheral nerve endings and the central nervous system. The most peripheral technique is **topical anesthesia** to the skin or other body surface. Small and large peripheral nerves can be anesthetized individually (**peripheral nerve block**) or in anatomic nerve bundles (**plexus anesthesia**). Spinal anesthesia and epidural anesthesia merges into the central nervous system.

☀ **Injection of local anesthetics is often painful. A number of methods can be used to decrease this pain including buffering of the solution with bicarb and warming.**

Kinds (Types) of Local and Regional Anesthesia

☀ In dependence on method and admission level of the local anesthetic to nerves, which conduct painful impulses, the types of anesthesia are divided to

1. Topical (terminal);

2. Infiltrative;

3. Conduction;

☀ - Intraosseous;

☀ - Intravenous under tourniquet;

☀ - Epidural;

☀ - Spinal;

☀ - Peripheral nerve block;

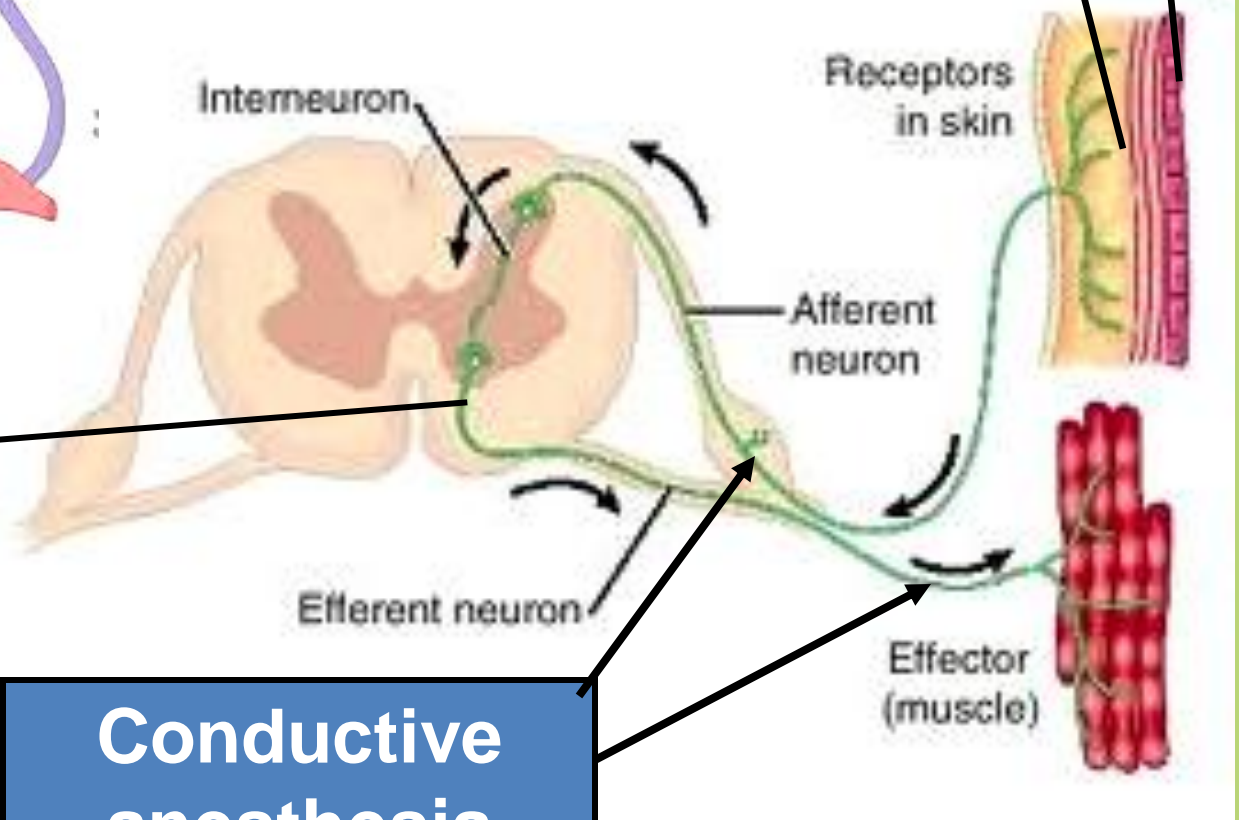
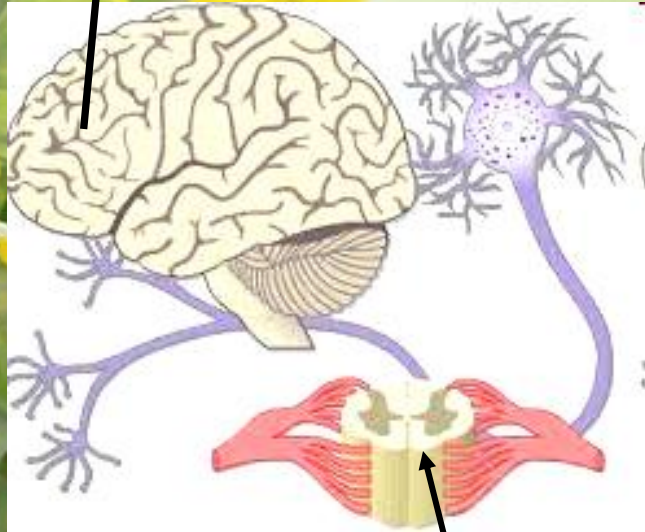
☀ - Plexus anesthesia;

☀ - Local anesthesia of body cavities

**General
anesthesia**

Terminal anesthesia

Infiltrative anesthesia



**Conductive
anesthesia**

VARIETY OF LOCAL ANESTHESIA

(CLASSIFICATION ON LEVEL ANESTHETIC'S EFFECT)

TERMINAL ANESTHESIA



Method by
A.W.Wishnevsky - method
"INFILTRATION
ANESTHESIA" with bring
in layers solution in tissue.
Prescription:
Novocain - 2,5
sodium chloride - 5,0
potassium chloride - 0,075
calcium chloride - 0,125
aqua distillate - 1000,0

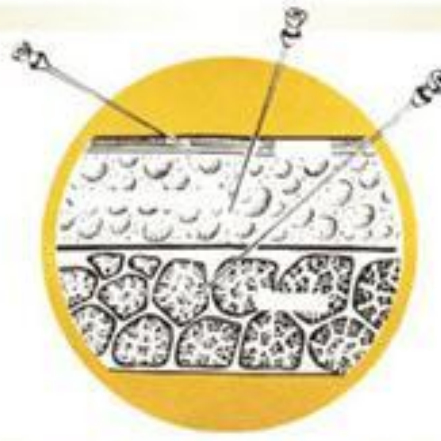


ANESTHESIA BY COATING OR MUCOUS IRRIGATION

ANESTHESIA OF FINGER BY OBERST-LUCASHEVICH



**INTERCOSTAL
ANESTHESIA**



**INFILTRATION
ANESTHESIA**



**PLEXUS ANESTHESIA
(PLEXUS NERVOSUS)**

CLASSIFICATION of LEVEL ANESTHETICS EFFECT (cont...)



SACRAL ANESTHESIA



**NERVE ROOT ANESTHESIA
CONDUCTIVE ANESTHESIA**



**PERIDURAL ANESTHESIA
(EXTRADURAL)**



**SPINAL ANESTHESIA
(INTRADURAL)**

Topical anesthesia

- ☀ **Topical anesthetics reversibly block nerve conduction near their site of administration, thereby producing temporary loss of sensation in a limited area.**
- ☀ Topical anesthetics are used for various skin and mucous membrane (conjunctiva, oral, nasal, throat, anal and other) conditions, including (but not limited to) pruritus(зуд) and pain due to minor burns, skin eruptions (eg, varicella (ветряная оспа), sunburn, poison ivy, insect bites), and local analgesia on intact skin.
- ☀ Topical anesthesia typically prevents pain during medical examinations or procedures..

Topical anesthetics

☀ METACAIN DS 5% cream topical anesthesia +
FREE SHIPPING



☀ EMLOCAINE Lidocaine 2,5% -

Prilocaine, 5% solution of lidocaine hydrochloride
(xycaïn),



☀ 2% solution PIROMECAINE,

☀ TRYMECAINE 4% - Anesthetic effect starts in
15 minutes and remains 60–90 minutes,

☀ BUPIVACAINE or marcaine 0.25% and 0.5%
solutions (with and without epinephrine),

☀ DICAINE - Instil 0,5 - 1 % Dicain solution or
0.5Dicain ointment

**This method of
anesthesia used in**



otorhinolaryngology

ophthalmology

endoscope

urology

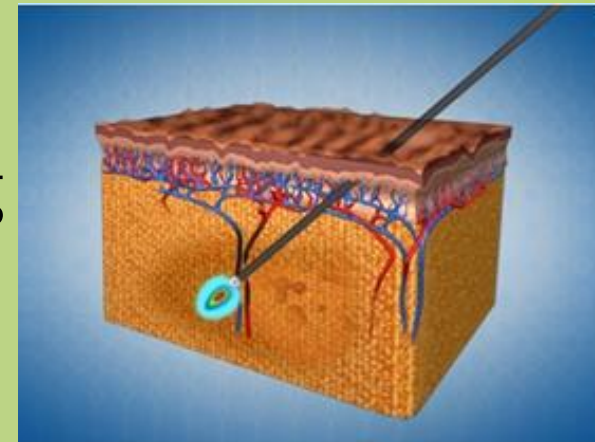
gynecology

pulmonology

Cosmetic surgery

Infiltrative anesthesia

☀ **Infiltrative** anesthesia is made layer by layer introduction of the solution of anesthetic on each next operation stage. Infiltration tissues by 0,25% solution of Novocain for counting of high hydrostatic pressure spreads on the considerable extent of tissue washing the nervous fibers in them that provides effective blockade of painful sensitiveness. The low concentration of the solution of anesthetic and running out at the moment of cutting the tissue, practically excludes an intoxication danger, without looking at introduction of its considerable volumes.



The periods of passing the local Infiltrative anesthesia:

- ☀ 1. **Introduction period** of anesthetic solution - includes the fulfillment anesthetic injections. The pain of the first injection diminishes making "lemon pellicles", through which the anesthesia is conducting.
- ☀ 2. **The period of waiting** - the time, necessary for guaranteeing of action of the anesthetic solution on nervous outflows and nervous trunks. It depends on the kind of anesthesia, anesthetic and its concentration.
- ☀ 3. **Period of full anesthesia** continues 1-2 hours. The painful sensitiveness at that time disappears as impellent function and reflexes can be well kept.
- ☀ 4. **Renewing period** -the sensitiveness is recovered, that is characterized by the pain in the field of surgical intervention and edema of soft tissues in the result of operation trauma.

Indication for infiltrative anesthesia


- ☀ 1. Ambulatory surgical operations;
- ☀ 2. Small on volume surgical interventions;
- ☀ 3. In weakened and exhausted patients;
- ☀ 4. In old and extreme-age people with diseases of cardiac-vascular and respiratory systems.
- ☀ 5. In case of contra-indication to general anesthesia (narcosis).

Contra-indications for infiltrative anesthesia

- ☀ 1. Raised sensitiveness of organism to anesthetic;
- ☀ 2. Mental affections;
- ☀ 3. Acute nervous excitement;
- ☀ 4. Early child age (till 10 years);
- ☀ 5. The urgent surgical interventions, connected with acute bleeding;
- ☀ 6. Expressed fibrous changes of soft tissues;
- ☀ 7. The surgical operations, which call for conducting of dirigible breathing;
- ☀ 8. Long-term operations on body cavities;
- ☀ 9. The refusal of the patient from local anesthesia.
- ☀ 10. Allergic reactions to local anesthetics

Complications of local anesthesia:

- ☀ **Local:** the damage by needle of anatomic formations or internal organs (nerve trunks, vessels, spinal cord, organs of pectoral or abdominal cavities), infectivity of soft issues, bleeding, hematoma, inflammatory infiltrates, Ischemic necrosis paresis, paralyses, peritonitis, etc.
- ☀ **General** - connected with overdoses of anesthetic or raised sensitiveness of organism to it.
 1. Light degree - vasomotor discords (dizziness, pallor, cold sweat, general weakness tachycardia, nausea).
 2. Middle degree - stinging of central nervous system (impellent flustering, hallucinations, cramps, vomit).
 3. Heavy degree - violation of activity of life important organs and systems (collapse, stop of breathing and cardiac activity).
- Allergic reactions** are nettle rash, Kvinke's swollen, bronchospasm, anaphylactic shock.



All forms of anesthetics are invasive to a patient and therefore **consent** should be obtained as for other procedures. Ideally patients should be given a leaflet regarding anesthesia and then counsel regarding the intended benefits and the risks of anesthesia. In a general practice setting it will be the responsibility of the clinician who administers the local anesthesia to ensure good, non-coercive (не принудительное) consent is obtained.

Conductive (regional) anesthesia

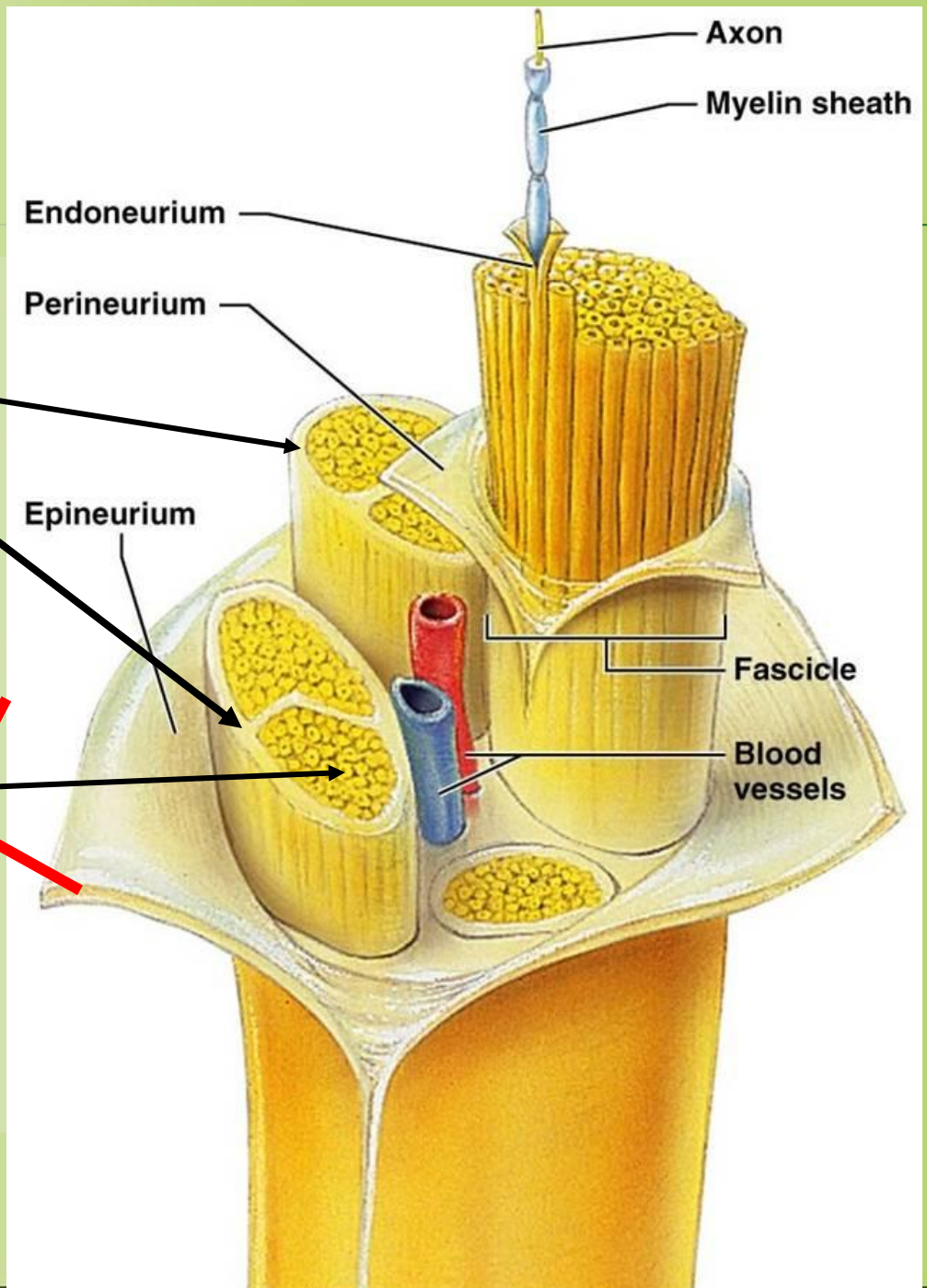
☀ **Conductive anesthesia** - method of regional analgesia, when the solution of the local anesthesia is put ***into the nervous trunk*** or interning proximally from the field of operation.

While fulfilled the conductive anesthesia one should to keep certain demands:

- ☀ - The solution of anesthetic must be put perineural, **but not intraneural (NB!)**;
- ☀ - To give brining warning of antiseptic into vessel that controls by aspirator clamp
- ☀ - When the solution of adrenaline is used as the component of the anesthetic solution, it is used in the concentration 1:200000 and is added immediately before blockade
- ☀ - The recommended concentration of solution is kept severely (according to the pharmacology instruction) is not exceed a maximum dose

☀ perinevral

☀ not
intraneural
(NB!);



Kinds (Types) of Regional Anesthesia

- ☀ **Intraosseous;**
- ☀ **Intravenous under tourniquet;**
- ☀ **Field block** - subcutaneous injection of a local anesthetic in an area bordering on the field to be anesthetized.
- ☀ **Peripheral nerve blocks** - injection of a peripheral nerve to anesthetize that nerve's area of innervation.
- ☀ **Plexus anesthesia** - injection of local anesthetic in the vicinity of a nerve plexus
- ☀ **Sympathetic block**: inject LA around sympathetic nerves
- ☀ **Local anesthesia of body cavities** (e.g. intrapleural anesthesia, intraarticular anesthesia)
- ☀ **Epidural;**
- ☀ **Spinal.**

Uses in surgery

- ☀ Virtually every part of the body can be anesthetized using conduction anesthesia. However, only a limited number of techniques are in common clinical use. Sometimes conduction anesthesia is combined with general anesthesia or sedation for the patient's comfort and ease of surgery.

Typical operations performed under conduction anesthesia include:

- ☀ **Eye surgery** (surface anesthesia with topical eye anesthetics, retrobulbar block)
- ☀ **ENT operations, head and neck surgery, dental surgery** (infiltration anesthesia, field blocks, peripheral nerve blocks, plexus anesthesia)
- ☀ **Shoulder and arm surgery** (plexus anesthesia, intravenous regional anesthesia)
- ☀ **Heart and lung surgery** (epidural anesthesia combined with general anesthesia)

Cont..

- ✿ **Abdominal surgery** (epidural/spinal anesthesia, often combined with general anesthesia)
- ✿ **Gynecological, obstetrical and urological operations** (spinal/epidural anesthesia)
- ✿ **Bone and joint surgery of the pelvis, hip and leg** ((spinal/epidural anesthesia, peripheral nerve blocks, intravenous regional anesthesia)
- ✿ **Surgery of skin and peripheral blood vessels** (topical anesthesia, field blocks, peripheral nerve blocks, spinal/epidural anesthesia)
- ✿ **Uses in acute pain**

Important complications of regional anaesthesia


- ☀ Pain - 25% of patients still experience pain despite spinal anaesthesia
- ☀ Post-dural headache from CSF leak
- ☀ Hypotension and bradycardia through blockade of the sympathetic nervous system
- ☀ Limb damage from sensory and motor block
- ☀ Epidural or intrathecal bleed
- ☀ Respiratory failure if block is 'too high'
- ☀ Direct nerve damage

- ☀ Hypothermia
- ☀ Damage to the spinal cord - may be transient or permanent
- ☀ Spinal infection
- ☀ **Aseptic meningitis**
- ☀ Haematoma of the spinal cord - enhanced by use of LMWH preoperatively
- ☀ Anaphylaxis
- ☀ Urinary retention
- ☀ Spinal cord infarction


Some specific complications of regional anaesthesia

☀ **Post-dural puncture headache**

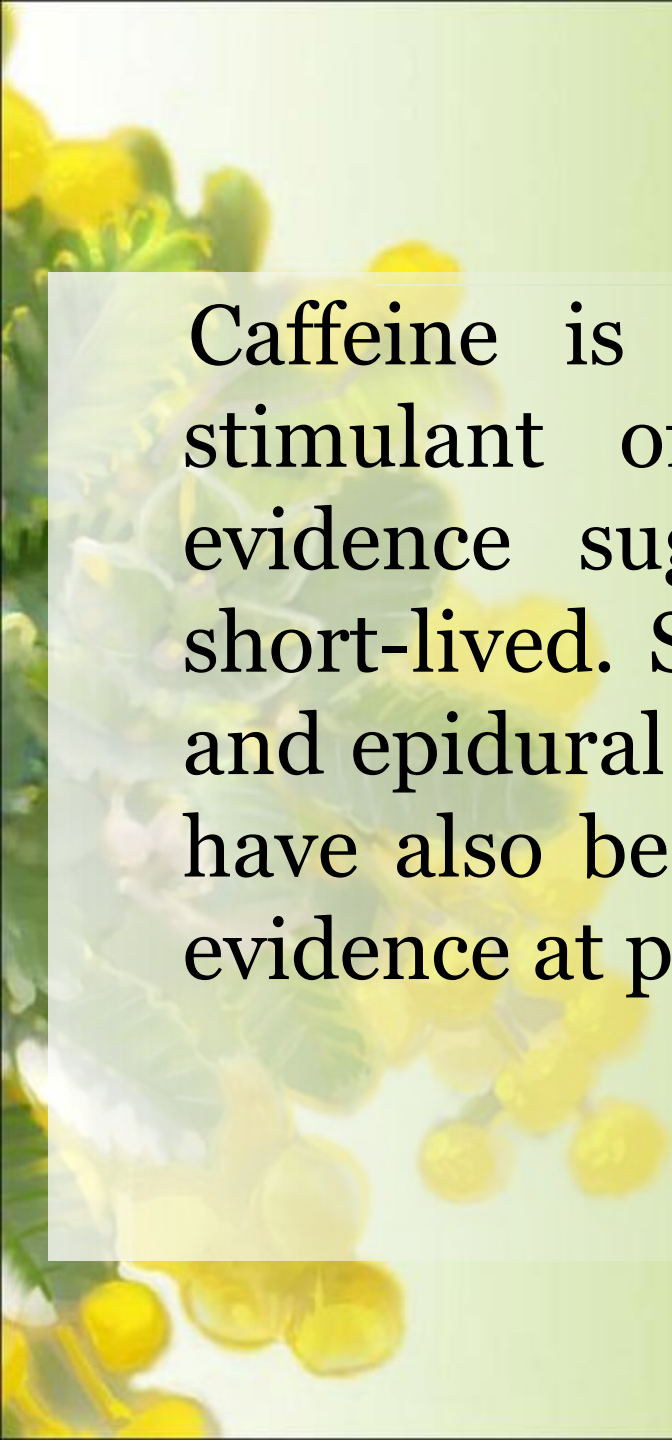
- ☀ Post-dural puncture headache is very common after spinal anaesthesia and especially in young adults and obstetrics. The headache results from CSF leak from the puncture site. It is enhanced by use of larger gauge needles and reduced by pencil-tipped needles. Presenting symptoms may include headache, photophobia, vomiting and dizziness.



Post-dural puncture headache **is treated** with analgesia and adequate hydration. Bedrest makes no clear difference to headache resolution.



Occasionally epidural blood patch is used where 15 mls of the patient's blood are injected at the site of the meningeal tear.



Caffeine is also used and acts as a stimulant of the CNS, although the evidence suggests that the benefit is short-lived. Subcutaneous **sumatriptan** and epidural saline as a bolus or infusion have also been researched, although the evidence at present is inconclusive.



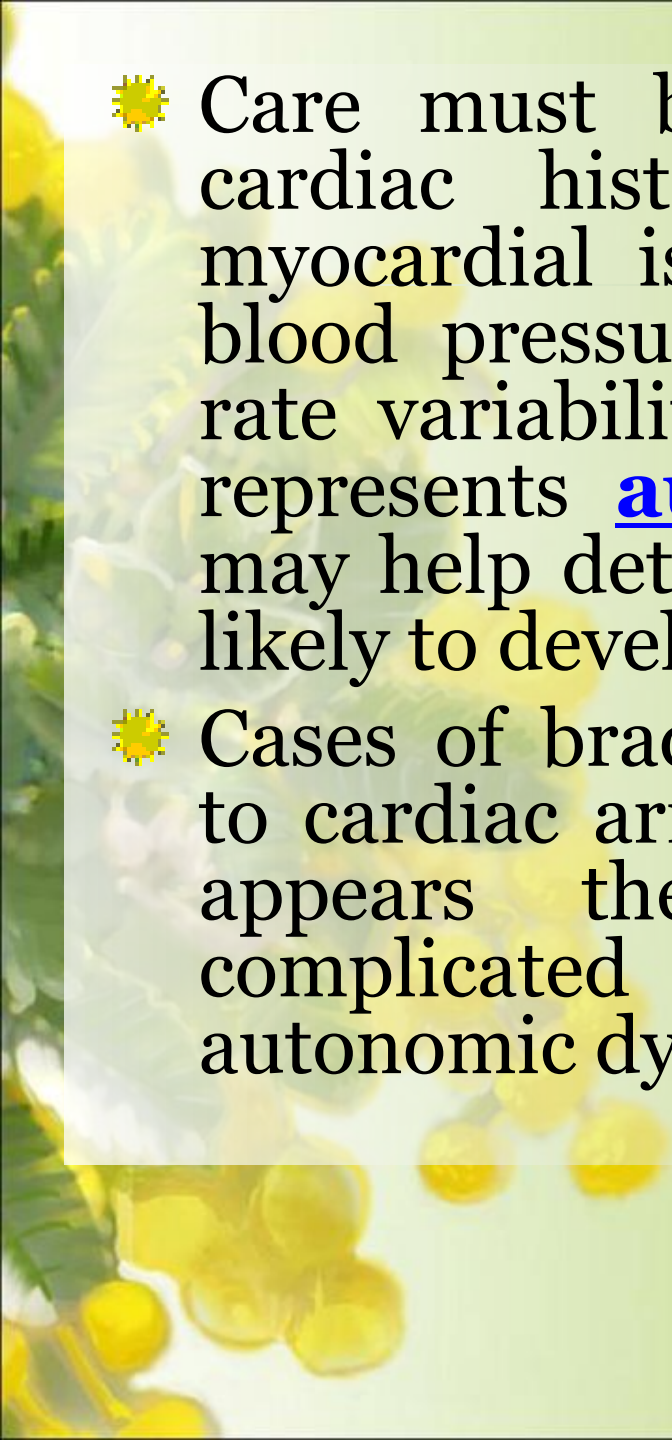
☀ **Total spinal block**

Total spinal block can occur with the injection of large amounts of anaesthetic agents into the spinal cord. It is detected by a high sensory level and rapid muscle paralysis. The block moves up the spinal cord so that respiratory embarrassment may occur, as can unconsciousness. In these situations the patient needs prompt assessment and may need to be intubated and ventilated until the spinal block wears off.



☀ Hypotension

- ☀ Up to half of patients receiving spinal anaesthesia will develop transient hypotension as sympathetic nerves are blocked. This usually responds to prompt fluid replacement, usually starting with crystalloids followed by colloids. Occasionally hypotension can be severe and may require vasopressors along with fluids.



☀ Care must be taken in patients with a cardiac history as they may develop myocardial ischemia with minor drops in blood pressure. It is suggested that heart rate variability prior to spinal anaesthesia represents autonomic dysfunction and may help determine patients who are more likely to develop hypotension.

☀ Cases of bradycardia with asystole leading to cardiac arrest have also occurred and it appears the underlying aetiology is complicated and not just related to autonomic dysfunction.

☀ **Neurological deficits**

- ❑ **Cauda equina syndrome** may occur and can be transient or permanent. This is a common reason for patients to refuse spinal anaesthesia. There may also be traumatic injury to the spinal cord.
- ❑ **Adhesive arachnoiditis** is a longer-term sequela of spinal anaesthesia, occurring weeks and even months later. It is characterised by proliferation of the meninges and vasoconstriction of spinal cord blood vessels. This results in gradual sensory and motor deficits from ischaemia and infarction of the spinal cord.

A decorative graphic on the left side of the slide featuring green leaves and clusters of small yellow flowers. A semi-transparent white rectangular box is overlaid on the lower part of this graphic.

Some kinds of regional anesthesia

Intravenous regional anesthesia (bier`s block)

☀ **History:**

- 1st introduced by August Bier in 1808
- Repopularised by holmes in 1963

Indication: Bier`s block is indicated to:

1. Any procedure on the arm below the elbow or leg below the knee that is completed within 40-60min
2. Its use is limited to procedures lasting less than an hour because of increasing discomfort from the tourniquet.
3. Onset of anesthesia is rapid , reasonable muscle relaxation is obtained

Intravenous regional anesthesia(bier`s block)

Contraindications :

☀ If the tourniquet cannot safely be used such as
:In severe Raynaud`s or homozygous sickle cell disease

Caution should be obtained in patients who have sustained crush injuries of the relevant limb as potentially viable tissue will be subjected to further period of hypoxia

Raynaud`s phenomenon :

☀ **is digital ischemia induced by cold and emotion , has 3 phases:**

1. Pallor :due to digital artery spasm and/or obstruction
2. Cyanosis:due to deoxygenation of static venous blood
3. Redness:due to reactive hyperemia

☀ **Primary(raynaud disease):** due to **idiopathic** digital artery vasospasm

☀ **Secondary(raynaud syndrome):** due to

1. **CTD: SYSTEMIC SCLEROSIS, CREST, SLE**
2. **ATHEROSCLEROSIS**
3. **Drugs: nicotin**
4. **Thoracic outlet obstruction**
5. **Malignancy**

Equipment:

- ☀ **Double cuff tourniquet:** proximal (upper), distal (lower)
 1. Doesn't leak
 2. Can inflated to at least 50 mm Hg above patients systolic BP
- ☀ **Cannula** inserted in distal vein
- ☀ **Resuscitation equipment** As with all local anesthetic blocks resuscitation equipment should be immediately available

Drugs :

☀ **Prilocaine** (Drug of choice) :

1. The Least toxic local anesthetic
 2. Has the largest therapeutic index
 - Therapeutic index of a drug is ratio of the dose that produces toxicity to that produce clinically desired or effective response in a population
 - Therapeutic index is a measure of a drug safety ,as a large value indicates that there is a wide range between doses that are effective and doses that are toxic
- ☐ If not available use **lidocaine**
 - ☐ It is essential that **plain, non adrenaline containing solutions** are used
 - ☐ **Bupivacaine** and **etidocaine** **should never be used** for Bier's block - they are significantly protein bound with high risk of cardio toxicity

DOSE :

- ☀ ARM: 30-40ml of 0.5% prilocaine or 0.5% lidocaine)
- ☀ LEG :50-60ml of 0.5% prilocaine or 0.5% lidocaine)

Technique :

- ☀ Before beginning :
 1. Patient **Blood Pressure** SHOULD BE MEASURED
 2. Place **I.V. cannula** in the distal vein limb scheduled for surgery
 3. Place **I.V. cannula** in the other limb in case of complication <<require IV drug administration>>

Technique :Continue

1. The double tourniquet applied to the upper arm or thigh
 - ✓ **Never placed on the forearm or lower leg as adequate arterial compression cannot be obtained**
2. *More effective block by tightly wrapping the distal part of the limb with an ESMARCH rubber bandage before inflating tourniquet*
3. *The proximal tourniquet is then inflated to a pressure of 50 to 100 mmHg above patient systolic BP*

Technique :Continue

4. Remove the rubber bandage
5. The local anesthetic solution is then *slowly injected* into the indwelling cannula and the patient warned that the limb may start to feel hot and mottled skin appearance,
analgesia occur within 3-5 min
6. Inflate the distal tourniquet
7. Deflate the proximal <<the patient complain of pain due to pressure from it>>>>> ...*the surgery start*

Technique :Continue

- ✱8. At the end of the procedure, the tourniquet is deflated and normal sensation quickly returns.

It has been suggested that if the tourniquet is reinflated again 20-30 seconds, the rate of washout of local anaesthetic from the limb and hence the incidence of side-effects is decreased.

In any event, the patient should be warned that they may experience tinnitus, dizziness or transient drowsiness following deflation of the tourniquet.

Complications of Bier`s block

- ✱ Bier`s block is safe
- ✱ Complications are due to toxicity of local anesthesia ,occur if tourniquet suddenly deflate soon after injection of LA
- ✱ Even if the surgery is completed within a few minutes, on no account should the tourniquet be deflated until at least 20 minutes has passed since the injection of the local anaesthetic or serious toxic side-effects may occur

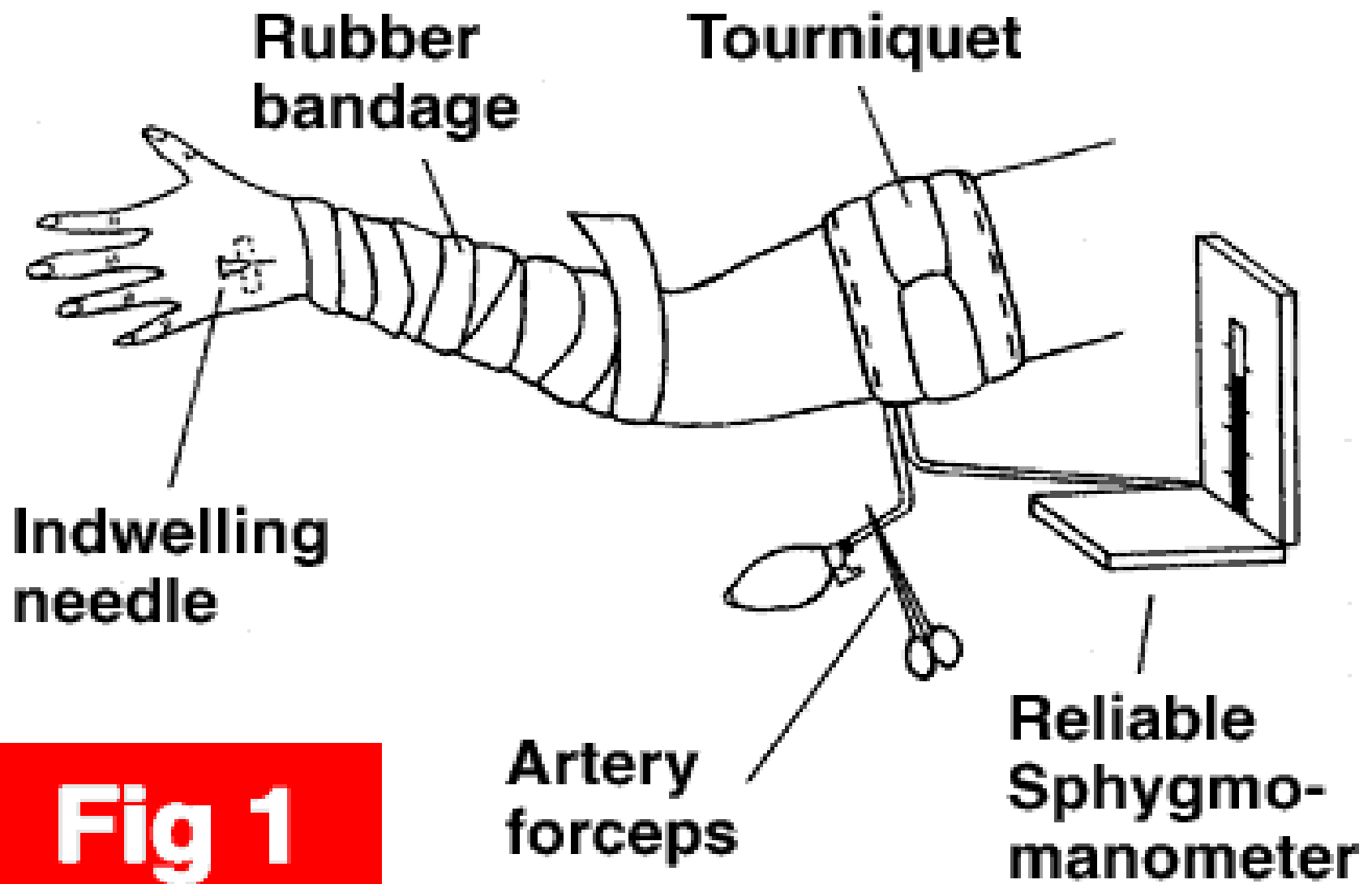


Fig 1



Intraosseous anesthesia

- ☀ An anesthesia produced by the injection of an anesthetic agent **into the cancellous portion of a bone** . **It's kind of intravenous anesthesia**

Used for

- ☀ For infiltration as well as intra-septal and intra-osseous injection in dental practice
- ☀ No painful palatal anesthesia necessary for tooth extractions
- ☀ Profound instant anesthesia with chair time savings of approximately 10 minutes
- ☀ Positive tactile feedback during anesthetic delivery reduces pain - lower delivery rate
- ☀ Reduces amount of anesthetic needed
- ☀ Safe needle disposal system reduces needle stick injury



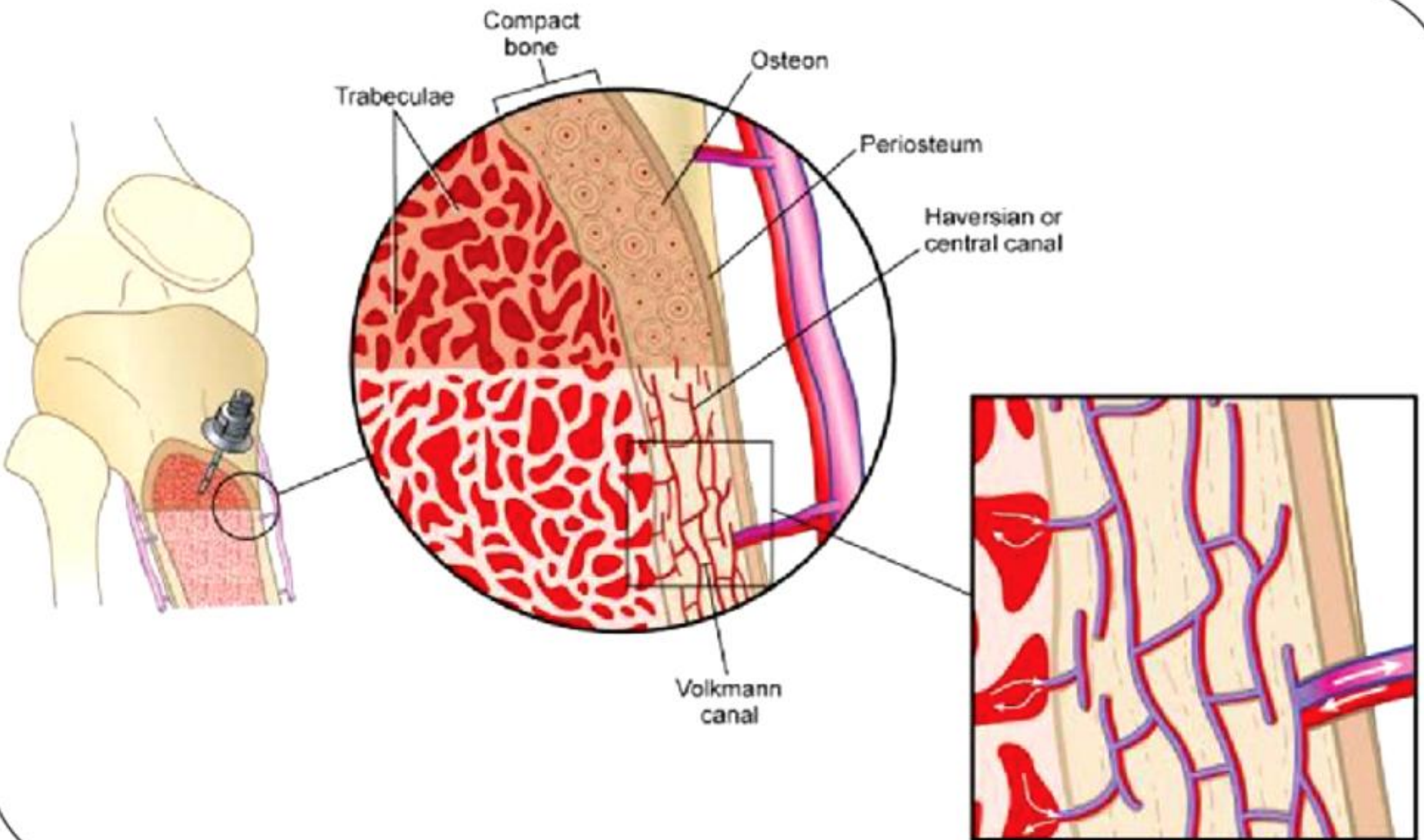
Who Needs an IO?

Acute patients who...

- ☀ Have limited or no vascular access
- ☀ Previously required central venous access for infusion due to difficult vascular access
- ☀ Have an immediate need for drugs or fluids
- ☀ Require multiple IV sticks to obtain vascular access for medication or fluid infusion
- ☀ Require rapid intubation or sedation
- ☀ Need access in emergencies
- ☀ Are in cardiac or respiratory arrest



Anatomy of Intraosseous Access

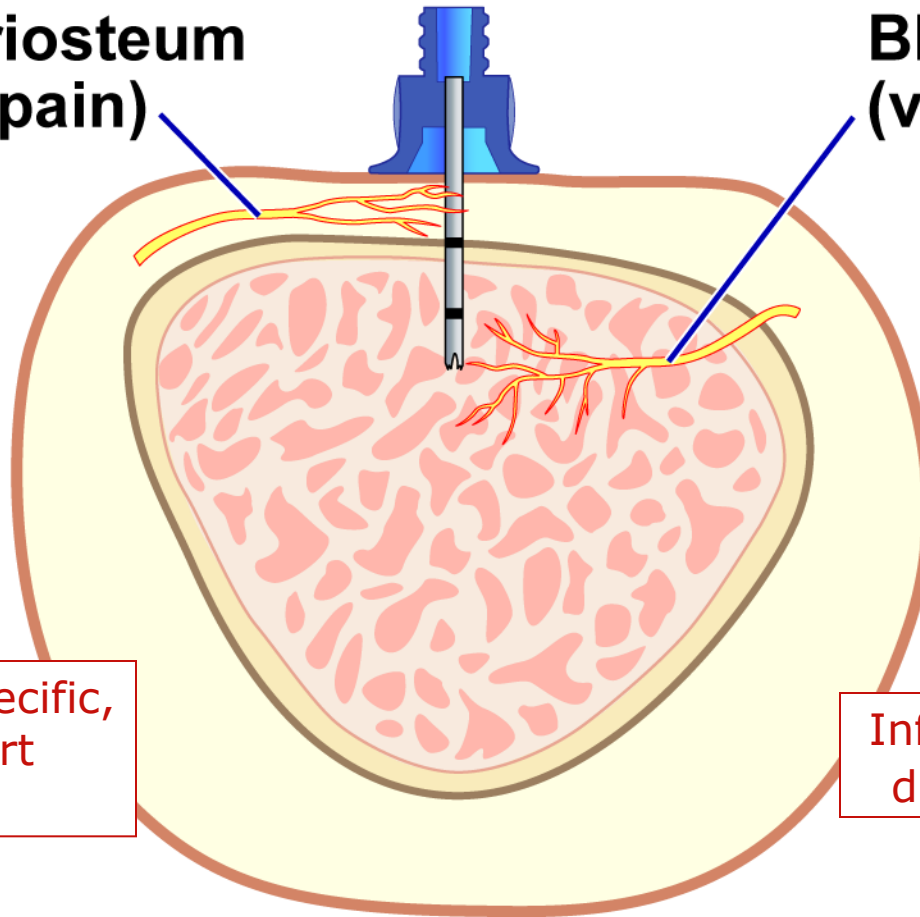


Thousands of small veins lead from the medullary space to the central circulation

Intraosseous Usage and Pain

**Pain Sensors
Skin and Periosteum
(somatic pain)**

**Pain Sensors
Blood vessels
(visceral pain)**



Insertion pain is specific,
local and of short
duration

Infusion pain is general,
diffuse and protracted

Peripheral Nerve Blockade :

Regional anesthetic procedures that inhibit conduction in fibers of the peripheral nervous system. It can be divided into:

Minor nerve blocks involve the blocking of single nerve entities such as the inferior alveolar nerve, mental nerve, ulnar or radial nerve.

Major nerve blocks involve the blocking of deeper nerves or trunks with a wide dermatomal distribution (e.g. brachial plexus blockade).

The commonly used LA agents are: Lidocaine, prilocaine, mepivacaine, and bupivacaine.

Some examples of blocks follows

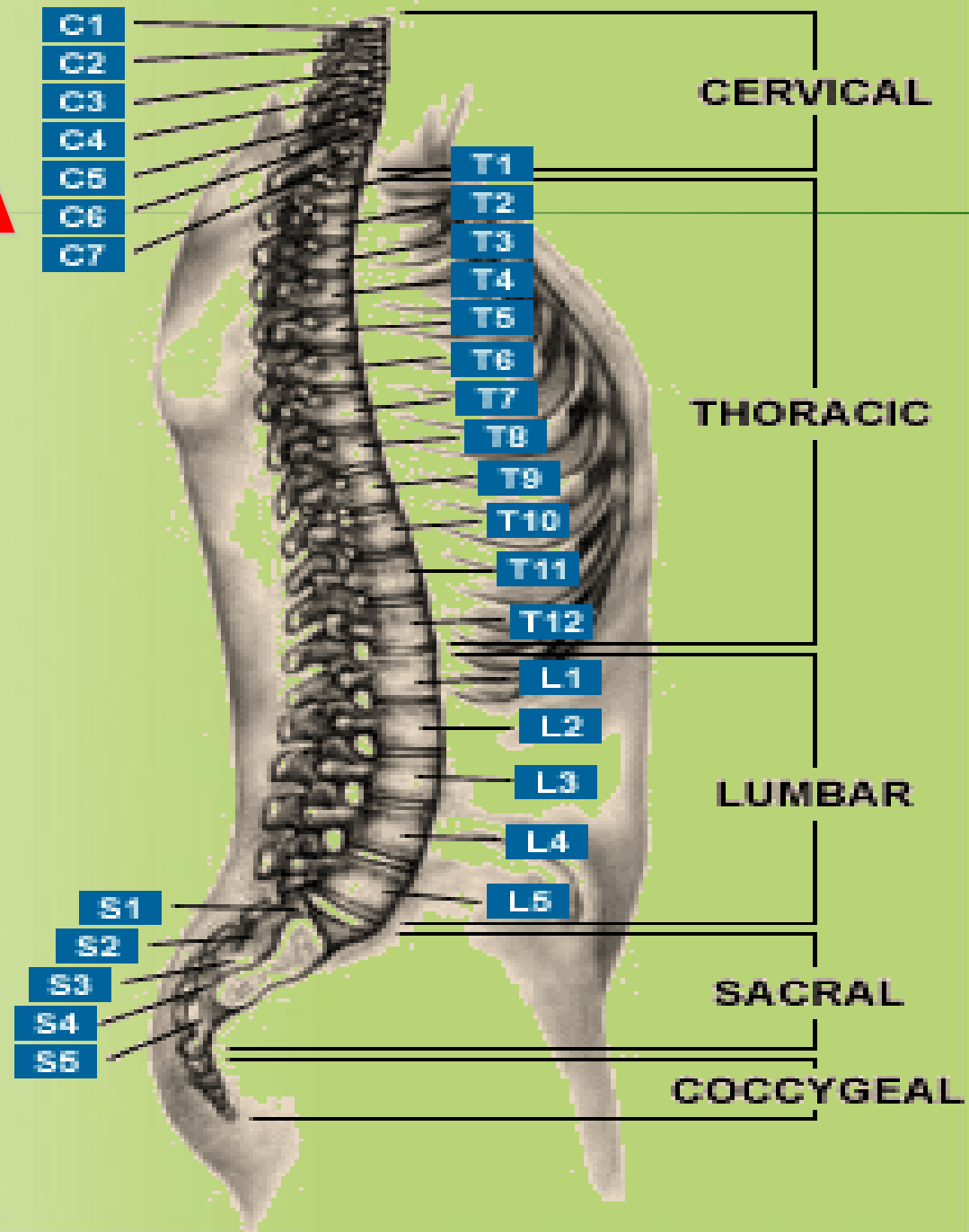
☀ 1. Surgical blocks

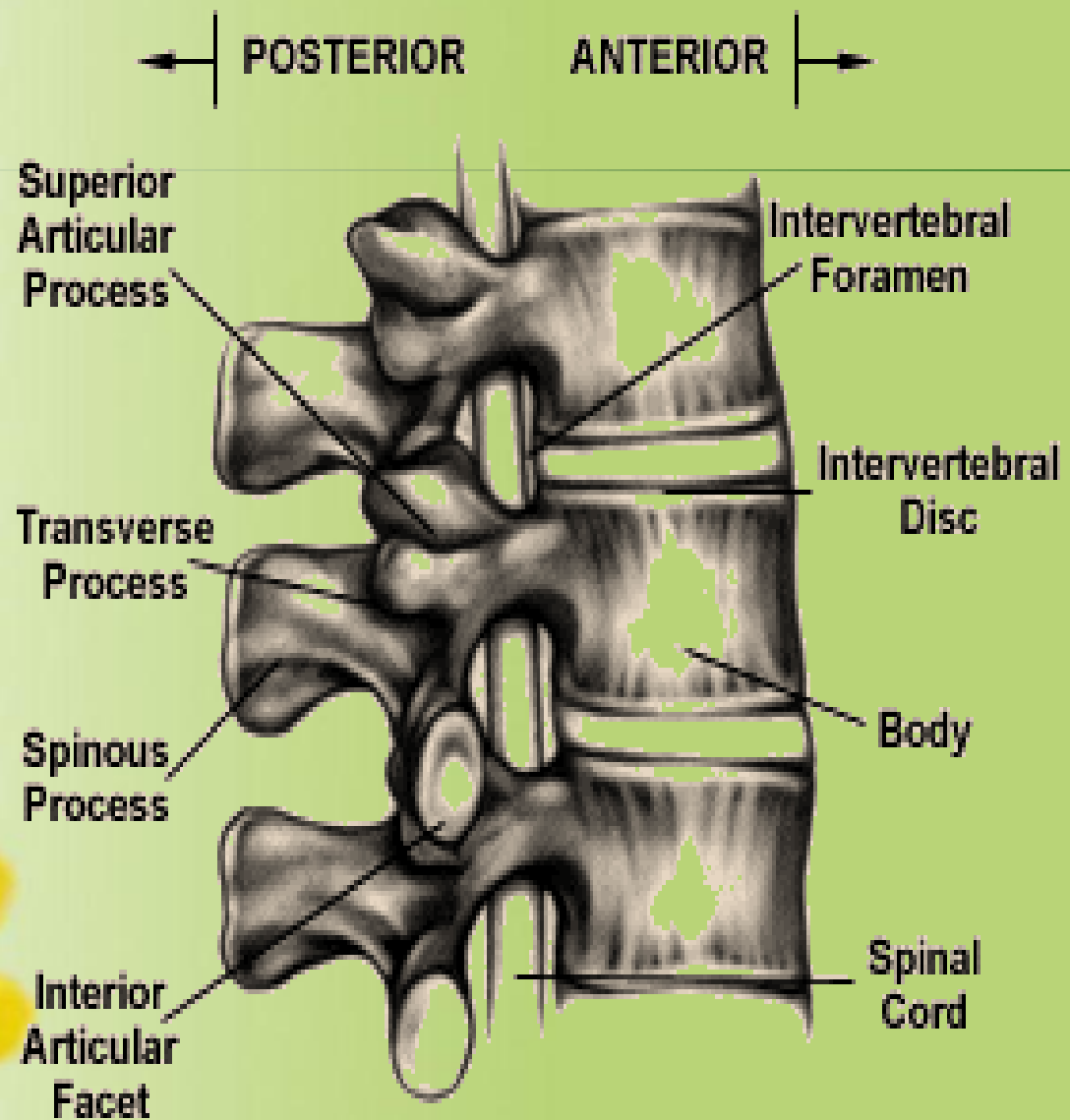
- a. **Paravertebral block of the cervical plexus** for procedures in the area between the jaw and the clavicle.
- b. **Intercostal block** for relatively superficial intraabdominal procedures, such as drain placement.
- c. **Branchial plexus or axillary block** for arm procedures.
- d. **Median, radial, or ulnar nerve block** for the elbow or wrist.
- e. **Hand and digital block** for fingers.
- f. Blocks in other specific areas, such as a **penile block** for circumcision in adults.

2. Diagnostic or therapeutic blocks

- ✱ a. **Sympathetic nerve ganglion block.**
- ✱ b. **Stellate ganglion block** to increase circulation in peripheral vascular disease in the head, neck, arm, or hand.
- ✱ c. **Paravertebral lumbar block** to increase circulation in the lower extremities.
- ✱ d. **Celiac block** for relief of abdominal pain of pancreatic origin.

SPINAL ANESTHESIA





Anatomy.

Skin.

Subcutaneous fats.

Supraspinous ligament.

Interspinous ligament.

Ligamentum flavum.

Epidural space.

Dura.

Subarachnoid space.

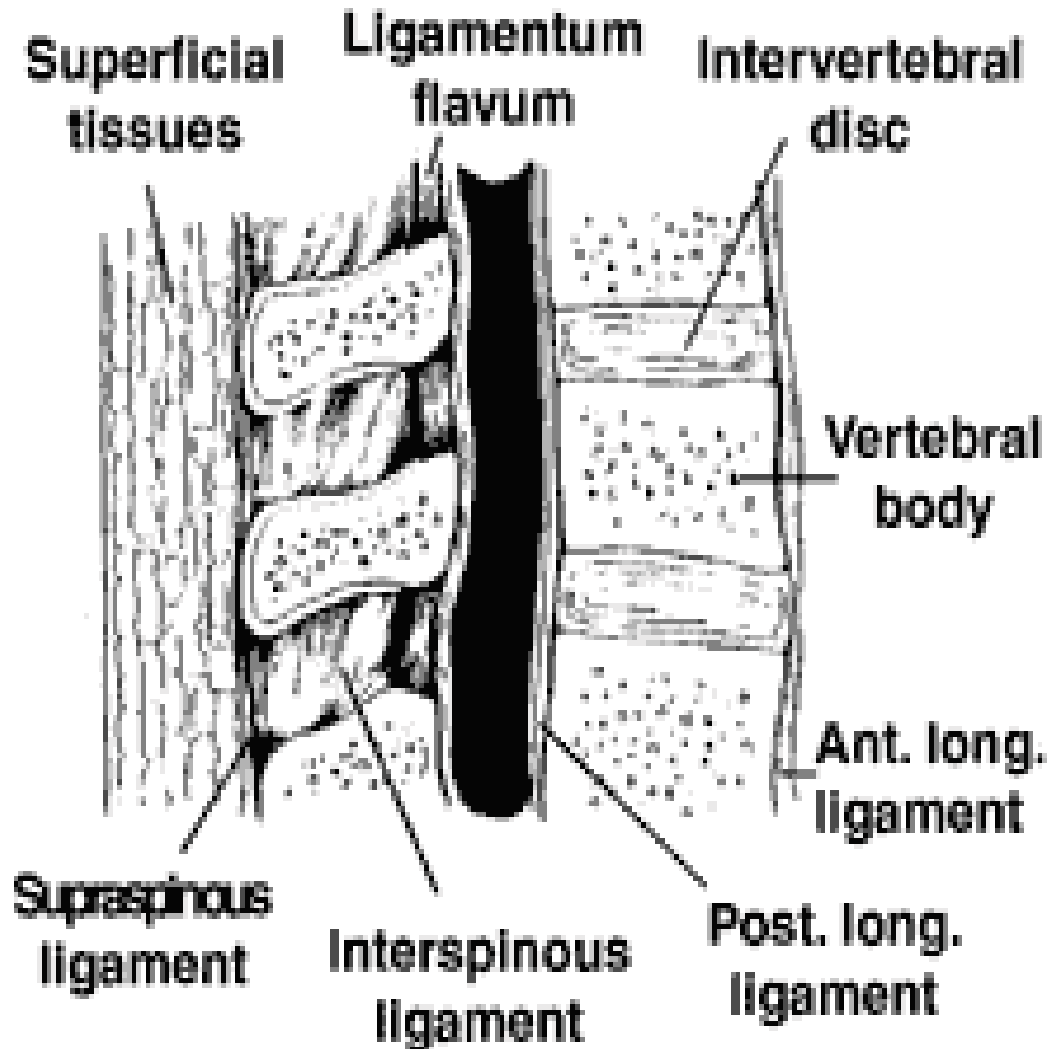



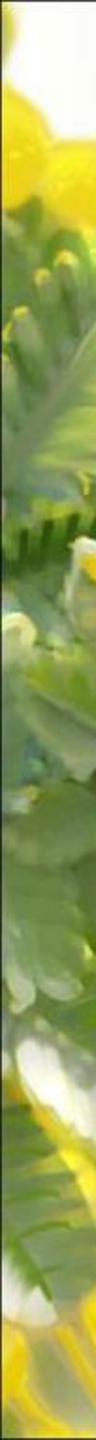
Fig 1

Section of lumbar vertebrae

- 
- ☀ The spinal cord usually **ends at the level of L1 in adults and L3 in children.**
 - ☀ Dural puncture above these levels is associated with a slight **risk of damaging the spinal cord** and is best avoided.
 - ☀ **An important landmark to remember is that a line joining the top of the iliac crests is at L4 to L4/5**

Mechanism of action

- ☀ Local anaesthetic solution injected into the subarachnoid space blocks conduction of impulses along all nerves with which it comes in contact, although some nerves are more easily blocked than others.
- ☀ There are three classes of nerve: motor, sensory and autonomic. Stimulation of the motor nerves causes muscles to contract and when they are blocked, muscle paralysis results. Sensory nerves transmit sensations such as touch and pain to the spinal cord and from there to the brain, whilst autonomic nerves control the calibre of blood vessels, heart rate, gut contraction.

- 
- ☀ Generally, autonomic and sensory fibres are blocked before motor fibres. This has several important consequences. For example, vasodilation and a drop in blood pressure may occur when the autonomic fibres are blocked.
 - ☀ **Practical implications of physiological changes.** The patient should be well hydrated before the local anaesthetic is injected and should have an intravenous infusion in place so that further fluids or vasoconstrictors can be given if hypotension occurs.



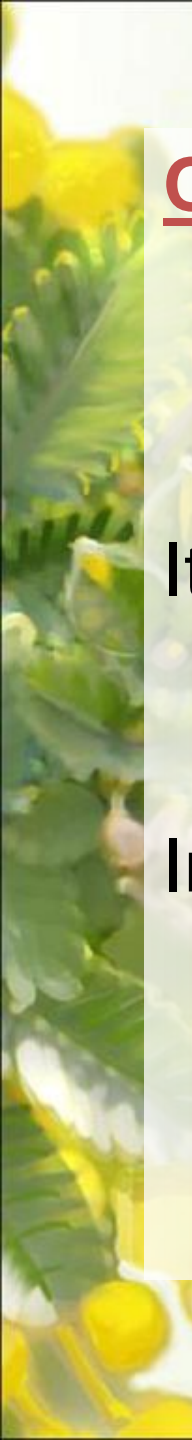
The Advantages of Spinal Anaesthesia

- 1. Cost..**
- 2. Patient satisfaction.**
- 3. Respiratory disease.**
- 4. Patent airway.**
- 5. Diabetic patients.**
- 6. Muscle relaxation.**
- 7. Blood loss during operation is less.**

Indications for Spinal Anaesthesia.

Spinal anaesthesia is **best reserved for operations below the umbilicus** e.g. hernia repairs, gynaecological and urological operations and any operation on the perineum or genitalia.

All operations on the leg are possible, but an **amputation**, though painless, may be an **unpleasant experience for an awake patient**.



Older patients and those with systemic disease such as chronic respiratory disease, hepatic, renal and endocrine disorders such as diabetes.

It is suitable for managing patients with **trauma** if they have been adequately resuscitated and are not hypovolaemic.

In **obstetrics**, it is ideal for manual **removal of a retained placenta** (again, provided there is no hypovolaemia).

Contra-indications to Spinal Anaesthesia.

☀ **Absolute:**

- ☀ 1. Inadequate resuscitative drugs and equipment.
- ☀ 2. Coagulopathy or other bleeding disorders.
- ☀ 3. Severe hypovolaemia. (Shock)
- ☀ 4. Patient refusal.
- ☀ 5. Increased Intracranial Pressure.
- ☀ 6. Severe aortic stenosis.
- ☀ 7. Severe Mitral stenosis.

Relative contraindication

- 1. Sepsis
- 2. Uncooperative patients.
- 3. Pre-existing neurological deficit.
- 4. Stenotic valvular heart disease.
- 5. Severe spinal deformities.
- 6. Lack of consent




Controversial indications

- 1. Prior back surgery at the site of injection.**
- 2. Inability to communicate with the patients.**
- 3. Complicated Surgery:**
 - Prolonged Surgery.**
 - Major Blood Loss.**

Local Anaesthetics for Spinal Anaesthesia.

- ☀ **Bupivacaine (Marcaine).** 0.5% hyperbaric (heavy) bupivacaine is the best agent to use if it is available. **0.5% plain bupivacaine is also popular.** Bupivacaine lasts longer than most other spinal anaesthetics: usually **2-3 hours.**
- ☀ **Lignocaine (Lidocaine/Xylocaine).** Best results are obtained with 5% hyperbaric (heavy) lignocaine which lasts 45-90 minutes.



Cinchocaine (Nupercaine, Dibucaine, Percaine, Sovcaine). 0.5% hyperbaric (heavy) solution is similar to bupivacaine.

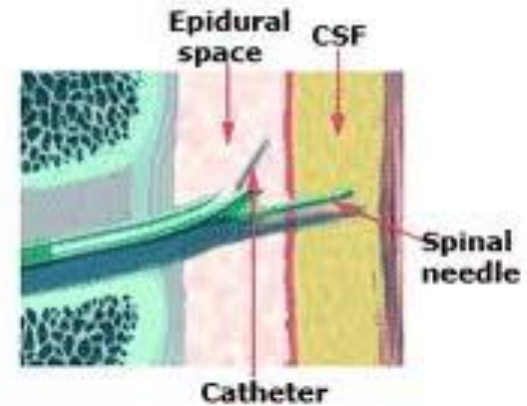
Amethocaine (Tetracaine, Pantocaine, Pontocaine, Decicain, Butethanol, Anethaine, Dikain). A 1% solution can be prepared with dextrose, saline or water for injection.

Mepivacaine (Scandicaine, Carbocaine, Meaverin). A 4% hyperbaric (heavy) solution is similar to lignocaine.

Position

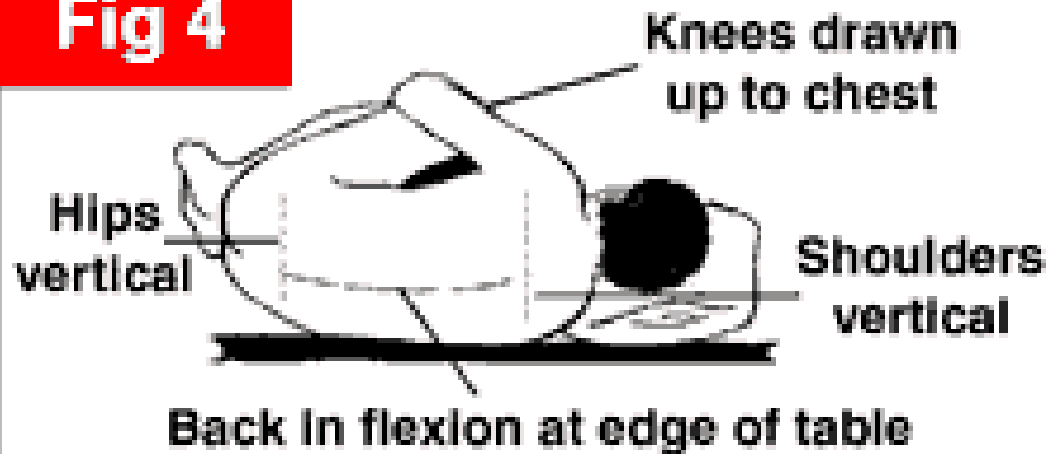


The anatomy of the combined spinal and epidural



1. Lateral (Lt lateral)
2. Sitting

Fig 4



Female



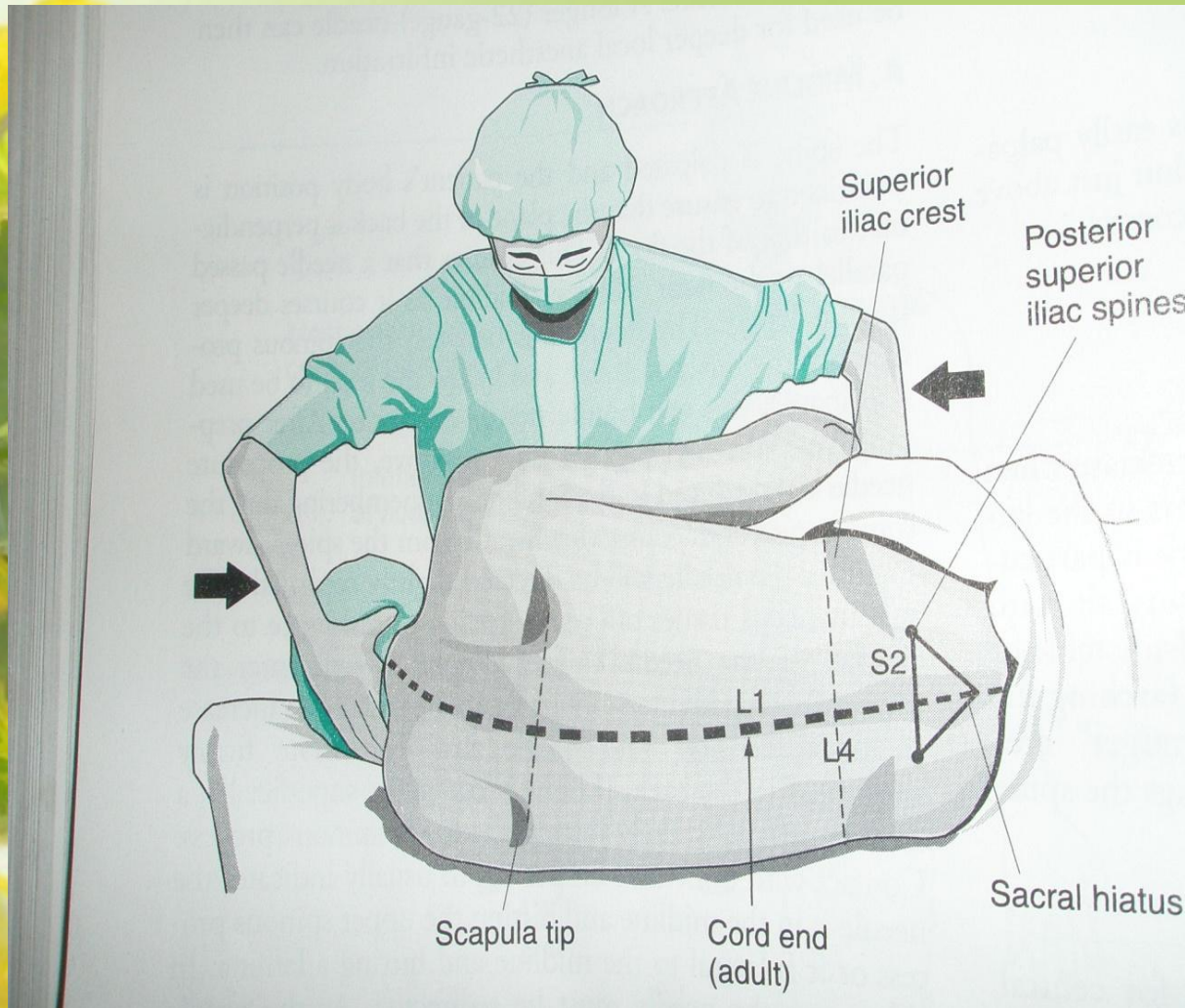
Male



Note how the level of the sub-arachnoid space varies

Males tend to have wider shoulders than hips and so are in a slight "head up" position when lying on their sides, whilst for **females with their wider hips**, the opposite is true.

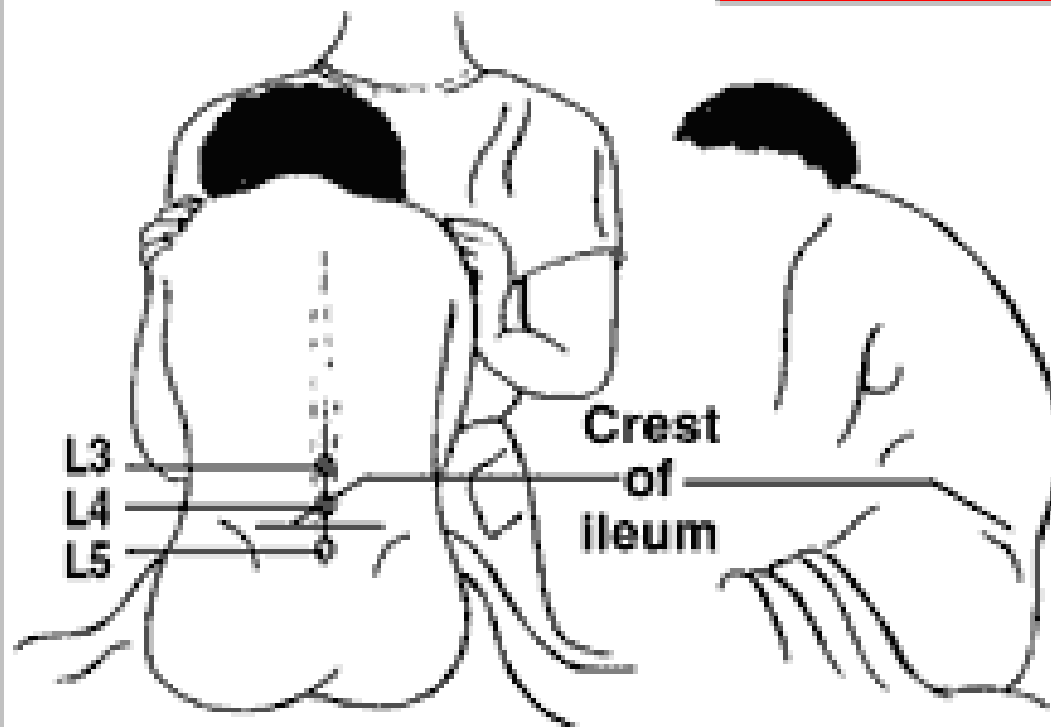
LEFT LATERAL POSITION



SITTING POSITION



Figure 3



Ideal sitting position for spinal anaesthesia

The sitting position is preferable in the obese whereas the lateral is better for uncooperative or sedated patients.



Factors Affecting the level of Spinal anesthesia

- **The baricity of the local anaesthetic solution.**
- **Dosage , concentration and volume injected .**
- **Site of injection.**
- **Position of the patient.**
 - During Injection.
 - Immediately after injection.
- **Patient Height.**

Complication

1.Immediate complication

- Hypotension and Cardiac arrest.
- Total spinal block leading to respiratory arrest.
- Urinary retention.
- Epidural hematoma, Bleeding.

2.Late complication

- Post dural puncture headache (PDPH)
- Backache
- Focal neurological deficit
- Bacterial meningitis

Treatment of Hypotension.

Hypotension is due to **vasodilation** and a functional **decrease in the effective circulating volume**.

1.vasoconstrictor drugs

- 2.All hypotensive patients should be given **OXYGEN** by mask until the blood pressure is restored.
3. **Raising their legs** thus **increasing the return of venous blood to the heart**.
- 4.**Increase the speed of the intravenous infusion** to maximum until the blood pressure is restored to acceptable levels.
5. **pulse is slow**, give **atropine** intravenously.

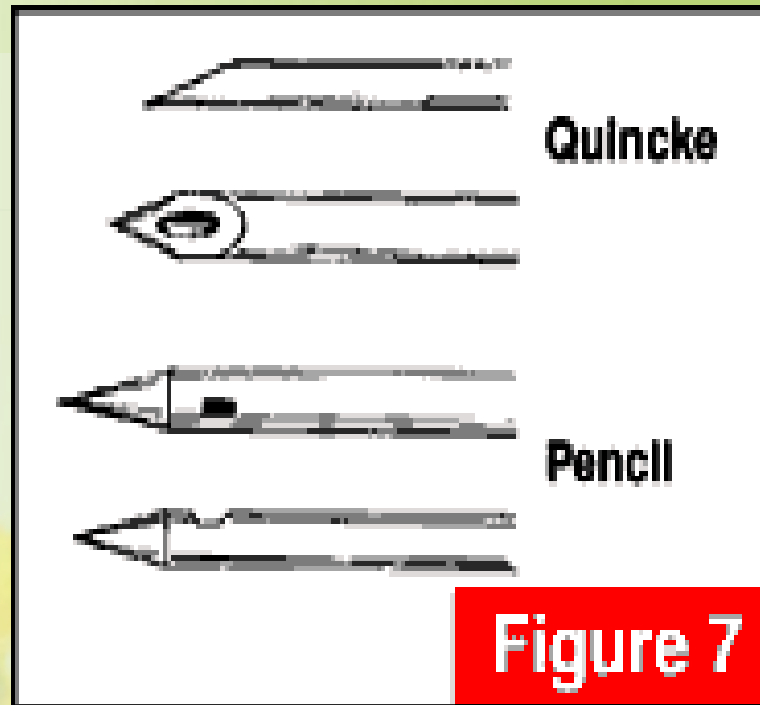
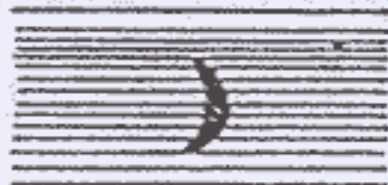


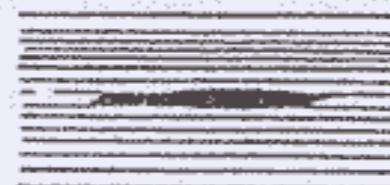
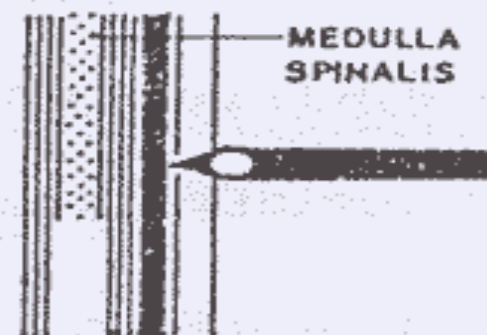
Figure 7

It is widely considered that **pencil-point needles (Whiteacre or Sprotte)** make a smaller hole in the dura and are associated with a lower incidence of headache (1%) than conventional **cutting-edged needles (Quincke)**

VERTICAL INSERTION



PARALLEL INSERTION

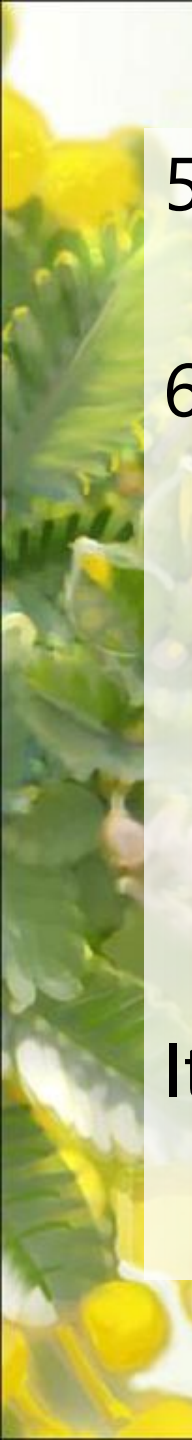


DURAL HOLE



Treatment of spinal headache.

1. Remain **lying flat in bed** as this relieves the pain.
2. They should be encouraged to **drink** freely or, if necessary, be given **intravenous fluids to maintain adequate hydration**.
3. **Simple analgesics** such as paracetamol, aspirin or codeine may be helpful,

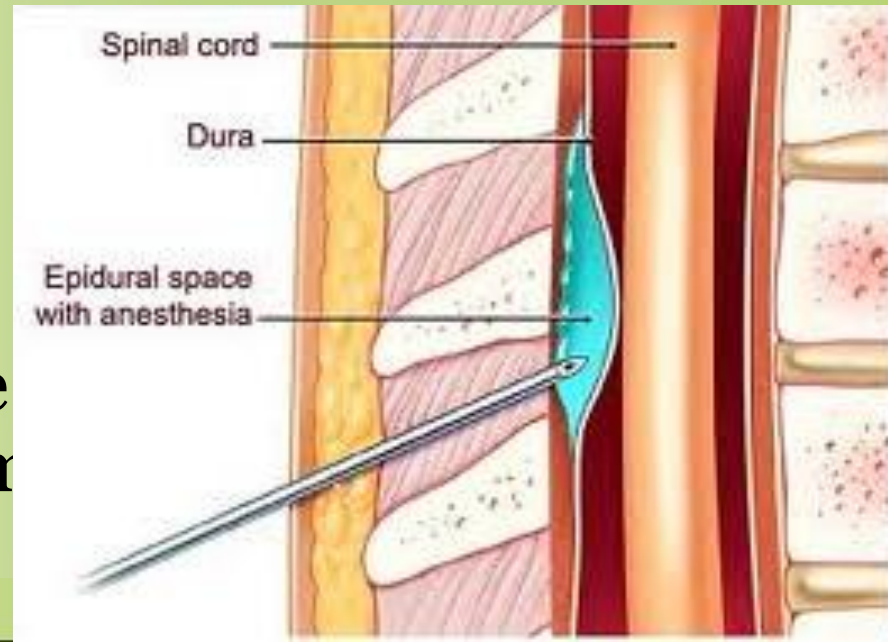
- 
5. **Caffeine containing drinks** such as tea, coffee or Coca-Cola are often helpful.
 6. **Prolonged or severe headaches** may be treated with **epidural blood patch** performed by aseptically injecting 15-20ml of the patient's own blood into the epidural space. This then **clots and seals the hole and prevents further leakage of CSF.**

It used to be thought that bedrest for 24 hours following a spinal anaesthetic would help reduce the incidence of headache.

Epidural anesthesia

☀ ***Epidural anesthesia*** - a local anesthetic is injected into the epidural space where it acts primarily on the spinal nerve roots. Depending on the site of injection and the volume injected, the anesthetized area varies from limited areas of the abdomen or chest to large regions

- ☀ of the body.
- ☀ Epidural anaesthesia can
- ☀ be used as sole anaesthetic
- ☀ for procedures involving the
- ☀ lower limbs, pelvis, perineum
- ☀ and lower abdomen.



☀ Epidural anesthesia is regional anesthesia that blocks pain in a particular region of the body. The goal of an epidural is to provide analgesia, or pain relief, rather than anesthesia which leads to total lack of feeling. Epidurals block the nerve impulses **from the lower** spinal segments. This results in decreased sensation in the lower half of the body.

☀ Epidural medications fall into a class of drugs called local anesthetics, such as bupivacaine, chloroprocaine, or lidocaine. They are often delivered in combination with opioids or narcotics such as fentanyl and sufentanil in order to decrease the required dose of local anesthetic. This produces pain relief with minimal effects. These medications may be used in combination with epinephrine, fentanyl, morphine, or clonidine to prolong the epidural's effect or to stabilize the patient's blood pressure.

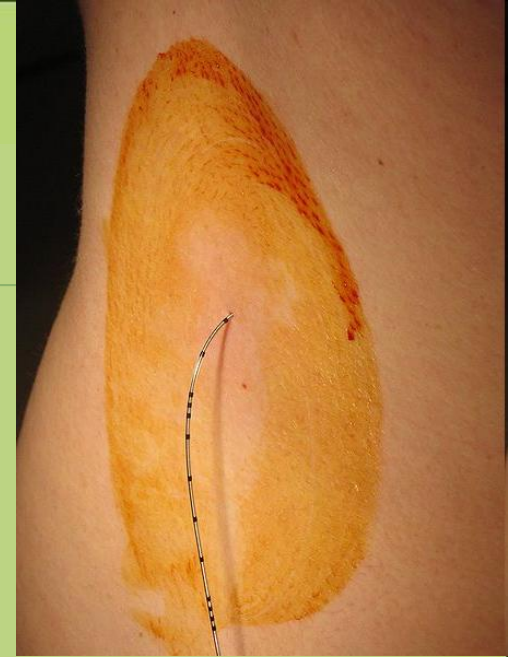
Difference..

For an epidural:

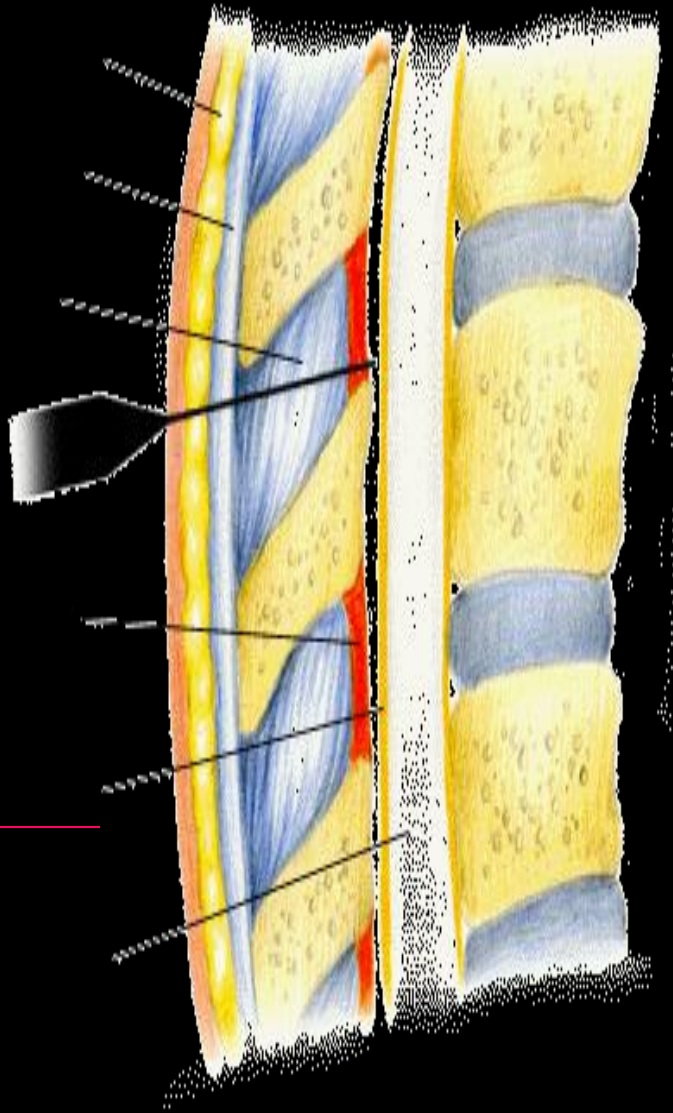
- ☀ The doctor will inject medicine just outside of the sac of fluid around your spinal cord. This is called the epidural space.
- ☀ The medicine numbs, or blocks feeling in a certain part of your body so that you cannot feel pain. The medicine begins to take effect in about 10 to 20 minutes. It works well for longer procedures. Women often have epidurals during childbirth.
- ☀ A small tube (catheter) is often left in place. You can receive more medicine through the catheter to help control your pain during or after your procedure.

For a spinal:

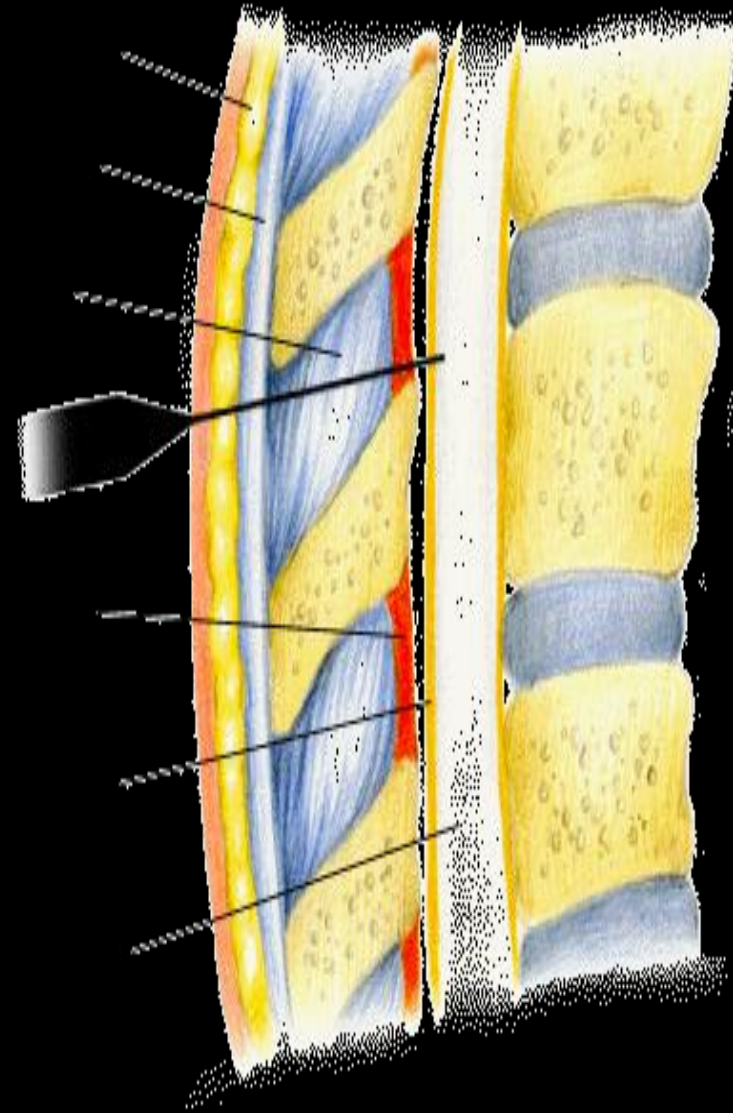
- ☀ The anesthesiologist will inject medicine into the fluid in your spinal cord. This is usually done only once, so you will not need to have a catheter placed.
- ☀ The medicine begins to take effect right away. It works well for shorter and simpler procedures.



EPIDURAL



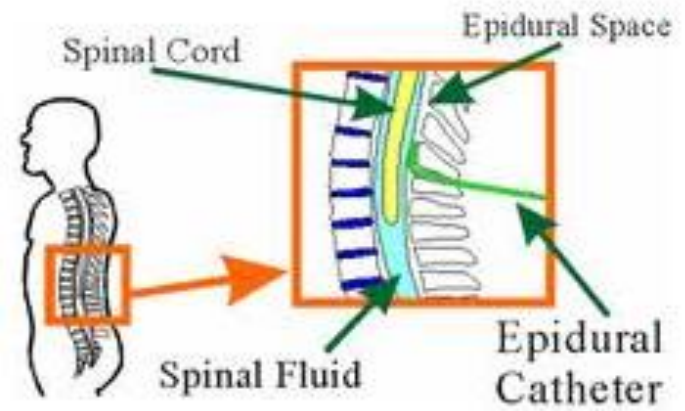
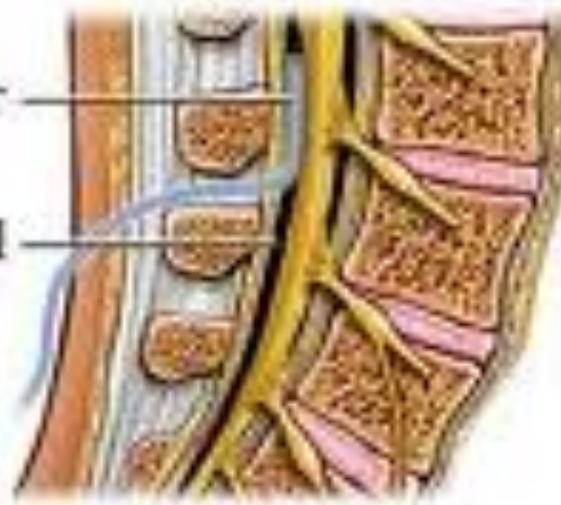
Spinal





Catheter

Epidural space



Positions for an epidural



Sitting up



Lying on side

Specific uses

- ☀ **Hip and knee surgery.** Internal fixation of a fractured hip is associated with less blood loss when central neuraxial block is used. The rate of deep venous thrombosis is reduced in patients undergoing total hip and knee replacement, when epidural anaesthesia is used.
- ☀ **Vascular reconstruction of the lower limbs.** Epidural anaesthesia improves distal blood flow in patients undergoing arterial reconstruction surgery.
- ☀ **Amputation.** Patients given epidural anaesthesia 48-72 hours prior to lower limb amputation may have a lower incidence of phantom limb pain following surgery, although this has not been substantiated.
- ☀ **Obstetrics.** Epidural analgesia is indicated in obstetric patients in difficult or high-risk labour, e.g. breech, twin pregnancy, pre-eclampsia and prolonged labour. Furthermore, Caesarean section performed under central neuraxial block is associated with a lower maternal mortality owing to anaesthetic factors than under general anaesthetic.

☀ Low concentration local anaesthetics, opioids, or combinations of both are effective **in the control of postoperative pain** in patients undergoing abdominal and thoracic procedures. Epidural analgesia has been shown to minimise the effects of surgery on cardiopulmonary reserve, i.e. diaphragmatic splinting and the inability to cough adequately, in patients with compromised respiratory function, such as those with chronic obstructive airway disease, morbid obesity and in the elderly. Epidural analgesia allows earlier mobilization, reduces the risk of deep venous thrombosis, and allows better cooperation with chest physiotherapy, preventing chest infections.

☀ **Thoracic trauma with rib or sternum fractures.** Adequate analgesia in patients with thoracic trauma improves respiratory function by allowing the patient to breathe adequately, cough and cooperate with chest physiotherapy

Contraindications

Absolute

- ☀ **Patient refusal**
- ☀ **Coagulopathy.** Insertion of an epidural needle or catheter into the epidural space may cause traumatic bleeding into the epidural space. Clotting abnormalities may lead to the development of a large haematoma leading to spinal cord compression.
- ☀ **Therapeutic anticoagulation.** As above
- ☀ **Skin infection at injection site.** Insertion of the epidural needle through an area of skin infection may introduce pathogenic bacteria into the epidural space, leading to serious complications such as meningitis or epidural abscess.
- ☀ **Raised intracranial pressure.** Accidental dural puncture in a patient with raised ICP may lead to brainstem herniation (coning).
- ☀ **Hypovolaemia.** The sympathetic blockade produced by epidurals, in combination with uncorrected hypovolaemia, may cause profound circulatory collapse.

Contraindications

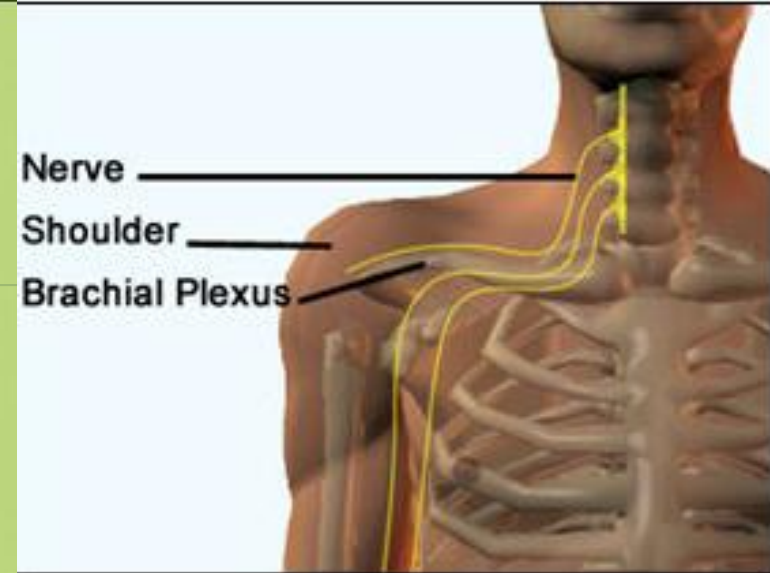
Relative

- ✱ **Uncooperative patients** may be impossible to position correctly, and be unable to remain still enough to safely insert an epidural.
- ✱ **Pre-existing neurological disorders**, such as multiple sclerosis, may be a contraindication, because any new neurological symptoms may be ascribed to the epidural.
- ✱ **Fixed cardiac output states.** Probably relative rather than absolute. This includes aortic stenosis, hypertrophic obstructive cardiomyopathy (HOCM), mitral stenosis and complete heart block. Patients with these cardiovascular abnormalities are unable to increase their cardiac output in response to the peripheral vasodilatation caused by epidural blockade, and may develop profound circulatory collapse which is very difficult to treat.
- ✱ **Anatomical abnormalities of vertebral column** may make the placement of an epidural technically impossible.
- ✱ **Prophylactic low dose heparin** (see discussion below)

Interscalene block

☀ An interscalene block is an injection of local anaesthetic **into the base of the neck**. It numbs the nerves that go to the shoulder. This is one of many types of nerve block. This particular nerve block is usually used as part of an anaesthetic for an operation on the shoulder. It can also be used for an operation on the arm or hand.

☀ The block usually lasts for several hours. Shoulder will be numb and feel heavy during this time. One advantage of the block is that it reduces the amount of other strong painkillers, such as morphine, needed during and after the operation.

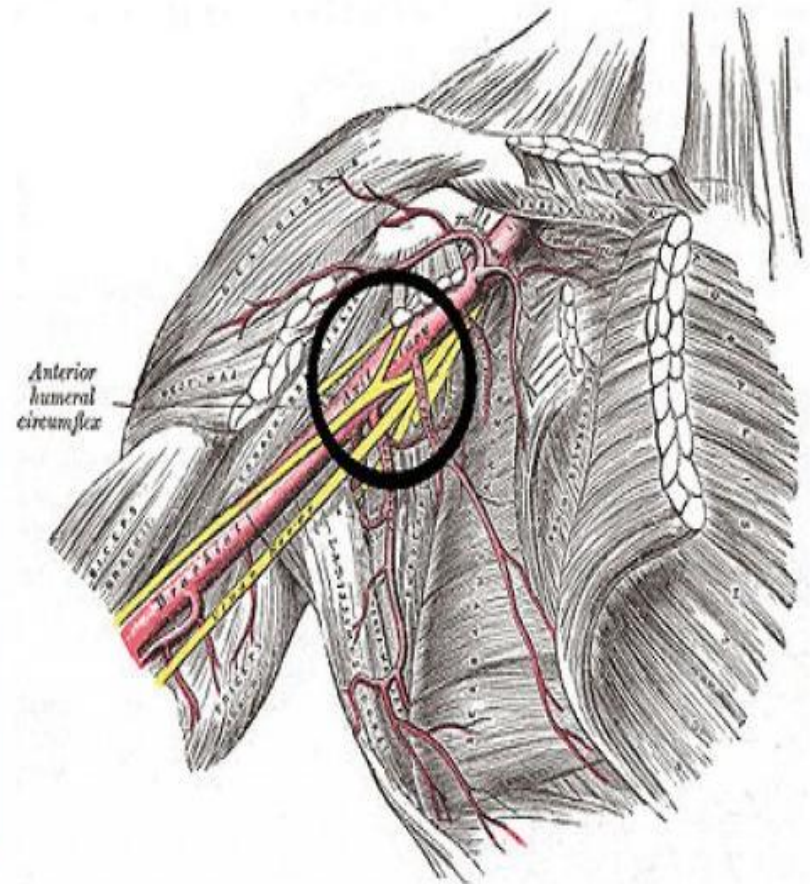


☀ The nerve block may be used with a general anaesthetic, in which case you will be asleep for the nerve block. If the block is instead of a general anaesthetic, you will be awake, or sedated (sleepy).

Interscalene Brachial Plexus Block

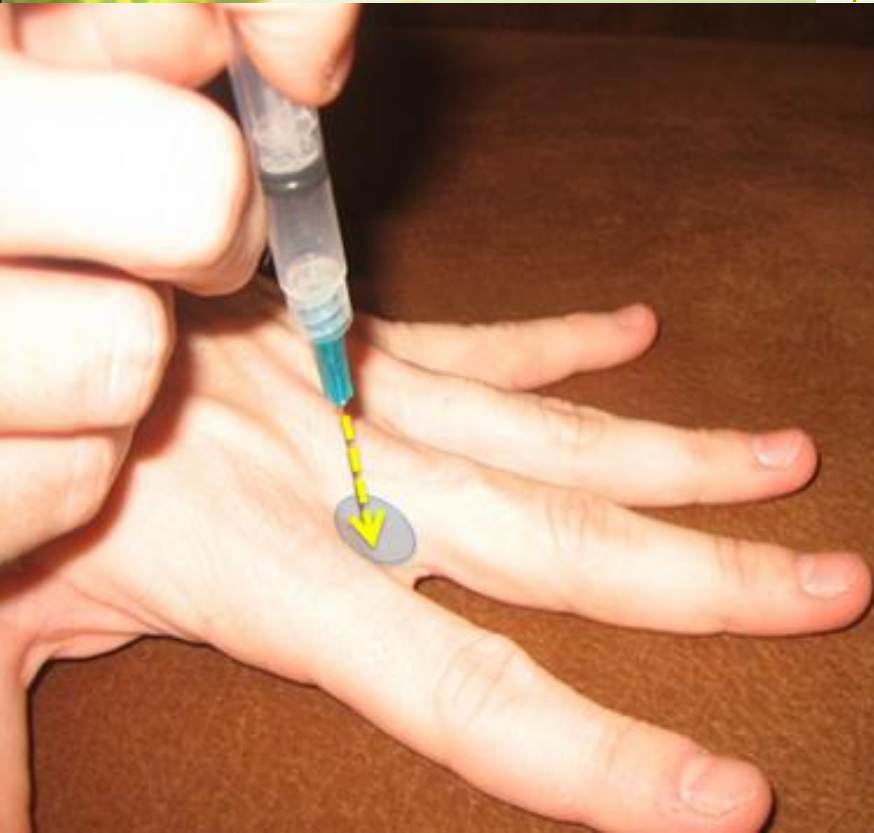


Axillary Nerve Block



The bundle of nerves supplying the arm are accessible at various spots in the neck and under the arm. Axillary blocks target the nerves that give sensation to the lower part of the arm, the forearm. The under arm location is the best spot to numb these nerves.

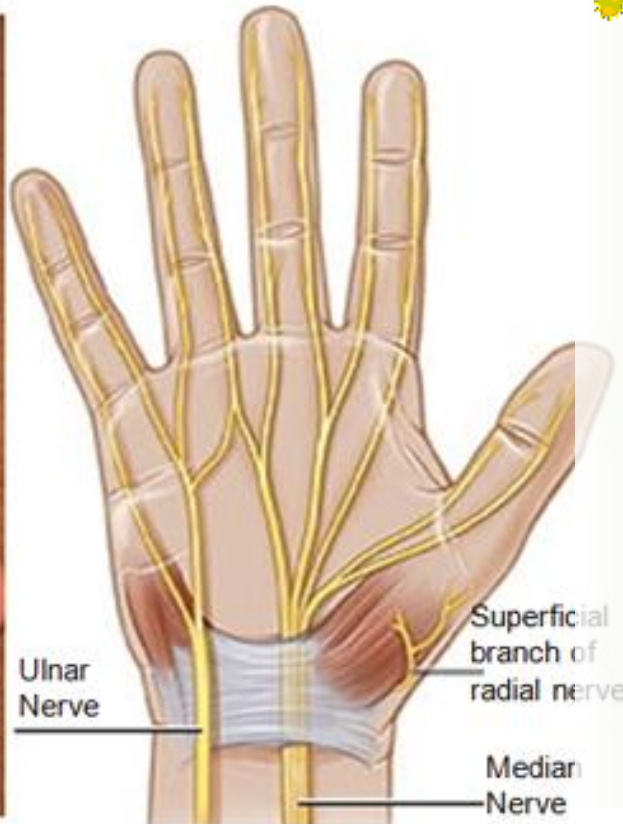
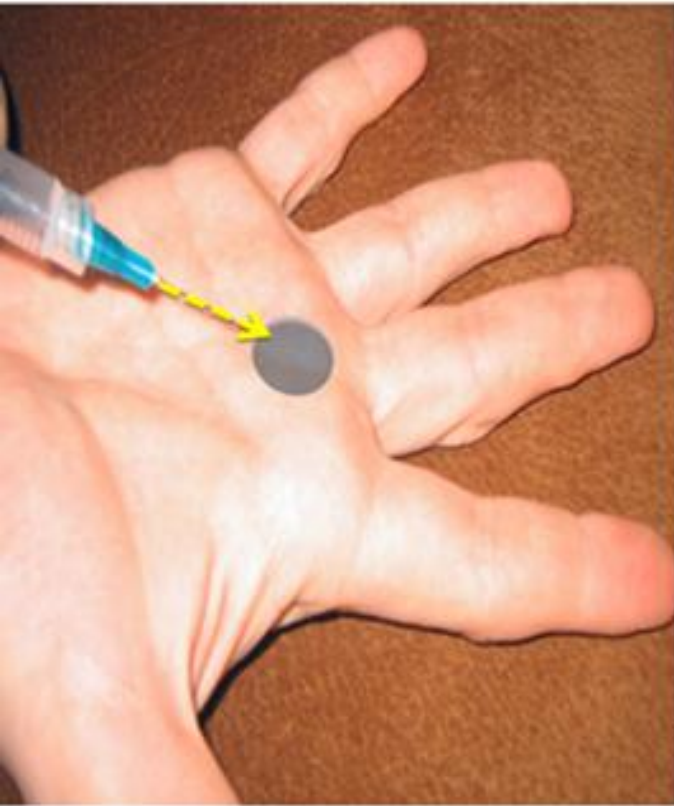
Web-space block



The web-space block is effective in obtaining anesthesia and is the least painful. With the hand palm-down, hold the syringe perpendicular to the digit and insert the needle into the web space, just distal to the metacarpal-phalangeal (MCP) joint (left-hand image). Advance the needle straight down toward the volar aspect of the web space without piercing the volar surface. Slowly inject anesthetic infiltrating the surrounding tissues of the web space as the needle is withdrawn. Repeat the procedure on the opposite web space of the involved digit.



Transthecal block

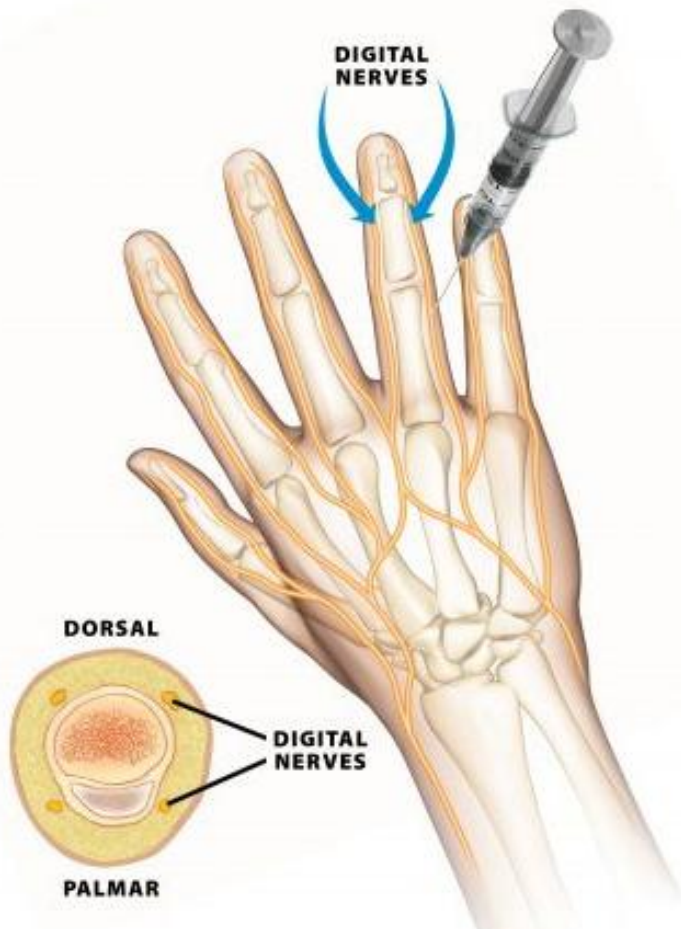


Total analgesia of a digit can be achieved rapidly with a transthecal block. With the patient's hand palm-up, palpate the flexor tendon just proximal to the MCP joint. The skin is penetrated at an angle of 45° at the level of the distal skin crease of the palm (left-hand image) just proximal to the MCP joint, and the needle is advanced to the level of the flexor tendon sheath.



Total analgesia of a digit can be achieved rapidly with a transthecal block. With the patient's hand palm-up, palpate the flexor tendon just proximal to the MCP joint. The skin is penetrated at an angle of 45° at the level of the distal skin crease of the palm (left-hand image) just proximal to the MCP joint, and the needle is advanced to the level of the flexor tendon sheath. If the sheath has been entered correctly, injection of the anesthetic should flow freely. If this does not occur, it is likely that the tendon has not been entered and the needle should be withdrawn gradually, maintaining pressure on the syringe, until free flow of local anesthesia commences. The right-hand image shows the palmar and digital branches of the ulnar and median nerves.

Digital Nerve Block (Upper Extremity)



This is a block that is useful for **any type of digital surgery**. It is commonly performed in emergency departments for laceration washout and repair. The fingers have a nerve supply originating from the median and ulnar nerves. They form the proper palmar digital nerves which are located on each side of the flexor tendon sheath and the dorsal digital nerves which are located on the dorsolateral and dorsomedial aspect of the finger. Each nerve occupies a "corner" of the finger and accompanies an artery and vein



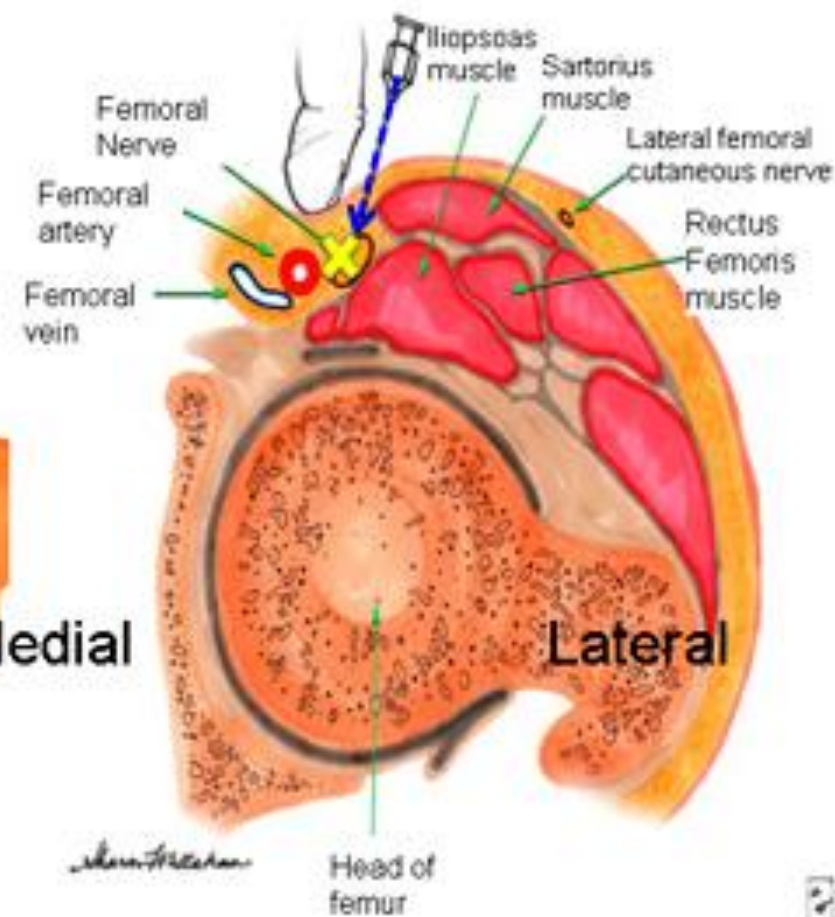
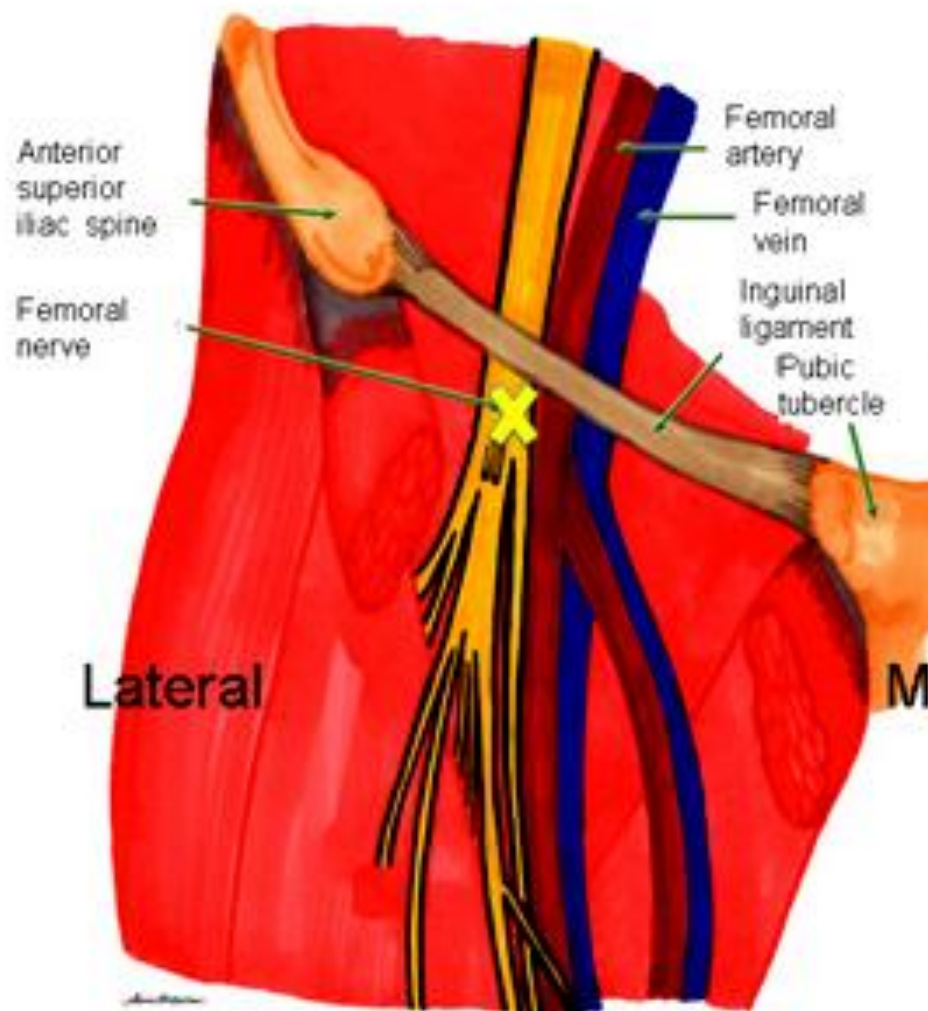
☀ The hand after being prepped should be pronated. The needle used should be short beveled and high gauged. The dorsolateral and dorsomedial borders of the proximal phalanx distal to the metocarpophalangeal joint are the entry points for the needle. A small skin wheal should be made at each entry point. The needle is inserted and contact with the phalanx should be made. Local anesthetic should be injected (1 mL) as the needle is withdrawn 1-2 mm from the bone. As the needle is withdrawn an additional 1 mL of local anesthetic should be injected. The process should be performed **on the opposite side of the proximal phalanx to ensure total digital anesthesia**. Nerve injury is the primary complication that can arise. This can result from using volumes of local anesthetic that are too

Femoral Block

femoral nerve block is a basic nerve block technique that is easy to master, carries a low risk of complications, and has a significant clinical applicability for surgical anesthesia and post-operative pain management.



This block is well suited for surgery such on the anterior thigh, knee, quadriceps tendon repair, and postoperative pain management after femur and knee surgery. When combined with a block of the sciatic nerve, anesthesia of almost the entire lower extremity from the mid-thigh level can be achieved. The success rate of this block for surgery is very high, nearing 95%.



Popliteal Block

☀ The popliteal nerve block is a block of the sciatic nerve in the popliteal fossa with the patient in the prone position. The block is ideal for surgeries of the lower leg, particularly the foot and ankle. It anesthetizes the same dermatomes as both the anterior and lateral approaches to the sciatic nerve. Unlike more proximal approaches to the sciatic nerve, the popliteal nerve block preserves hamstring function, allowing easier ambulation of the postoperative patient. Even so, patients should be cautioned against bearing weight on the blocked lower extremity for 24 hours, as with all blocks of the sciatic nerve.



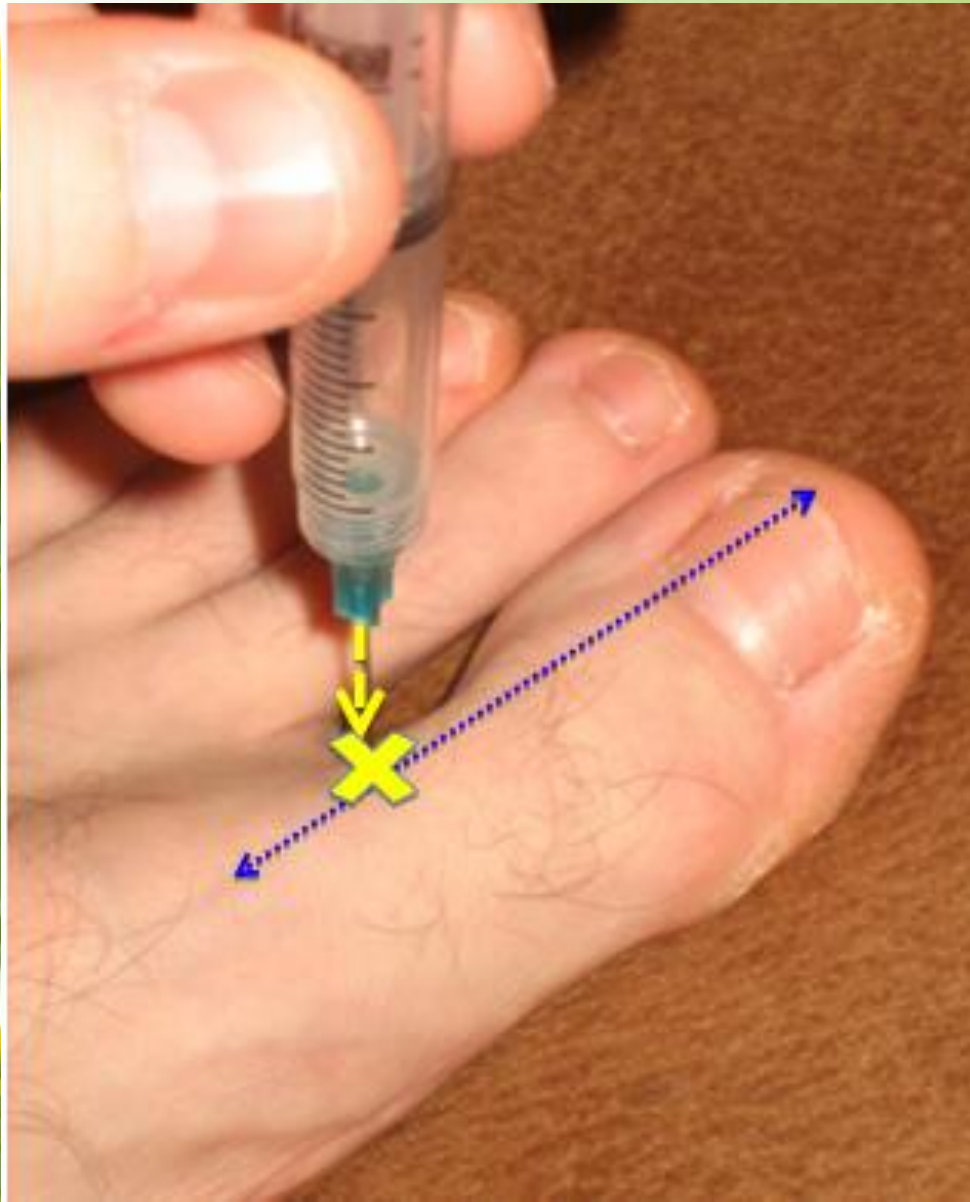
3-sided digital block of the great toe



☀ The 3-sided digital block is useful for anesthetizing the great toe. First insert the needle at 90° at the medial aspect of the digit, just distal to the metatarsal-phalangeal joint. Advance the needle toward the plantar side without piercing the volar skin, then slowly inject the anesthetic as the needle is withdrawn.

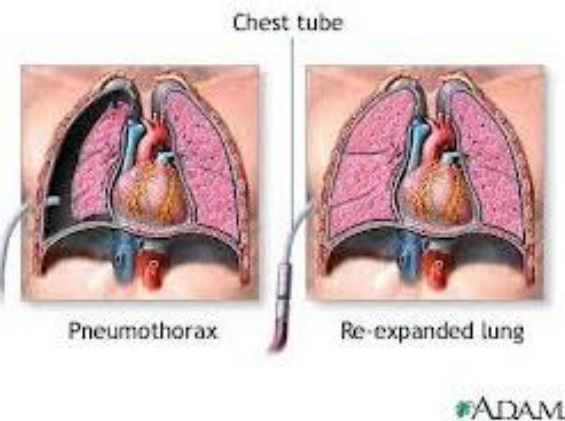
☀ Redirect the needle medially and advance the needle from the medial to the lateral side. Slowly inject the anesthetic as the needle is withdrawn.





☀ With the needle at 90° , make another injection over the already anesthetized skin at the lateral aspect of the digit and, once again, advance the needle toward the plantar side without piercing the volar skin, then slowly inject the anesthetic as the needle is withdrawn.

Local anesthesia of body cavities

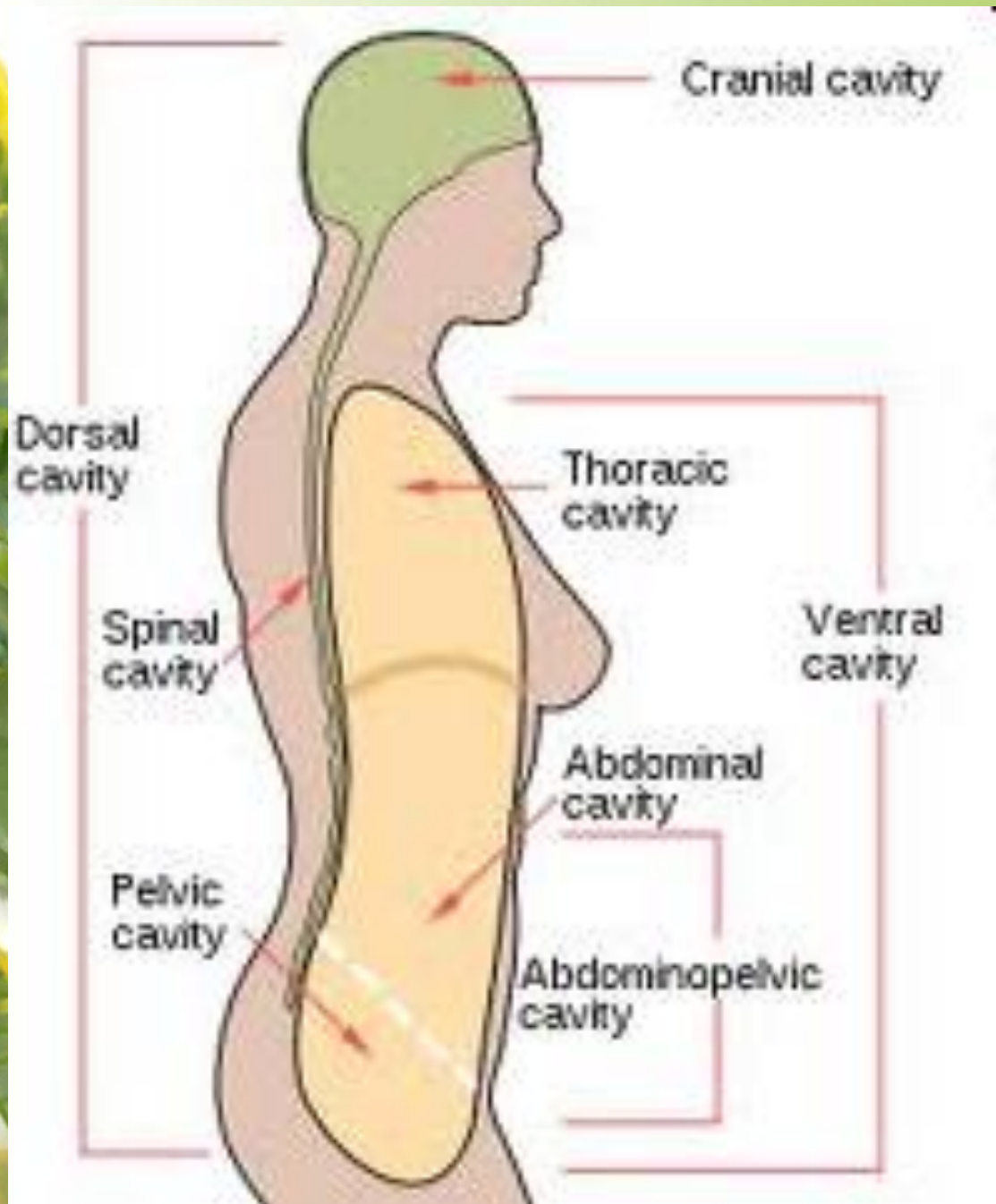


- ✱ Intrapleural anesthesia,
- ✱ Sinus cavities anesthesia
- ✱ Oral cavity anesthesia,
- ✱ intraarticular anesthesia



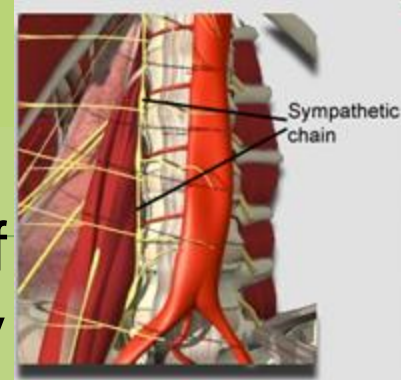
(intraarticular injection, the injection of a medication into a joint space, usually to reduce inflammation, such as in bursitis or fibromyositis. With the same technique abnormally excessive fluid may be withdrawn from the joint space. The fluid may be a result of trauma or inflammation. The local intra-articular injection **of anesthetic agents** is a widespread practice following arthroscopic surgery)





Schema of Human body cavities

Sympathetic block:



- ☀ The sympathetic nerves are a group of nerves run in front of the spinal column. They are part of the autonomic nervous system and control many types of bodily functions such as sweating, blood pressure and digestion. Occasionally, these nerves can be injured causing pain.
- ☀ **Celiac plexis/ Splanchnic nerve block** -Sympathetic nerve block injections applied to the upper abdomen to treat pain related to pancreatitis or pancreatic cancer
- ☀ **Lumbar sympathetic block** -Applied to the lower back to treat CRPS, formerly known as causalgia in the lower legs.
- ☀ **Hypogastric block** -Injections delivered to the lowest part of the back to treat pelvic and anal pain
- ☀ **Ganglion of Impar block**-A sympathetic nerve block delivered by injection to treat anal pain



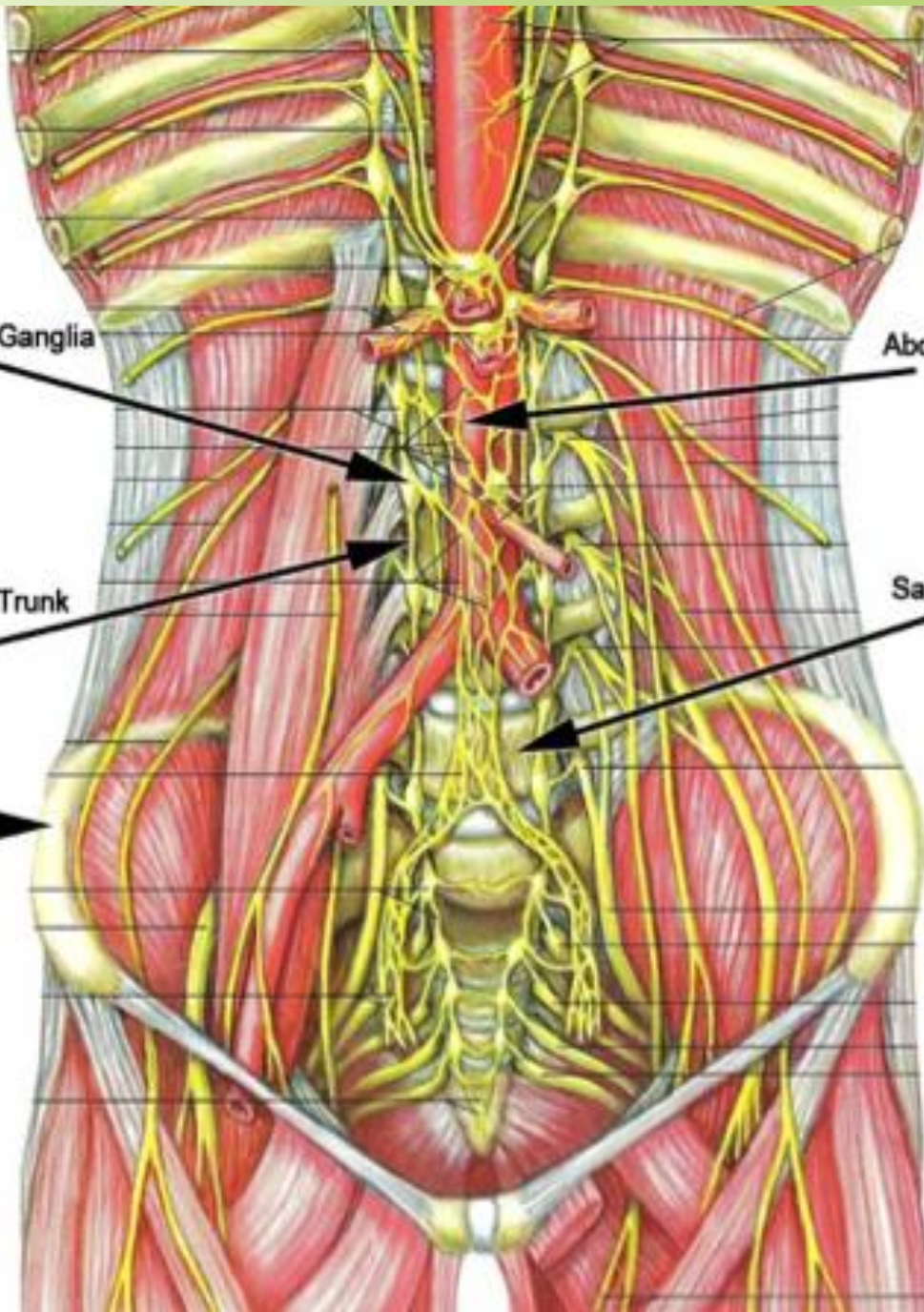
Lumbar Sympathetic Ganglia

Abdominal Aorta

Lumbar Sympathetic Trunk

Sacral Vertebral Body

Pelvic Bone





END

THANK YOU