Epidural Technique

The 4 p's for the administration of epidural anesthesia are preparation, position, projection, and puncture.

Preparation

- Prepare the patient. Discuss options, risks and benefits. Explain what to expect during an epidural anesthetic.
- Decide whether to use a single shot, continuous catheter, or intermittent bolus technique. For surgical procedures, a continuous catheter technique is often used. The Crawford needle is appropriate for a one shot technique, whereas a Tuohy needle is appropriate for epidural catheter insertion.
- Decide on the technique to identify the epidural space. Choices include loss of resistance and hanging drop technique.

Positioning

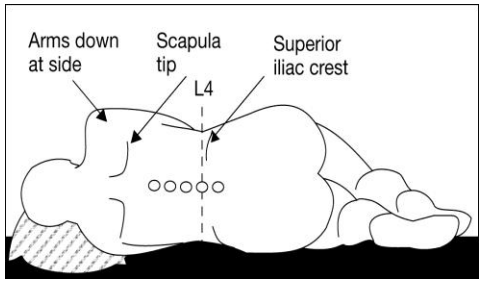
Proper positioning is essential for a successful block. Proper positioning can be difficult for several reasons.

1. Your assistant may not understand how the patient should be positioned or the rationale behind positioning.
2. The patient may not understand your instructions.
3. Sedation may make the patient unable to cooperate or follow directions.

There are three positions used for the administration of epidural anesthesia: lateral decubitus, sitting, and prone.

Lateral Decubitus

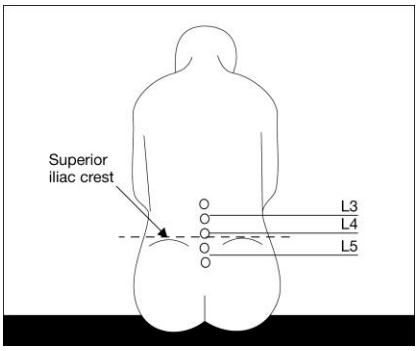
- Allows the anesthesia provider to administer more sedation- less dependence on an assistant for positioning. (Never over sedate a patient).
- The patient is positioned with their back parallel with the side of the OR table. Thighs are flexed up, and neck is flexed forward (fetal position).

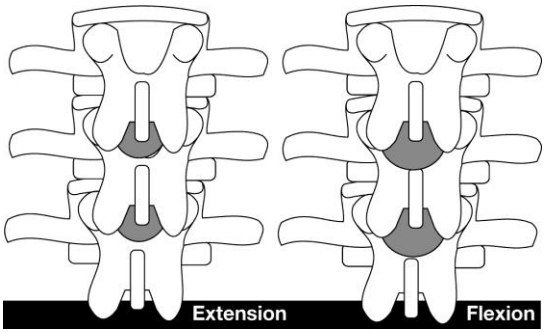


- In children, a lateral decubitus position is often used for the caudal approach. This allows for the maintenance of a patent airway, since the caudal technique is often performed under general anesthesia in pediatric patients. Regional techniques are discouraged during general anesthesia in adult populations due to the risk of nerve injury.
- Position changes are not as critical with epidural anesthesia. The onset of epidural anesthesia is faster in the dependent areas of the body.

Sitting

- Identify anatomical landmarks. This may be a challenge in the obese or in those with abnormal anatomical curvatures of the spine.
- Place the patients' feet on a stool. Have the patient sit up straight, head flexed, arms hugging a pillow, or on a table in front of them. Make sure the patient does not simply lean forward. A number of descriptions may help the patient understand the position they are to assume. For example, "please arch your back to resemble the letter C; or arch your back like a mad cat". This will maximize the "opening" of the vertebral interspaces.





Prone Position

- Used for caudal approach in adults.

Projection and Puncture

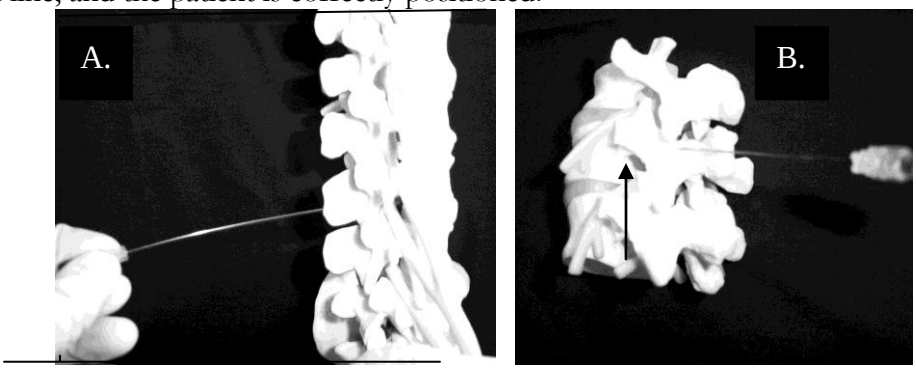
- After a sterile prep, place a skin wheal at the predetermined site of insertion.
- Identify midline! If off the midline it will be difficult to locate the epidural space. If the needle is inserted further than normal, blood is returned in the needle, and/or the patient complains of a paresthesia, stop. Reassess landmarks and needle insertion point.
- Insert the epidural needle into the ligamentum flavum. Anatomical structures transversed include skin, sub cutaneous tissue, supraspinous ligament, and interspinous ligament. If the needle is not placed in the ligamentum flavum, the anesthesia provider may experience false positives with the loss of resistance technique.
- In the lumbar area, the depth of skin to ligamentum flavum is approximately 4 cm for most adults. Eighty percent of adults have a skin to ligamentum flavum depth of 3.5-6 cm. The average thickness of the ligamentum flavum is 5-6 mm. Controlling the needle is important to avoid a dural puncture. In the thoracic area, needle control is important to avoid dural puncture and risk of spinal cord injury.
- Loss of resistance technique: once the needle is placed into the ligamentum flavum, remove the stylet. Attach a glass syringe with 2-3 ml of preservative free normal saline and a small (0.25 ml) air bubble. The needle is held steady by the non-dominant hand. The dominant hand holds the syringe. Steady pressure is applied to the plunger to compress the air bubble. Slowly and steadily advance the needle until loss of resistance is noted.
- Hanging drop technique: place the needle into the ligamentum flavum. Next, apply a drop of preservative free normal saline to the hub of the needle. Apply slow, steady pressure to

the needle until the hanging drop gets "sucked" in. The epidural space contains subatmospheric pressure.

- Once the epidural space has been identified, advance the needle 1-2 mm further. Some anesthesia providers do this to ensure the tip of the needle is not obstructed by tissue, hindering insertion of the catheter. On the other hand, this may increase the risk of inadvertent dural puncture. An alternative is to inject an additional 2-3 ml of preservative free normal saline, expanding the epidural space and pushing structures away.
- Insert the catheter 3-4 cm into the epidural space for surgical patients. Inserting the catheter further may lead to a unilateral block. For OB patients, insert the catheter 4-5 cm to prevent migration of the catheter out of the epidural space during labor and delivery.
- The dose and volume of local anesthetic for epidural anesthesia is large enough to cause systemic toxicity if injected into a blood vessel, and a high spinal if injected in the subarachnoid space. To help identify inadvertent venous cannulation or subarachnoid placement, a test dose should be performed.
- A test dose consists of 3 ml of 1.5% preservative free lidocaine with 1:200,000 epinephrine. Forty-five milligrams of lidocaine, if injected intrathecally, will result in a spinal anesthetic. Fifteen micrograms of epinephrine, if injected intravascularly, will result in a 20% or more increase in heart rate. Blood pressure may be elevated or remain the same. False positives may occur with epinephrine. For example, a laboring patient may have a contraction at the same time that the test dose was administered, resulting in a concurrent increase in heart rate or blood pressure. False negatives may occur. For example, a patient may be on a beta blocker which will block/blunt an increase in heart rate.
- Aspiration before each injection is helpful, but may not always detect intravascular or subarachnoid placement of a catheter.
- Incremental dosing of 5 ml every 5 minutes should be performed. This dose should be enough to cause symptoms of intravascular injection without seizures and/or cardiovascular collapse.
- Catheter migration may occur any time. This can lead to an intravascular or intrathecal injection. Aspirate before dosing and dose the epidural incrementally. Be cautious and have a high index of suspicion. Some clinicians will use a test dose with each subsequent injection, along with aspiration and incremental dosing.

Problems that may be Encountered when Administering Epidurals

- Bone is encountered by the needle. Reassess the direction of the needle, ensure the needle is mid line, and the patient is correctly positioned.



A. Needle contacting spinous process
B. Needle contacting lamina

- Inability to thread the catheter. Ensure the needle is in the epidural space by placing an additional 3 ml of preservative free normal saline. If there is a loss of resistance, then attempt to insert the catheter. Rotating the needle slightly may help. If the catheter still cannot be inserted, start over.
- Fluid returns through the needle. When using preservative free normal saline, a small amount may come back. If it does not stop and continues, then the needle may have transversed the dura. If this is suspected, place the epidural at another level and monitor for the development of a post dural puncture headache. If fluid stops, thread the catheter and administer a test dose to ensure that the needle/catheter did not cross the dura. If the test dose is negative, cautiously dose the epidural.
- Blood returns in the catheter or needle. The needle/catheter may have entered into an epidural vein. Remove the needle and/or catheter and start over. Make sure the needle is midline.
- Pain (paresthesia) upon insertion of the needle. Remove needle immediately and assess position. Commonly, insertion is not midline and the needle should be repositioned.
- Pain (paresthesia) upon insertion of the epidural catheter. It is not unusual to get a brief shock like symptom or sensation during catheter insertion. If it does not stop, remove the catheter. It may be in contact with a nerve root.
- Pain with injection. The direction of the catheter cannot be controlled during insertion. The tip may be against a nerve root. Pull the catheter back 1 cm and attempt to inject again. If pain continues, remove the catheter and start over.

Failed Epidural

Epidural anesthesia is more subjective than spinal anesthesia. There is not a clear cut end point, like CSF with a spinal. The anatomy of the epidural space lends to a less predictable spread of local anesthetic. There are several factors that may lead to a failed epidural block. These include false loss of resistance, misplaced local anesthetic, unilateral block, segmental sparing, and visceral pain.

- False loss of resistance. It is possible to insert a catheter in tissue other than the epidural space. Spinal ligaments may be soft, resulting in a false loss of resistance. Being off the midline, in the paraspinous muscle, may also result in a false sense of loss of resistance.
- Misplaced local anesthetic. Local anesthetics may be misplaced in other anatomical areas including the subarachnoid space, subdural space, and intravenously. These complications have been discussed earlier.
- Unilateral block. The catheter may have traveled out of the epidural space or pointed laterally. Pulling the catheter back 1-2 cm may move the catheter back into a midline position. Pulling back on the catheter may also move the catheter out of the epidural space.
- Segmental sparing may occur due to anatomical conditions (septa) within the epidural space. Additional local anesthetic may help alleviate this condition. Sacral sparing may occur due to the larger size of L5-S2. Elevating the head of the bed and adding local anesthetic will increase the concentration of local anesthetic in this area, creating a denser block.
- Visceral pain is not a failure of epidural anesthesia. Visceral afferent fibers travel with the vagus nerve and are difficult to block. Intravenous supplementation with analgesics and sedatives may be required to get the patient through "uncomfortable" portions of the surgical procedure. If unable to adequately treat discomfort, then general anesthesia should be induced.

Monitoring

After successful placement of an epidural anesthetic, the patient should be monitored continuously for block progression and complications. Heart rate, pulse oximetry, level of consciousness, and signs and symptoms of toxicity should be monitored continuously. Blood pressure should be taken every 3 minutes or more frequently if needed. The patient should be monitored for the following conditions:

- Block progression- ensure that the block is adequate for the surgical procedure and does not progress too high.
- Hypotension- treat aggressively, if > 20% of the baseline blood pressure
- Bradycardia- treat aggressively, since it may progress to cardiac arrest
- Numbness of the arms and hands- may indicate that the block is too high
- Problems with breathing- may indicate that the block is too high
- Changes in the level of consciousness

For an in-depth discussion of the complications of neuraxial complications, please refer to Chapter 3.

Obstetric Care

Neuraxial blockade is preferred over a general anesthetic in the obstetric population, if not contraindicated. Dose of local anesthetics are often reduced to prevent excessive spread. Excessive spread may occur due to changes in intra-abdominal anatomy and an increased sensitivity to local anesthetics related to altered hormone levels.

Postoperative Care

During recovery from an epidural anesthetic, the patient should receive the same vigilant care as the patient recovering from general anesthesia. In addition, the patient should be assessed for block regression. The patient with an epidural is more likely to experience hypotension in the postoperative period. Treatment includes a Trendelenburg position, additional intravenous fluids, oxygen, and vasopressors as needed. Assess the patient for urinary retention if they do not have an urinary catheter. Discharge should not occur until vital signs are stable and the epidural block is regressing. The patient should remain in bed until full sensory and motor function has returned. The first time a patient is ambulated a nurse should assist the patient, ensuring full function has returned.

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