SPINAL ANESTHESIA

A Seminar by : Stephanie N. Ammari
Regional Anesthesia

- Is the use of local anesthetics to block sensations of pain from a large area of the body, such as an arm or leg or the abdomen ... based on the dermatomes.
- Neuraxial Anesthesia refers to local anesthetics placed around the nerves of the CNS, such as spinal anesthesia, epidural anesthesia, caudal anesthesia.
THE ROLE OF NEURAXIAL ANESTHESIA IN ANESTHETIC PRACTICE

• Neuraxial blocks may reduce the incidence of venous thrombosis and pulmonary embolism, cardiac complications in high-risk patients, bleeding and transfusion requirements, vascular graft occlusion, and pneumonia and respiratory depression following upper abdominal or thoracic surgery in patients with chronic lung disease.

• Neuraxial blocks are routinely employed for labor analgesia, cesarian delivery, orthopedic surgery, perioperative analgesia, and chronic pain management.
THE ROLE OF NEURAXIAL ANESTHESIA IN ANESTHETIC PRACTICE

• The Sick Elderly Patient.
  A spinal anesthetic with little or no intravenous sedation may reduce the likelihood of postoperative delirium or cognitive dysfunction, which is sometimes seen in the elderly.

• The Obstetric Patient.
  Is associated with less maternal morbidity and mortality than is general anesthesia.
Mechanism of Action

- The principal site of action for neuraxial blockade is believed to be the nerve root, at least during initial onset of block.
- Local anesthetic is injected into:
  - CSF … (spinal anesthesia)
  - the epidural space … (epidural and caudal anesthesia)
Manifestations

- Cardiovascular Manifestations … produce variable decreases in blood pressure that may be accompanied by a decrease in heart rate.

- Pulmonary Manifestations … there is only a small decrease in vital capacity, which results from a loss of the abdominal muscles’ contribution to forced expiration.

- Gastrointestinal Manifestations … Neuraxial block–induced sympathectomy allows vagal “dominance” with a small, contracted gut and active peristalsis.
Indications

1. lower abdomen .
2. Perineum .
3. Hip.
4. Lower extremities .
5. Lower spine .

*** for example : Hernia , gynaecology & obstetrics procedures (e.g : cesarian delivery ) , surgical procedure on lower limbs .

*Upper abdominal procedures (eg, gastrectomy) have been performed with spinal or epidural anesthesia, but because it can be difficult to safely achieve a sensory level adequate for patient comfort these techniques are less commonly used.
Contraindications to neuraxial blockade.

- **Absolute**
  1. Infection at the site of injection.
  2. Lack of consent.
  3. Coagulopathy or other bleeding diathesis.
  4. Severe hypovolemia.
  5. Increased intracranial pressure.
Contraindications to neuraxial blockade.

- **Relative**
  1. Sepsis.
  2. Uncooperative patient.
  3. Preexisting neurological deficits.
  4. Demyelinating lesions.
  5. Stenotic valvular heart lesions.
  6. Left ventricular outflow obstruction (hypertrophic obstructive cardiomyopathy).
  7. Severe spinal deformity.
Contraindications to neuraxial blockade.

- Controversial
  1. Prior back surgery at the site of injection.
  2. Complicated surgery.
  3. Prolonged operation.
  4. Major blood loss Maneuvers that compromise respiration.
Anatomy

- The laminae extend between the transverse processes and the spinous processes, and the pedicle extends between the vertebral body and the transverse processes.
- The pedicles are notched superiorly and inferiorly, these notches forming the intervertebral foramina from which spinal nerves exit.
- Ventrally, the vertebral bodies and intervertebral disks are connected and supported by the anterior and posterior longitudinal ligaments. Dorsally, the ligamentum flavum, interspinous ligament, and supraspinous ligament provide additional stability. Using the midline approach, a needle passes through these three dorsal ligaments and through an oval space between the bony lamina and spinous processes of adjacent vertebra.
• The spinal cord normally extends from the foramen magnum to the level of L1 in adults. In children, the spinal cord ends at L3 and moves up with age.
• The spinal canal contains the spinal cord with its coverings (the meninges), fatty tissue, and a venous plexus. The meninges are composed of three layers: the pia mater, the arachnoid mater, and the dura mater.
• Cerebrospinal fluid (CSF) is contained between the pia and arachnoid mater in the subarachnoid space.
Surface Anatomy

Spinous processes are usually palpable and help to define the midline. Ultrasound can be used when landmarks are not palpable.

With the arms at the side, the spinous process of T7 is usually at the same level as the inferior angle of the scapulae. (Tuffier’s line) usually crosses either the body of L4 or the L4–L5 interspace.

Source: Gadsden Jeff, Dean R. Jones: Anesthesiology Self-Assessment and Board Review: BASIC Examination
Patient Positioning

- Sitting Position
Anatomic approach

A. Midline Approach.
B. Paramedian Approach.
C. Assessing Level of Blockade With knowledge of the sensory dermatomes, the extent of sensory block can be assessed by a blunted needle or a piece of ice.
D. Ultrasound-Guided Neuraxial Blockade.

ultrasound guidance can facilitate neuraxial blockade in patients with poorly palpable landmarks.
Spinal needle placement (midline and paramedian)
Factors affecting the dermatomal spread of spinal anesthesia.

- **Most important factors:**
  1. Baricity of anesthetic solution.
  2. Position of the patient
     - During injection
     - Immediately after injection.
  3. Drug dosage.
  4. Site of injection.
Factors affecting the dermatomal spread of spinal anesthesia.

- Other factors:
  1. Age.
  2. Cerebrospinal fluid
  3. Curvature of the spine.
  4. Drug volume.
  5. Intraabdominal pressure.
  7. Patient height.
Baricity of the local anesthetic

- **Baricity**: Local anesthetic density relative to CSF.
- A hyperbaric solution of local anesthetic is denser (heavier) than CSF … solution migrates caudally when the patient is in the sitting position.
- A hypobaric solution is less dense (lighter) than CSF.
- An isobaric solution: its density = CSF density… solution tends to remain at the level of injection.
- *** The best type to be used is the HYPERBARIC solution.
- *** to change a hypobaric solution into hyperbaric … use DEXTROSE
## Spinal Anesthetic Agents

The best agent is the Bupivacaine

<table>
<thead>
<tr>
<th>Drug</th>
<th>Preparation</th>
<th>Dose (mg)</th>
<th>Procedures</th>
<th>Duration (h)</th>
<th>Epinephrine</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Chloroprocaine</td>
<td>1%, 2%, 3%</td>
<td>30–60</td>
<td>Ambulatory, T8</td>
<td>1–2</td>
<td>Not recommended (flu-like symptoms)</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>2%</td>
<td>40–50</td>
<td>Ambulatory, T8</td>
<td>1–2</td>
<td>Only modest effect, not recommended</td>
</tr>
<tr>
<td>Mepivacaine&lt;sup&gt;3&lt;/sup&gt;</td>
<td>1.5%</td>
<td>30 (T9)</td>
<td>Ambulatory surgery, knee scope, TURP</td>
<td>1–2</td>
<td>Not recommended</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45 (T6)&lt;sup&gt;4&lt;/sup&gt;</td>
<td></td>
<td>1.5–3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>60 (T5)</td>
<td></td>
<td>2–3.5</td>
<td></td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>0.5%</td>
<td>7.5</td>
<td>Ambulatory lower limb</td>
<td>1–2</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>10</td>
<td>THA, TKA, femur ORIF</td>
<td>2</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>15</td>
<td></td>
<td>3</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4–5</td>
<td></td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>0.75% in 8.25% dextrose</td>
<td>4–10</td>
<td>Perineum, lower limbs&lt;sup&gt;5&lt;/sup&gt;</td>
<td>1.5–2</td>
<td>1.5–2.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lower abdomen</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Upper abdomen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ropivacaine</td>
<td>0.5%, 0.75%</td>
<td>15–17.5</td>
<td>T10 level</td>
<td>2–3</td>
<td>Does not prolong block</td>
</tr>
<tr>
<td></td>
<td></td>
<td>18–22.5</td>
<td>T8 level</td>
<td>3–4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1% + 10% dextrose</td>
<td>18–22.5</td>
<td>T4 level</td>
<td>1.5–2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(equal volumes D&lt;sub&gt;10&lt;/sub&gt; and ropivacaine)</td>
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</tbody>
</table>
### Adjuvant

<table>
<thead>
<tr>
<th>Adjuvant</th>
<th>Dose (mcg)</th>
<th>Duration (h)</th>
<th>Comments/Side Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fentanyl</td>
<td>10–25</td>
<td>1–2</td>
<td>Itching; nausea; urinary retention; sedation; ileus; respiratory depression (delayed with morphine → ↓ dose with elderly or sleep apnea)</td>
</tr>
<tr>
<td>Sufentanil</td>
<td>1.25–5</td>
<td>1</td>
<td></td>
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<tr>
<td>Morphine</td>
<td>125–250</td>
<td>4–24</td>
<td></td>
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<tr>
<td>Epinephrine</td>
<td>100–200</td>
<td></td>
<td>Prolongs nerve exposure to local anesthetic + α-adrenergic modulation</td>
</tr>
<tr>
<td>Phenylephrine</td>
<td>1000–2000</td>
<td></td>
<td>Hypotension. Prolongs tetracaine but not bupivacaine. Extends tetracaine better than epinephrine does. May cause TNS</td>
</tr>
<tr>
<td>Clonidine</td>
<td>15–150</td>
<td></td>
<td>Hypotension. Sedation. Prolongs motor and sensory block</td>
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*Until very recently in North America, hyperbaric spinal anesthesia was used.*

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1. THA, total hip arthroplasty. KKA, total knee arthroplasty. TNS, transient neurological symptoms. TURP, transurethral resection of the prostate. ORIF, open reduction and internal fixation.
2. Each change of 15 mg prolongs or hastens ambulatory micturition by 20–30 min. Fentanyl, 10 mcg, extends surgical block but not ambulatory recovery times and should probably be added if using 30 mg dose to ensure adequate duration.
3. Very low dose (4–8 mcg) works well for ambulatory, unilateral, knee surgery. Keep patient lateral, affected side down, for 6 min after block.