Management of Epidural Analgesia

Course ID: 1001 - Credit Hours: 4

Author(s)

Katharine M Woo, RN, MSN, ACNS-BC & AOCNS, attended college at the University of Hawaii for higher education where she obtained an Associate Degree in Nursing, a Bachelor of Art in Zoology, a Master of Science in Pharmacology and a Master of Science in Nursing with an emphasis in Adult Health. Her nursing background is primarily in Hematology/Oncology and Cardiac Care with a concentration in infusion therapy. Her professional career has included the positions of Staff Nurse, Charge Nurse, Clinical Nurse Specialist, and Nurse Manager. Currently, she is the Nurse Manager of a PICC Program, a Direct Observation Unit and a Medical/Surgical/Telemetry Unit. Her clinical nursing knowledge is a reflection of theories and savvy clinical practice acquired over twenty years of bedside experiences.

Disclosures

None

Audience

This course is designed for Registered Nurses and will serve as didactic training. Clinical competency will need to be validated at local facility per institutional policy.

Accreditation

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Course Objectives

At the end of this educational offering the participant will be able to identify

1. Three anatomical relevance to complications expressed in epidural analgesia
2. Two unique physiological expression in epidural block different from systemic pain medication administration
3. Two surgical procedures appropriately supported by the epidural analgesia administered into the thoracic space
4. Two irreversible complications associated with epidural analgesia
5. Three categories of pharmacological agents administered via epidural catheter
6. Two pharmacological properties of each of the three drug classes utilized in epidural analgesia
7. The procedure for the determination of sensory block
8. The method for assessing the extent of the motor block
9. The scale for assessing the level of consciousness
10. Two factors determining patient’s ability to ambulate
11. The timing for catheter removal if patient is on pharmacological deep vein thrombosis (DVT) prophylaxis
Introduction

Epidural analgesia is a regional method effective for intraoperative anesthetic augmentation and postoperative pain management. The range of application includes labor and delivery and thoracic, abdominal, gynecological, urological, orthopedic, and vascular procedures. Drugs administered to the epidural space potently block the first synaptic nociceptive signal transmission from the spinal cord to the periphery. Small doses of pharmaceutical agents directly applied to the nerve roots elicit strong analgesia, particularly when a combination therapy of narcotics and local anesthetics is employed for the synergic effects. The adverse side effects of drowsiness, confusion, constipation, urinary retention, itchiness, nausea and respiratory depression of epidural analgesia are greatly reduced compared to those of systemically generated by higher doses of oral or intravenous preparations. However, the epidural route of administration is not without its potential risks. The timely and proper assessment of the patient receiving analgesia via epidural catheter is essential for the prevention of rare, but serious complications ranging from inadequate pain control to irreversible neurological sequelae caused by hematoma or abscess formation within the epidural space.

PRECAUTIONS/KEY POINTS

Understanding the anatomy and physiology of the epidural space and its related structures (Figure 1) is fundamentally important for the recognition of mechanisms of epidural blockade and potential complications.

Figure 1: Diagram illustrates the anatomical structures of the spinal canal
1. The epidural space is a potential space which lies within the spinal canal between the external dural membrane and the periosteum lining of the vertebral structure. This space along the canal is anatomically butting against the bony vertebral structures (Figure 2) and thereby limited to volume expansion. Any dramatic size increase due to hematoma or abscess formation in this space will cause severe impingement of the nerve roots and spinal cord. If immediate surgical decompression is not rendered, paralysis will become the debilitating lifelong consequence.

2. The epidural space is richly embedded with venous plexuses and adipose tissues. Patients exhibiting coagulopathy or receiving anticoagulant therapy are contraindicated for epidural analgesia. The potential for bleeding during catheter placement is amplified with the above conditions. The post operative deep vein thrombosis prophylaxis and removal of epidural catheter requires meticulous attention to timing for dosing and choice of appropriate anticoagulant therapy.

3. Epidural analgesia is contraindicated for a patient with unexplained neurological symptoms, active neurological disease, localized infection in lumbar area, systemic sepsis or bleeding disorders.

4. Within the epidural space, the converging nerve fibers conduct outgoing and incoming signal transmissions to mediate the survival instincts and functionality of the human body. The small myelinated sympathetic fibers which control the “fight or flight” responses are most susceptible to pharmacological blockade while the large motor fibers are least sensitive to drug actions. Therefore, the neuraxial blockade is clinically manifested in the descending sequence of sympathetic, sensory and motor capability loss. Medications can be adjusted in concentration and volume to provide regional block without compromising the motor control and hemodynamic regulation. Epidural agents such as fentanyl and local anesthetics can further impact the sympathetic nerve fibers triggering intense hypotension and alarming bradycardia.

5. The epidural catheter is anatomically inserted at a level appropriate to the site of surgery
The extent of the sensory blockade expressed in **dermatomes** will vary depending upon the site of catheter insertion (i.e. lumbar, abdominal, thoracic) and the density of agents determined by the volume and concentration of drugs administered. An agent of a more diluted concentration but administered at a higher volume can exert a high level of block with less adverse side effects.

**Table 1**

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<th>Labor</th>
<th>Hip/Knee</th>
<th>Laparotomy</th>
<th>Thoracotomy</th>
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<tbody>
<tr>
<td><strong>Level of Insertion</strong></td>
<td>L2-L4</td>
<td>L2-L4</td>
<td>T8-T10</td>
<td>T5-T7</td>
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<td><strong>Height of Block</strong></td>
<td>T8-T9</td>
<td>T10</td>
<td>Upper Abd T7-T8</td>
<td>Relevant area</td>
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<tr>
<td><strong>Density of Block</strong></td>
<td>Minimal Motor and Sensory</td>
<td>Sensory and Minimal Motor</td>
<td>Sensory and Minimal Motor</td>
<td></td>
</tr>
</tbody>
</table>

6. Dermatomes (Figure 4) are the mapping of sensory expression innervated by the corresponding sensory nerve fibers from different segments of the spine. The loss of sensation two to three levels above the catheter tip placement provides adequate post operative pain control, whereas beyond the normal levels of sensory blockade reflects inadvertently high block. Epidural analgesia administered above the lumbar region exerts regional effects with minimal effect over the motor ability. For the patient post abdominal surgery or thoracotomy receiving epidural analgesia, ambulation should be an integral part of the plan of care. The accurate assessment of sensory and motor block and vital signs is important to determine adequate pain control and ambulating ability, and furthermore, to recognize hemodynamic instability.
7. The spinal cord terminates at the L2 level in adult. Thus, the potential for injury to the spinal cord is greatly reduced when the epidural catheter insertion site is at or below L2.

PHARMACOLOGY OF EPIDURAL ANALGESIA

1. Pharmacologic agents commonly used for epidural analgesia include local anesthetics, opioids, or alpha agonists which can be used alone or in combination.

   a. Local anesthetics-Bupivacaine (Marcaine), chloroprocaine, or lidocaine (Xylocaine)
   b. Opioids-Morphine, duramorph (preservative free morphine), fentanyl (a synthetic opioid which is 100 times more potent than morphine) or sufentanil (shorter acting, but 5 to 10 times more potent than fentanyl). The hydrophilic opioid (such as morphine) is desirable for single dose injection which sustains pain control for a long duration from (12 to 18 hours) without motor impairment.
c. **Alpha agonists**—Clonidine or epinephrine can be used as an adjuvant to augment the analgesic effect of the local anesthetics and prolong its duration of actions. The alpha agonist is generally used as a substitute for the opioid in combination therapy to avoid unwanted side effects from narcotics.

2. The **pathways of drug absorption/distribution** within the epidural space include:
   a. Diffusion through the dura into the various spinal structures/components
   b. Uptake by vasculature within the epidural space
   c. Absorption by fatty tissues in the epidural space serving as a depository for slow release

3. **Local anesthetic toxicities** can be extensive if considerable amounts of drug enter the epidural vasculature. They include light-headedness, tinnitus, circumoral tingling and numbness, anxiety, confusion, tremor, convulsion, coma and cardio-pulmonary arrest. If toxicities are suspected, stop epidural infusion and provide supportive measures until the toxic drug effects dissipate.

4. Opioid induced **respiratory depression and over-sedation** can be reversed by narcan.

5. Modes of epidural analgesia administration
   a. Single shot injection
   b. Intermittent boluses
   c. Continuous infusion
   d. Continuous infusion with intermittent boluses for breakthrough pain

**POTENTIAL COMPLICATIONS**

1. **Hypotension** is a rather common side effect because the sympathetic fibers are most sensitive to the agents used in epidural analgesia. It is also more likely associated with blockade above the umbilicus and epidural administration without incremental dosing.

2. Other common adverse side effects are **excessive sensory loss above the norm of 2 to 3 levels**, **unintended motor block**, **urinary retention**, **pruritus**, **inadequate pain control**, **nausea, vomiting, confusion, disorientation**, and **drowsiness**.

3. Serious/life-threatening complications include **paresthesia, cerebrospinal fluid leak, respiratory depression, epidural hematoma or abscess**, and **paralysis**. Although rare, **inadvertent total spinal block** can happen.

4. **Catheter insertion site infection** is usually associated with back pain, tenderness, erythema, swelling, drainage, and fever.
5. **Dural puncture/Post dural headache** is uncommon in caudal epidural placement since the spinal cord terminates at the space between L1 and L2 in adult. The headache will be alleviated with bed rest, adequate hydration and mild analgesics as needed. Unfortunately, these measures will serve only as supportive measures, not a cure. In severe cases, an epidural blood patch may be required to seal the leakage.

6. **Inadvertent high epidural block** can occur when large doses of local anesthetic accumulate in the epidural space. The intercostal muscles may be paralyzed and intubation will become necessary for life-support.

**ASSESSMENT**

1. On arrival from the Post Anesthesia Care Unit (PACU) or Operating Room (OR), inspect the epidural insertion site to ensure proper securement of the catheter (Figure 5), and the clear window dressing being dry (i.e. no leakage of cerebrospinal fluid), without tenderness, redness or swelling, clean and intact. The catheter is customarily taped to the shoulder and attached with a 0.2 micron filter/adaptor for intermittent boluses or continuous infusion. The injection port should be clearly labeled with the sign of “For Epidural Injection Only”.

2. Assessment frequency is hourly for the first four hours from arrival to the admitting unit, then every four hours thereafter if stable. Continue assessment for 24 hours after the last bolus dose before the removal of epidural catheter.

3. Assessment criteria include the following:
   
   a. Epidural catheter insertion site
   b. Vitals: Temperature, pulse/rhythms, blood pressure, respiration rate and continuous oxygen saturation
   c. Pain level assessed with the 0-10 **numeric pain intensity rating scale**
   d. Level of consciousness assessed with **Ramsey Scale**
### Level Criteria (Ramsey Scale)

<table>
<thead>
<tr>
<th>Level</th>
<th>Criteria (Ramsey Scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Patient is anxious and agitated or restless, or both</td>
</tr>
<tr>
<td>2</td>
<td>Patient is co-operative, oriented, and tranquil</td>
</tr>
<tr>
<td>3</td>
<td>Patient responds to commands only</td>
</tr>
<tr>
<td>4</td>
<td>Patient exhibits brisk response to light glabellar tap or loud auditory stimulus</td>
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<tr>
<td>5</td>
<td>Patient exhibits a sluggish response to light glabellar tap or loud auditory stimulus</td>
</tr>
<tr>
<td>6</td>
<td>Patient exhibits no response</td>
</tr>
</tbody>
</table>

e. Motor block is assessed with **Bromage Scale**—Ambulate patient only if assessed with Grade I or Grade II.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Criteria (Bromage Scale)</th>
<th>Degree of Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Free movement of legs and feet</td>
<td>Nil (0%)</td>
</tr>
<tr>
<td>II</td>
<td>Just able to flex knees with free movement of feet</td>
<td>Partial (33%)</td>
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<tr>
<td>III</td>
<td>Unable to flex knees, but with free movement of feet</td>
<td>Almost complete (66%)</td>
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<tr>
<td>IV</td>
<td>Unable to move legs or feet</td>
<td>Complete (100%)</td>
</tr>
</tbody>
</table>

f. Sensory block is assessed with the following procedure:

i. Explain procedure to the patient

ii. Wrap ice with a 4x4 gauze

iii. Apply wrapped ice to the forehead and ask patient to tell you how cold the ice feels

iv. Place wrapped ice to a location likely to be blocked bilaterally and at approximately the same level as the epidural catheter insertion site. Ask the patient if he/she feels the same degree of coldness as the forehead or different temperature. Patients may report the ice feeling colder, warmer, or the same.

v. Apply the ice above and below until it is clear about the upper and lower limit of the sensory block.

vi. Repeat the above step on the opposite side.

g. Inform Anesthesia with abnormal findings
Case Study

1. Mrs. Jackson, a 35 year old post partum patient, received epidural analgesia of 10 ml 0.125% Bupivacaine and 2mcg/ml Fentanyl via a catheter placed at L2. The catheter was removed at 0730 after childbirth.

Questions

(1). Motor loss in lower extremities with the epidural analgesia is manifested
   a. As completely numb
   b. Being able to flex both knees and move feet freely
   c. With painful leg movement
   d. With stiff right leg

(2). Assessment of epidural effects can be stopped
   a. Immediately
   b. At 1130
   c. Before midnight
   d. 24 hours after the last dose of epidural analgesia before the removal of epidural catheter

(3). Mrs. Jackson complains of headache and nausea whenever she breast feeds her baby. Treatment for her headache is
   a. Maintain hydration
   b. PO Tylenol 650 mg PRN headache
   c. Bed rest
   d. All of the above

(4). Etiology of postural headache post epidural analgesia
   a. A toxicity of local anesthetics
   b. Hypotension
c. Cerebrospinal fluid leak due to dura puncture

d. Postpartum blue

(5). Treatment for dural headache

a. IV Morphine 2 mg every two hours

b. IV Narcan to reverse Fentanyl

c. Blood patch

d. CT scan of head to rule out stroke

2. Mr. Owen is receiving continuous epidural analgesia of 0.166% Bupivacaine and 0.2mg/ml Duramorph (10 ml per hour) post exploratory laporotomy with a bolus dose of 1 ml every 30 minutes as needed.

Questions

(1). The insertion site of the epidural catheter is between T7 and T8. Sensory assessment should start from

a. Two dermatomes below T8

b. Between L4 and L6

c. Between T4 and T5

d. Two dermatomes above L1

(2). Mr. Owen is alert and oriented and assessed with a Grade III motor response using the Bromage Scale

a. Safe to ambulate independently

b. Maintain patient on bed rest and reassess motor ability in an hour

c. Encourage patient to stand to regain strength

d. Activate Rapid Response Team for possible hemodynamic instability
(3). Mr. Owen exhibits slight confusion and complaints of funny sensation around his lips
   a. Potential local anesthetic toxicity
   b. Stop epidural infusion
   c. Administer narcan 2 mg intravenously to reverse the opioid toxicity
   d. Normal complaints with epidural analgesia

(4). Patient has received 7 boluses in the last four hours.
   a. It is within normal limit for a patient post exploratory laparotomy
   b. Continue to assess patient’s pain level
   c. Discourage patient to use bolus for potential complications
   d. Inform anesthesia to titrate patient’s continuous rate

(5). Patient is resting comfortably without any distress, but his blood pressure is 90/58 and urinary output for the last four hours is 110 mls.
   a. Stop epidural infusion immediately
   b. Bolus patient with 500 ml normal saline
   c. Encourage incentive spirometry to prevent hypotension
   d. Administer vasopressin

3. Mr. Brighton is recovering from a right hip replacement performed two days ago. He has been receiving heparin 5000 units subcutaneously every 12 hours for DVT prophylaxis. The last dose was administered at 2100.

(1). Epidural catheter can be removed
   a. Immediately
   b. Discontinue heparin and wait 48 hours
   c. 12 hours after the last dose
   d. Administer Vitamin K before catheter removal
(2). Mr. Brighten complaints of progressive numbness in his lower extremities and discomfort at his lower back with stable vital signs and normal CBC.

a. Inform anesthesia immediately for potential hematoma formation within the epidural space
b. Provide hot pack for comfort measure
c. Encourage ambulation
d. Administer medication for pain control

(3). Mr. Brighten became febrile 24 hours after catheter removal.

a. Inspect epidural catheter insertion site for redness, swelling and drainage
b. Obtain blood culture, urine for analysis, sputum for culture
c. Assess surgical incision for infection
d. All of the above

(4). Mr. Brighton is asleep with a respiration rate of 10 and oxygen saturation of 89%

a. Not to worry, his epidural catheter has been removed
b. Wake patient up and encourage deep breath
c. Provide supplemental oxygen
d. Administer narcan immediately

Answers:

Case 1:  a, d, d, c, c
Case 2:  c, b, a, d, b
Case 3:  c, a, d, b
Summary

During the early development of caudal analgesia in the 1940s, this procedure was employed as a disparate measure for the survival of the recipient. In modern medicine, the application of epidural analgesia in labor and delivery and post operative pain management is becoming increasingly popular over the last half century. The benefits of epidural analgesia have been demonstrated in effectiveness and efficacy with greatly reduced rates of systemic side effects, stress induced myocardial infarction and impaired mobility. However, the safety of the patient receiving epidural analgesia is determined by the knowledge and technical competency (Attachment 1: Assessment Record is attached for your learning) possessed by the nurse managing his/her care.

REFERENCES


### EPIDURAL ANALGESIA ASSESSMENT RECORD

<table>
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<tr>
<th>Date___________</th>
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<td>Cont Infusion Rate</td>
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<td>Level of Consciousness</td>
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<td><strong>Ramsey Scale</strong></td>
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<td><strong>Motor Block</strong></td>
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<td>IV. Unable to move legs or feet</td>
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<td><strong>Sensory Block</strong></td>
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