EPIDURAL ANESTHESIA

done by: fadi haddad
• Anatomy
  – Epidural space - base of skull (foramen magnum) to the coccyx (sacroccocygeal membrane)
  – the peridural space between the dura mater and the periosteum lining the vertebral canal
  – Distance from skin to epidural space - 4-5 cm
  – Epidural space contains loose areolar tissue, fat, arterial and venous networks, lymphatics, spinal nerve roots
Thoracic spine

Spinal cord

Dura mater

Epidural space

Spinal space (subarachnoid space) containing cerebrospinal fluid

Epidural anaesthesia

Spinal anaesthesia

Area of injection

Nerve fibres

Sacrum
Definition

- Epidural anesthesia involves the use of local anesthetics injected into the epidural space to produce a reversible loss of sensation and motor function.
- The injected local anaesthetic solution produces analgesia by blocking conduction at the intradural spinal nerve roots.
EPIDURAL ANESTHESIA

- LA deposited in epidural space
- Block spinal nerve roots that traverse peridural space
- Blocks sympathetic nerves traveling with the anterior roots
- Applications range from sensory analgesia, minimal motor block, or dense anesthesia and full motor block - controlled by drug choice, concentration, dosage
Spread of Local Anesthetics within the Epidural Space

Local anesthetics administered in the epidural space move in a horizontal and longitudinal direction. Theoretically, if enough local anesthetic is injected, it could spread up to the foramen magnum and down to the sacral foramina. Clinically, the extent of longitudinal spread is volume dependent and cephalad spread is limited. It has been found that an epidural will spread only 4 additional dermatomes when increasing the volume of local anesthetics from 10ml to 30 ml.

Horizontal spread occurs through intervertebral foramina, entering the dural cuff. A small amount of local anesthetic may travel to the anterior epidural space. Diffusion into the CSF occurs at the dural cuff through arachnoid granules.
Horizontal movement

Longitudinal movement
Factors Influencing Spread of Solution

• **Height of patient**
  - Height plays a role in epidural block height. The shorter the patient, the less anesthetic required to achieve the same level of anesthesia as a tall patient. For example, a patient who is 5'3" may require 1 ml per dermatome, whereas a patient who is 6'3" may require 2 ml per dermatome.

• **Drugs used**

• **Volume**

• **Age**
  As patients age, less local anesthetic is required to achieve the same level of blockade as their younger counterpart. This is largely due to changes in the size and compliance of the epidural space.

• **Concentration**
  - Level of puncture and catheter insertion
continue

- **Gravity**

Positioning the patient after injection of local anesthetic into the epidural space impacts its spread and height, but not to the degree that it does with spinal anesthesia. For example, positioning the patient in a lateral decubitus position will concentrate local anesthetic and extend block height in the dependent area compared to the non-dependent area. A sitting patient will have more local anesthetic delivered to the lower lumbar and sacral dermatomes.
Distribution, Uptake & Elimination

It takes approximately 6-8 times the amount of local anesthetic in the epidural space to produce the same degree of blockade with a spinal anesthetic. This is due to the following factors:

- Larger mixed nerves are found in the epidural space.
- Local anesthetics must penetrate the arachnoid and dura mater.
- Local anesthetics are lipid soluble and will be absorbed into tissue and epidural fat.
- Epidural veins absorb a significant amount of local anesthetics. Peak blood concentrations occur 10-30 minutes after a bolus.
Local Anesthetics used for Epidural Anesthesia

When choosing a local anesthetic for epidural anesthesia, consider the following:

- local anesthetic potency and duration
- surgical requirements and duration
- postoperative analgesia requirements

Seven local anesthetics can be used to produce epidural anesthesia. Only preservative free solutions should be used. Check the label to ensure the solution is “preservative free” and prepared specifically for epidural/caudal anesthesia/analgesia.

**Short Acting:**
- 2- chloroprocaine

**Intermediate Acting:**
- lidocaine
- mepivacaine

**Long Acting:**
- Bupivacaine
- etidocaine
- ropivacaine
- levobupivacaine
Table 2. **Local Anesthetics Used in Epidurals**

<table>
<thead>
<tr>
<th>Agent</th>
<th>Concentration</th>
<th>Onset</th>
<th>Duration ( Alone)</th>
<th>Duration (With Epinephrine)</th>
<th>Maximum Dosage ( Alone)</th>
<th>Maximum Dosage (With Epinephrine)</th>
<th>Potency</th>
<th>Toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short-Acting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloroprocaine</td>
<td>2%-3%</td>
<td>5-15 min</td>
<td>30-45 min</td>
<td>30-90 min</td>
<td>800 mg</td>
<td>1,000 mg</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Intermediate-Acting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lidocaine</td>
<td>0.5%-2%</td>
<td>15 min</td>
<td>30-120 min</td>
<td>120-360 min</td>
<td>300 mg</td>
<td>500 mg</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Mepivacaine</td>
<td>1%-2%</td>
<td>15 min</td>
<td>60-140 min</td>
<td>140-200 min</td>
<td>400 mg</td>
<td>500 mg</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>Long-Acting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>0.25%-0.75%</td>
<td>10-20 min</td>
<td>120-240 min</td>
<td>180-240 min</td>
<td>175 mg</td>
<td>225 mg</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Etidocaine</td>
<td>1%-1.5%</td>
<td>5-15 min</td>
<td>2-4 h</td>
<td>NA</td>
<td>300 mg</td>
<td>400 mg</td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>Ropivacaine</td>
<td>0.5%-1%</td>
<td>15 min</td>
<td>2-6 h</td>
<td>NA</td>
<td>200 mg</td>
<td>NA</td>
<td>Moderate</td>
<td>Low</td>
</tr>
</tbody>
</table>

*min: minute; NA: not applicable.*

*Source: References 20-25.*
<table>
<thead>
<tr>
<th>Agent</th>
<th>Concentration</th>
<th>Onset</th>
<th>Sensory Block</th>
<th>Motor Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloroprocaine</td>
<td>2%</td>
<td>Fast</td>
<td>Analgesic</td>
<td>Mild to moderate</td>
</tr>
<tr>
<td></td>
<td>3%</td>
<td>Fast</td>
<td>Dense</td>
<td>Dense</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>≤ 1%</td>
<td>Intermediate</td>
<td>Analgesic</td>
<td>Minimal</td>
</tr>
<tr>
<td></td>
<td>1.5%</td>
<td>Intermediate</td>
<td>Dense</td>
<td>Mild to moderate</td>
</tr>
<tr>
<td></td>
<td>2%</td>
<td>Intermediate</td>
<td>Dense</td>
<td>Dense</td>
</tr>
<tr>
<td>Mepivacaine</td>
<td>1%</td>
<td>Intermediate</td>
<td>Analgesic</td>
<td>Minimal</td>
</tr>
<tr>
<td></td>
<td>2–3%</td>
<td>Intermediate</td>
<td>Dense</td>
<td>Dense</td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>≤ 0.25%</td>
<td>Slow</td>
<td>Analgesic</td>
<td>Minimal</td>
</tr>
<tr>
<td></td>
<td>0.5%</td>
<td>Slow</td>
<td>Dense</td>
<td>Mild to moderate</td>
</tr>
<tr>
<td></td>
<td>0.75%</td>
<td>Slow</td>
<td>Dense</td>
<td>Moderate to dense</td>
</tr>
<tr>
<td>Ropivacaine</td>
<td>0.2%</td>
<td>Slow</td>
<td>Analgesic</td>
<td>Minimal</td>
</tr>
<tr>
<td></td>
<td>0.5%</td>
<td>Slow</td>
<td>Dense</td>
<td>Mild to moderate</td>
</tr>
<tr>
<td></td>
<td>0.75–1.0%</td>
<td>Slow</td>
<td>Dense</td>
<td>Moderate to dense</td>
</tr>
</tbody>
</table>
Types – selective blockade possible because it can be performed at any level of spine

- Cervical epidural
- Thoracic epidural
- Lumbar epidural
- Caudal epidural
Cervical epidural
Indications

- Epidural anesthesia provides excellent operating conditions for surgical procedures below the umbilicus. Procedures include:
  - cesarean section
  - procedures of the uterus, perineum*
  - hernia repairs
  - genitourinary procedures
  - lower extremity orthopedic procedures
• May be used in
  – Poor risk patients
  – Cardiac diseases
  – Pulmonary diseases
  – Metabolic disturbances
  – When GA is contraindicated
  – When spinal anesthesia is contraindicated
  – Painful conditions including post-op pain relief
Advantages

- Well-defined area of anesthesia
- Longer duration
- More severe disturbances of spinal anesthesia minimized
- Return of gastrointestinal function generally occurs faster than with general anesthesia
- The ability to use the epidural catheter for postoperative analgesia
- Less respiratory effects
- Patent airway
- Decreased incidence of deep vein thrombosis and pulmonary emboli formation compared to general anesthesia
**Disadvantages**

- Technically more difficult
- Muscle relaxation not complete
- Large volume necessary
- Danger of dural puncture
- Risk of block failure. The rate of failure is slightly higher than with a spinal anesthetic.
- Always be prepared to induce general anesthesia if block failure occurs.
- Onset is slower than with spinal anesthesia. May not be a good technique if the surgeon is impatient or there is little time to properly perform the procedure.
complication

- Low blood pressure
- Loss of bladder control
- Itchy skin
- Feeling sick
- Inadequate pain relief
- Headache
- Temporary or permanent nerve damage
- Infection
Contraindications – similar to spinal

- Severe hemorrhage
- Coagulation defects (hematoma formation)
- Previous laminectomy
- Uncooperative, Patient refusal
- Local inflammation at site
<table>
<thead>
<tr>
<th></th>
<th>Epidural anesthesia</th>
<th>Spinal anesthesia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Site of injection</strong></td>
<td>In the epidural space</td>
<td>Subarachnoid space</td>
</tr>
<tr>
<td><strong>Onset and duration</strong></td>
<td>Slow onset and continuous duration (use catheter)</td>
<td>Rapid onset and limited duration</td>
</tr>
<tr>
<td><strong>Advantages</strong></td>
<td>Can be used in analgesia</td>
<td>Not used</td>
</tr>
<tr>
<td><strong>Needle dose</strong></td>
<td>Curved, long and blunt (touhy) 10–30ml</td>
<td>Small and sharp 1–4ml</td>
</tr>
<tr>
<td><strong>Space</strong></td>
<td>Any space usually lumbar</td>
<td>Lumbar</td>
</tr>
<tr>
<td><strong>Quality of sensory and motor nerve block</strong></td>
<td>Less</td>
<td>More liable</td>
</tr>
</tbody>
</table>
| **Toxicity**          | Hypotention gradual total spinal +++ systemic toxicity +++ | Sudden + + +
## 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:</td>
<td>Identification of the Peridural space: Using the Loss of Resistance technique.</td>
</tr>
<tr>
<td>When CSF appears</td>
<td></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>
</table>
Thank youuuuu doctors