Spinal and Epidural Anesthesia

1. Definition

2. Advantages

3. Indications and Contra-indications

4. Local Anaesthetics for Spinal Anaesthesia.
The vertebral column consists of 33 vertebrae: 7 cervical, 12 thoracic, 5 lumbar, 5 sacral, and 4 coccygeal segments. The vertebral column usually contains three curves. The cervical and lumbar curves are convex anteriorly, and the thoracic curve is convex posteriorly.
Five ligaments hold the spinal column together. The **supraspinous ligaments** connect the apices of the spinous processes from the seventh cervical vertebra (C7) to the sacrum. The supraspinous ligament is known as the **ligamentum nuchae** in the area above C7. The **interspinous ligaments** connect the spinous processes together. The **ligamentum flavum**, or yellow ligament, connects the laminae above and below together. Finally, the **posterior and anterior longitudinal ligaments** bind the vertebral bodies together.
The three membranes that protect the spinal cord are the dura mater, arachnoid mater, and pia mater. The **dura mater**, or tough mother, is the outermost layer. The **dural sac** extends to the second sacral vertebra (S2). The **arachnoid mater** is the middle layer, and the subdural space lies between the dural mater and arachnoid mater. The arachnoid mater, or cobweb mother, also ends at S2, like the dural sac. The **pia mater**, or soft mother, clings to the surface of the spinal cord and ends in the filum terminale, which helps to hold the spinal cord to the sacrum.

The space between the arachnoid and pia mater is known as the subarachnoid space, and spinal nerves run in this space, as does CSF.
Spinal Cord

- Extends from foramen magnum to:
  - **Adult**: lower border of L1 in / upper border of L2
  - **Infants/children**: L3
- It is about **45 cm** long
- **Duramater, Subarachnoid space & subdural space**: S2 in adults( S3 in children)

  S. C gives **31 pairs** of spinal nerve

  An extension of piamater, the **FILUM TERMINALE** penetrate the dura and attach the terminal end of spinal cord [**conus medullaris**] to the periosteum of **the coccyx**
When preparing for spinal anesthetic blockade, it is important to accurately identify **landmarks** on the patient.
<table>
<thead>
<tr>
<th>Dermatomal Level</th>
<th>Surface Landmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>C8</td>
<td>Little finger</td>
</tr>
<tr>
<td>T1,T2</td>
<td>Inner aspect of the arm</td>
</tr>
<tr>
<td>T4</td>
<td>Nipple line, root of scapula</td>
</tr>
<tr>
<td>T7</td>
<td>Inferior border of scapula, Tip of xiphoid</td>
</tr>
<tr>
<td>T10</td>
<td>Umbilicus</td>
</tr>
<tr>
<td>L2 to L3</td>
<td>Anterior thigh</td>
</tr>
<tr>
<td>S1</td>
<td>Heel of foot</td>
</tr>
</tbody>
</table>
### Anatomic Landmarks to Identify Vertebral Levels

<table>
<thead>
<tr>
<th>Anatomic Landmark</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>C7</td>
<td>Vertebral prominence, the most prominent process in the neck</td>
</tr>
<tr>
<td>T7</td>
<td>Inferior angle of the scapula</td>
</tr>
<tr>
<td>L4</td>
<td>Line connecting iliac crests</td>
</tr>
<tr>
<td>S2</td>
<td>Line connecting the posterior superior iliac spines</td>
</tr>
<tr>
<td>Sacral hiatus</td>
<td>Groove or depression just above or between the gluteal clefts above the coccyx</td>
</tr>
</tbody>
</table>
Objectives of the Lecture continue
Spinal and Epidural Anesthesia

5. Factors affecting the spread of local anesthetic agents

6. How to perform the spinal anesthesia?

Objectives of the Lecture

8. Definition of Epidural anesthesia

9. Indication contraindication and complications

10. Technique

11. Differences between spinal and Epidural Anesthesia
Definition

Spinal anaesthesia: is the injection of small amounts of local anaesthetics into the (CSF) at the level below (L2), where the spinal cord ends, anaesthesia of the lower body part below the umbilicus is achieved.
Advantages of spinal anesthesia (SPA)

1. Cost. The costs associated with SPA are minimal.
2. Patient satisfaction. the majority of patients are very happy with this technique.
3. Respiratory disease. SPA produces few adverse effects on the respiratory system as long as unduly high blocks are avoided.
4. Patent airway. As control of the airway is not compromised, there is a reduced risk of airway obstruction or the aspiration of gastric contents.
Advantages of SPA  

5. Diabetic patients. There is little risk of unrecognised hypoglycaemia in an awake patient.

6. Muscle relaxation. SPA provides excellent muscle relaxation for lower abdominal and lower limb surgery.

7. Bleeding. Blood loss during operation is less than when the same operation is done under general anaesthesia.
Advantages of SPA  Continue

8. Splanchnic blood flow. Because of its effect on increasing blood flow to the gut, spinal anaesthesia reduces the incidence of anastomotic dehiscence.

9. Visceral tone. The bowel is contracted by SPA and sphincters relaxed although peristalsis continues. Normal gut function rapidly returns following surgery.

10. Coagulation. Post-operative deep vein thromboses and pulmonary emboli are less common following spinal anaesthesia.
Indications

1. Operations below the umbilicus: hernia repairs, gynaecological and urological operations

2. Any operation on the perineum or genitalia
Indications of SPA continue

3. All operations on the leg except for limb amputation which is possible but an unpleasant experience for an awake patient so here the patient is supplied with light general anaesthetic
Indications of SPA  continue

4. Special indications

• Elders

• Chronic systemic disease, hepatic, renal and endocrine disease (DM)

• Most patients with mild cardiac diseases except for stenotic valvular disease and uncontrolled hypertension
Contra-indications

1. Patient refusal

2. Uncooperative patients: like young children and psychiatric or mentally handicapped patients

3. Clotting disorders: as bleeding from ruptured peridural vein is common, patients with low platelet count or those on anticoagulant drugs (heparin + warfarin) are at high risk of hematoma formation
Contra-indications continue

4. Hypovolemic : since SPA has marked hypotensive effect, hypovolemic patients must be adequately rehydrated and resuscitated

5. Septicemia : leading to CSF infection and meningitis

6. Anatomical deformities (relative contraindication) as it will probably only serve to make the dural puncture more difficult.
Contra-indications continue

7. Neurological disease. Any worsening of the disease postoperatively may be blamed erroneously on the spinal anaesthetic.

8. Inadequate resuscitative drugs and equipment. No regional anaesthetic technique should be attempted if drugs and equipment for resuscitation are not immediately to hand.
Local anesthetics for SPA

- Local anesthetic agents are either hyper-, hypo- or isobaric.

- Hyperbaric agents tend to spread below the level of injection and they are easier to predict that’s why they are prefered over iso- and hypobaric agents.
Local anesthetics for SPA continue

- Bupivacaine (Marcaine): 0.5%
  hyperbaric bupivacaine is the best

- 0.5% isobaric bupivacaine is also popular

- Lasts longer than most spinal anesthetics from 2-3 hours
Local anesthetics for SPA  

( 

Lidocaine )

• Lidocaine ( Xylocaine ) : 5% hyperbaric lidocaine is the best lasting 45-90 mins

• 2% lidocaine can be used but as a much shorter duration of action

• 0.2 ml of adrenaline 1:1000 + lidocaine will prolong the duration of action

• Lidocaine from ( multi dose vials ) should not be used intrathecally as they contain potentially harmful preservatives
Factors affecting the spread of local anesthetic solutions in CSF

1. The baricity of the local anesthetic solution
2. The position of the patient
3. The level of injection
4. The speed of injection (like all anesthetics)
5. Obesity: as increase in intraabdominal pressure decreases the subarachnoid space so dosis must be reduced
6. Pregnancy: increase in intraabdominal pressure leading to increase in peridural veins filling leading to less subarachnoid space and less dosis
How to perform the spinal injection?

• Clean the patient’s back with antiseptic.

• Locate a suitable interspinous space.

• Raise an intradermal wheal of LA agent at proposed puncture site.
How to perform the spinal injection?  

- Insert the needle: the structures that will be passed skin, subcutaneous tissue, supraspinous ligament, interaspinous ligament, lagementum flavum, dura mater.

- When CSF appears then slowly inject the local anesthetic.
Complications of spinal Anaesthesia

• Hypotension: due to vasodilatation and a functional decrease in the effective circulating volume.
  - By giving fluids and oxygen mask.
  - Raising the legs: simple and effective.
  - Increase the speed of IV infusion: until the blood pressure is restored.
  - If the pulse low give atropine IV.
  - Vasoconstrictor (ephedrine)
Complications of spinal Anesthesia continue

• Headache: within 12-24 h and may last for 1 week
  ➢ it is postural and it is often occipital associated with a stiff neck, nausea, vomiting, Dizziness and photophobia.
  ➢ Ask to lying flat in bed and give simple analgesics.
Complications of spinal Anesthesia continue

- Urinary retention: the sacral autonomic fibers are among the last to recover.

- Permanent neurological complications (rare): meningitis, arachnoiditis, peridural abscess

- Permanent paralysis: in elderly patient other cause: direct injury of the spinal cord.
Epidural Anesthesia

- Local anaesthetic solutions are deposited in the peridural space between the dura mater and the periosteum lining the vertebral canal. The peridural space contains adipose tissue, lymphatics and blood vessels. The injected local anaesthetic solution produces analgesia by blocking conduction at the intradural spinal nerve roots.
Epidural Anesthesia

• **Technique:**
  Loss of resistance technique to identify the epidural space.

• **0.5% Bupivacaine (mainly) or lidocaine (2.0%)** is usually used to produce epidural anaesthesia.
Indication and Contraindication:

- the same of spinal anaesthesia.

- Additional indication is the post operative pain management using the epidural catheter technique.

- **Complications:** the same of spinal anaesthesia, *except* the post dural puncture headache.
## Differences between Spinal and Epidural Anesthesia

<table>
<thead>
<tr>
<th>Spinal anaesthesia</th>
<th>Extradural Anaesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level: below L1/L2, where the spinal cord ends</td>
<td>Level: at any level of the vertebral column.</td>
</tr>
<tr>
<td>Injection: subarachnoid space i.e puncture of the dura mater</td>
<td>Injection: epidural space (between Ligamentum flavum and dura mater) i.e without puncture of the dura mater</td>
</tr>
<tr>
<td>Identification of the subarachnoid space: When CSF appears</td>
<td>Identification of the Peridural space: Using the Loss of Resistance technique.</td>
</tr>
<tr>
<td>Dosis: 2.5-3.5 ml bupivacaine 0.5% heavy</td>
<td>Dosis: 15-20 ml bupivacaine 0.5%</td>
</tr>
<tr>
<td>Onset of action: rapid (2-5 min)</td>
<td>Onset of action: slow (15-20 min)</td>
</tr>
<tr>
<td>Density of block: more dense</td>
<td>Density of block: less dense</td>
</tr>
<tr>
<td>Hypotension: rapid</td>
<td>Hypotension: slow</td>
</tr>
<tr>
<td>Headache: is a probably complication</td>
<td>Headache: is <strong>not</strong> a probable.</td>
</tr>
</tbody>
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