

Managing Regional Anesthesia Patients in the Perianesthesia Care Environment

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Case Study

- 20 year old female ASA I; 5ft 2in, 122 lbs, B/P 116/68; HR 58; RR 16
- History of ski injury to left knee
- Scheduled for ambulatory surgery: left knee anterior cruciate repair
- General anesthesia with regional left leg abductor block

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Case Study

- 58 year old female hysterectomy; 5ft 3in, 180 lbs, smoker, history of asthma and hypertension; B/P 168/90; HR 63; RR 16
- Regional anesthesia was selected because of MR's significant medical history
- T 11-12 thoracic epidural block
- PACU admission vitals: B/P 104/60; HR 58; RR 16 BPM; O2 Sat 98% on 2 Lm NC; Sensory block T6

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Objectives

- Discuss the anatomic and physiologic effects of regional anesthesia
- Describe the anesthesia agents used in regional anesthesia
- Identify key sensory/motor assessment parameters
- Summarize three complications from regional anesthesia

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What is a regional anesthesia/central neuraxial block?

- Spinal (subarachnoid block – SAB)
- Epidural
- Caudal

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Review of Relevant Anatomy

- Meninges - "PAD"
- Vertebrae (33)
 - Cervical (7)
 - Thoracic (12)
 - Lumbar (5)
 - Sacral (5)
 - Coccygeal (5)

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Do you know the difference between Spinal and Epidural Blockade?

SPINAL

- Direct access to nerves
- Less drug
- Fast onset
- Predictable effect
- Provides a block below level of blockade
- Usually no catheter

EPIDURAL

- Indirect access to nerves
- More drug
- Slower onset
- Less predictable
- Provides a band (segmental) block
- Usually catheter is placed

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Benefits of Neuraxial Blockade over General Anesthesia

- Avoid intubation
- Decrease stress response
- Awake during surgery
- Decrease post-op nausea, vomiting, and sedation
- Post-op analgesia
- Decreased blood loss
- Decreased blood clot formation
- Pre-emptive analgesia
- Less pulmonary dysfunction

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Combined Technique

- Epidural + general anesthesia
- Epidural + spinal

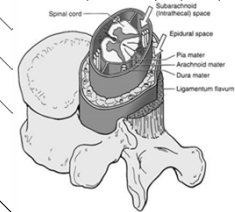
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Epidural Analgesia

- The epidural space covers the dura mater and consists of a venous plexus (blood vessels) and fat.

Epidural opiates diffuse across the dura and subarachnoid space (contains cerebrospinal fluid) and bind to mu receptors located in the substantia gelatinosa of the dorsal horn of the spinal cord.

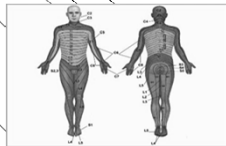
As a result, these opioid receptors block the release of substance P (neurotransmitter) and nociceptive impulses (pain sensations) from traveling to the higher brain centers.



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Epidural Catheter Placement

- The actual site (thoracic vs. lumbar epidurals) for catheter placement is determined by the dermatome innervating the area of pain.



Examples: The catheter is placed between:

- T4-8 for thoracic procedures depending upon whether the upper or lower lobes of the lung are affected.
- T6-8 for upper abdominal procedures, T7-10 for middle abdominal procedures, T8-11 for lower abdominal procedures.
- L1-4 for lower extremity procedures.

Note: L (lumbar level); T (thoracic level)

Miller's Anesthesia, 9th Edition. Miller RD, Eriksson L, Fleisher LA, et al. 2019.

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Regional Anesthesia Agents

- Lidocaine
- Bupivacaine
- Ropivacaine
- Epinephrine

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Mechanism of Action of Drugs

LOCAL ANESTHETICS

- level of Na⁺ channels
- LA bind to Na⁺ channels and prevent neurotransmission

OPIOIDS

- level of opioid receptors
- opioids bind to Mu receptors
- Mu₁ – “good effects”
- Mu₂ – “bad effects”
- blocks action potentials by inhibiting Ca⁺⁺ channels

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Common Epidural Analgesia Orders

Volume: 250 mL of preservative free 0.9% saline with the following:

- Fentanyl 1250 mcg (5 mcg/mL) with Bupivacaine 0.0625%
- Fentanyl 1250 mcg (5 mcg/mL) with Bupivacaine 0.125%
- Fentanyl 500 mcg (2 mcg/mL) with Bupivacaine 0.125% (For OB Laboring Patient)
- Bupivacaine 0.0625%
- Bupivacaine 0.125%

Only preservative-free drugs with preservative-free normal saline should be administered into the epidural space as preservatives are neurotoxic and may cause injury to the spinal cord.

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Properties of Epidural Opioids

Property	Lipophilic Opioids	Hydrophilic Opioids
Common drugs	Fentanyl, sufentanil	Morphine, hydromorphone
Onset of analgesia	Rapid onset (5-10 min)	Delayed onset (30-60 min)
Duration of analgesia	Shorter duration (2-4 hr)	Longer duration (6-24 hr)
Side effects		
Nausea and vomiting	Lower incidence with lipophilic than with hydrophilic opioids	
Pruritus	Lower incidence with lipophilic than with hydrophilic opioids	
Respiratory depression	Primarily early; minimal delay	Both early (<6 hr) and delayed (>6 hr) possible

Miller's Anesthesia, 9th Edition. 2019.

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Key Sensory/Motor Assessments

- Sensory assessments of the dermatomes
 - Anatomical assessments
- Motor assessment
 - Bromage scale
- Body alignment
- Careful positioning
 - Routine range of motion, if indicated
- Bladder assessment

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Neuroanatomy

- The effects of regional anesthesia are mediated by spinal nerve function
 - Each spinal nerve consists of 2 nerve roots
 - Ventral root originates from the anterior spinal cord; includes motor nerves relay motor nerve impulses from spinal cord to end organ – blood vessel
 - Dorsal root originates from the posterior spinal cord; includes sensory nerves relay nerve impulses from organ receptors to spinal cord
 - Dorsal (sensory root) differs from Ventral (motor root - thicker) in size and composition (myelin, lipid, fat)

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Dermatomes

- Definition
- How to check level
- Why is the level important?

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Summarize Three Types of Complications from Regional Anesthesia

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Common Side Effects

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Hypotension

- Decreased vascular resistance
- Predisposing factors
- Treatment
 - IV fluids
 - Sympathomimetic drugs
 - Trendelenburg position (controversial)
 - “tincture of time”

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Bradycardia

- Unopposed vagal (parasympathetic) tone
- Block of cardioaccelerator fibers (T₁-T₄)
- Treatment
 - Anticholinergics (atropine, glycopyrrolate)
 - Beta agonists (ephedrine, epinephrine)

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Nausea and Vomiting

- Unopposed vagal tone
- Hypotension
- Treatment
 - Anticholinergics
 - Increasing blood pressure
 - Antiemetics

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Respiratory Depression

- Block of phrenic nerve (C₃-C₅)
- Inability to “feel” intercostal muscles
- Dependence on accessory muscles
- Delayed respiratory depression with morphine
- Treatment
 - Oxygen
 - Reassurance
 - Intubation

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Opioids

Hydrophilic (water soluble) Opioids:

- » On the other hand, hydrophilic opioids (i.e., morphine and hydromorphone) diffuse slowly across the epidural space and tend to remain within the CSF, which produce a delayed onset but longer duration of analgesia, along with a generally higher incidence of side effects. As a result, monitoring for respiratory depression is required for up to 24 hours.



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Pruritis

- Due to agonism of Mu receptors (not histamine release)
- Treatment
 - Low dose naloxone or nalbuphine

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Urinary Retention

- Sympathetic and sensory blockade in sacral region
- Detrusor muscle relaxation by opioids
- S/S bladder overfilling
 - Hypertension
 - Tachycardia
 - Agitation
- Treatment
 - Urinary catheterization

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Shivering

- Impairment of thermoregulation
- Peripheral vasodilation lowers core temperature
- Treatment
 - Warm blankets
 - Bairhugger
 - Meperidine

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Post Dural Puncture Headache (PDPH)

Post Dural Puncture Headache (PDPH)

- Due to loss of CSF
- Predispositions
- Characteristic headache
- Treatment
 - Usually resolves spontaneously
 - Caffeine (IV or PO)
 - Epidural blood patch

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Epidural Hematoma

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Backache v. Epidural Hematoma

- Etiology unclear
 - Inflammatory response from needle
 - Irritation from LA or opioids
 - Ligament strain (muscle relaxation)
- Epidural hematoma
 - Be alert to backache w/ weakness of legs
 - Incontinence
 - Surgical Emergency
 - Confirmed with CT or MRI
 - If hematoma not surgically decompressed within 6-8 hours neurologic recovery is rare

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Concomitant Use of Epidural Analgesia and Anticoagulants

- Patients receiving concomitant anticoagulants have a higher risk of epidural/spinal hematoma.
- The sensory and/or motor nerves in the spinal cord may become compressed, leading to neurologic deficits. These include:
 - **Worsening sensory deficits:** numbness and/or paresthesias
 - **Worsening motor deficits:** leg weakness and/or paralysis, bowel/bladder dysfunction
 - **Pain at catheter insertion site;**
 - **Severe low back pain**

Therefore, assess these patients for onset of signs/symptoms of epidural/spinal hematoma.

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Total Spinal

- Definition
- Signs and symptoms
 - Profound hypotension
 - Bradycardia
 - Respiratory arrest
- Treatment
 - Assisted ventilation (possibly intubation)
 - IV fluids
 - vasopressors

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Post-op Factors that Precipitate High Blockade

- Increasing intra-abdominal pressure
 - Valsalva maneuver
 - Coughing
 - Lifting head or legs

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Local Toxicity

- Inadvertent injection of local anesthesia intravascular (venous or arterial)
- Signs and symptoms:
 - Headache, seizures, dysrhythmias, arrest
- Treatment:
 - 20 % lipid emulsion
 - Supportive therapy

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Reportable Conditions

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Reportable Conditions	
Immediately call authorized prescriber credentialed for epidural anesthesia:	
❖ Respiratory rate ≤ 8 /minute	❖ Signs and symptoms of epidural/spinal hematoma
❖ Evidence of airway obstruction	❖ Signs and symptoms of local anesthetic toxicity
❖ Sedation level of -2 or below on the Richmond Agitation Sedation Scale (RASS)	❖ Motor strength ≤ 4 for lower extremities or reduction from baseline
❖ Hypotension (Systolic blood pressure < 90 or per MD notification orders)	❖ Sensory level ≤ 4 for lower extremities or reduction from baseline
❖ Systolic blood pressure drops > 20 mmHg from lying/sitting BP baseline.	❖ Intolerable nausea and vomiting unrelieved by medication
❖ Pain level > 4 on a 0-10 scale	❖ Itching unrelieved by medication or naloxone is administered for itching
❖ Epidural catheter patency issues, or wet catheter	❖ Suspected catheter breaks or dislodgement

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Questions?

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What is the difference between Spinal Blockade from the Epidural Blockade?

- A. Spinal has direct access to nerves
- B. Spinal uses less drug
- C. Faster, more predictable effect
- D. Usually no catheter
- E. All of the above

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The following are all seen with respiratory depression from blocking the phrenic nerve (C_3-C_5), except:

- A. Inability to "feel" intercostal muscles
- B. Ability to move lower extremities
- C. Dependence on accessory muscles
- D. Delayed respiratory depression with morphine

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Signs and symptoms of local toxicity include:

- A. Headache
- B. Seizures
- C. Dysrhythmias
- D. All of the above

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