

Musculoskeletal Imaging and Intervention Section Imaging Procedures

Lumbar Epidural Injection

INDICATIONS

- Multilevel spine disease, especially acquired spinal or foraminal stenosis
- Herniated disk with nerve root irritation as an alternative to a focal nerve block

RISKS

- Pain
- Hematoma
- Allergic reaction
- Epidural abscess
- Transient hypotension (only with anesthesia injection)
- Intrathecal injection (arachnoiditis, meningitis)

CONTRAINDICATIONS

- Local skin infection over sacral hiatus
- Pilonidal cyst
- Concurrent illness (*e.g.*, cold, flu)

PREPROCEDURE COUNSELLING

- Discuss patient's symptoms and results of prior injections
- Take brief past medical and surgical history including allergies
- Explain the procedure in detail
- Explain the expectations of the procedure
 - Can expect some immediate relief for a few hours due to lidocaine 0.5% with return of pain later in the day
 - Should expect some result within 1-2 days
 - Can likely expect 6-8 weeks of pain improvement and/or relief. There is a broad range of potential results from resolution of pain to no change in symptoms.
- Explain activity limitations post procedure
- Take it easy the rest of the day, can return to routine activity the following day

PREREQUISITES

- Directed history is taken including symptoms, previous surgery, prior injections, allergy history, and other medical conditions including cardiac disease and diabetes
- Patient accompanied by someone to drive home.

- Prior to the procedure, it is critical to review the patient's cross sectional imaging study to select the best approach. Neither the lumbar/interspinal or caudal approaches have been shown to be more efficacious. At our institution, the lumbar/interspinal approach is preferred, generally in an attempt to place the steroid as close as possible to the suspected pain generator. The caudal approach is often reserved for patient's with altered anatomy due to prior lumbar surgery, if the posterior epidural space is too small, or when there is no cross sectional imaging available for review.
- AP and lateral L-spine plain films in last month to exclude infection, tumor, etc. as cause of back pain; also, to identify sacral hiatus and curve of sacrum.
- Check MRI (if available) or myelogram for inferior extent of thecal sac, Tarlov cysts, etc. to avoid with needle.
- Obtain signed consent.

MATERIALS

- Fluoroscopic unit
- Betadine
- 18G 1 ½" needle (3)
- 25G 1 ½" needle
- 22G 3 ½" needle, 10° curve
- 4x4s
- Steridrape
- Sterile towel
- 9 cc lidocaine 1% preservative free buffered with 1 cc sodium bicarbonate
- Syringes: 5 cc (2), 10 cc (2)
- IV Heplock Connecting tubing, short
- Omnipaque 300
- Kenalog (2 cc [80 mg])
- Lidocaine 0.5%, preservative free

TECHNIQUE – Caudal ESI

1. Place patient in prone position.
2. Palpate sacral hiatus, typically at superior aspect of gluteal crease and mark skin
3. Once the hiatus is identified by palpation, it is verified with lateral fluoroscopy.
4. Place 1-2 4 x 4 folded gauze pads between upper buttocks to catch Betadine drippings, which irritate the perineum.
5. The importance of a thorough and meticulous sterile preparation to avoid a potentially catastrophic infection cannot be overemphasized. Clean with Betadine and place plastic steridrape. Place sterile towel just distal to steridrape, over buttocks.
6. Anesthetize down to bone (25G and 1% lidocaine buffered with sodium bicarbonate) starting just caudal to sacral hiatus.
7. At a 45° angle, place 25 G 3 ½" needle with tip at the sacral hiatus. A stiffer or longer 22 G may be needed in a larger patient. If the needle is in the midline on the AP view, the remainder of the procedure is performed under lateral fluoroscopic control. Taking care to have a true lateral view with the femoral heads overlapping will help avoid confusion. The needle is then withdrawn slightly, and the needle hub is dropped nearly horizontally. Ideally the needle shaft will be in the same plane as the sacral canal. The needle is advanced with a gentle twisting motion to decrease the likelihood of lodging in the sensitive periosteum. Needle advancement is stopped at the level of S3 (thecal sac usually ends at S2). Check needle position in AP and lateral planes

(Figures 1 and 2).

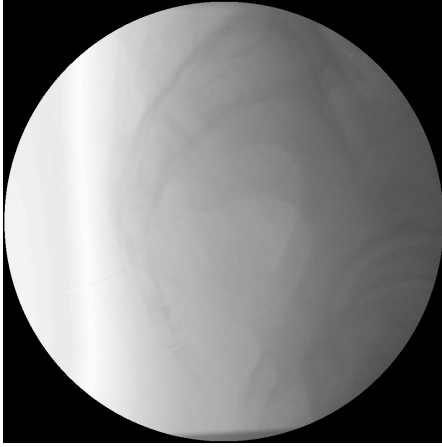


Fig 1: Early needle positioning, lateral.

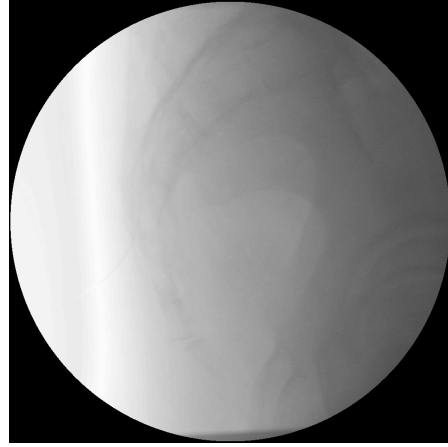


Fig 2: Late needle positioning, lateral.

8. The stylet is removed and the patient is asked to perform a valsalva maneuver to exclude intrathecal placement. We also attempt to aspirate with a 5 cc syringe.
9. An epidurogram is performed with 1-3 cc of contrast (Omnipaque-300), which should flow freely away from needle and surrounds dural sheaths of sacral nerve roots. The contrast distribution from the epidurogram resembles a Christmas tree and the injected contrast will not rapidly disperse. Look for free flow on both sides of midline (absent or incomplete plica mediana dorsalis). In a venous injection, the contrast will have a serpentine course and flow quickly away from the needle tip (Figure 3).

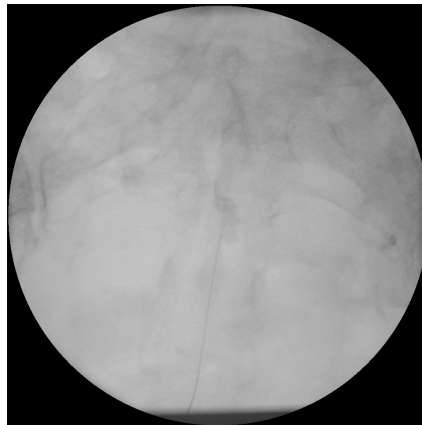
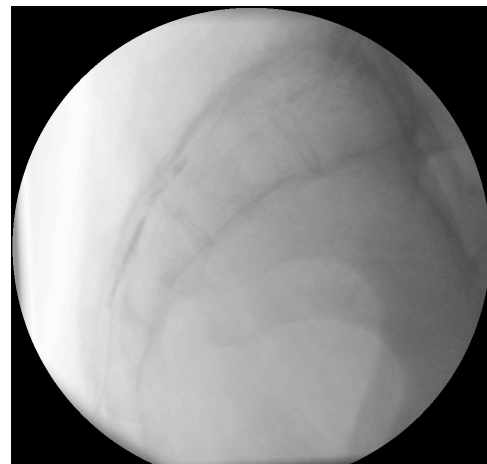
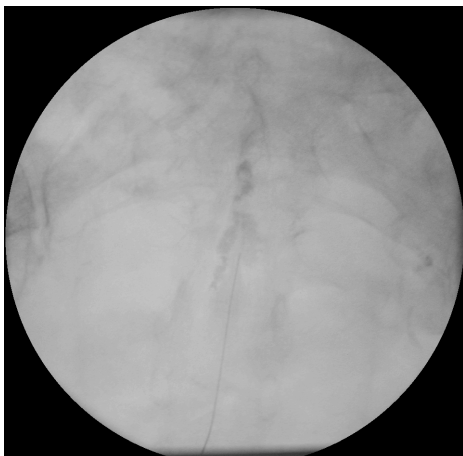


Fig 3: Early injection, AP.

10. Take AP and lateral spot films (Figures 4 and 5).



11. Inject 2 cc Kenalog (80 mg), followed by 8 cc of 0.5% preservative free lidocaine. Many patients experience pain down one or both legs, this can usually be improved with decreasing the injection rate.
12. Patients can leave after getting dressed unless they have problems with low blood pressure, bowel/bladder function, or leg weakness.

PITFALLS OF NEEDLE PLACEMENT IN CAUDAL ESI

Problem:	Solution:
Needle posterior to sacrum in soft tissues	Reposition
Needle anterior to sacrum (even in rectum)	Remove needle and start over with new clean needle
Needle in nerve sheath	Reposition
Intraosseous needle placement in osteoporotic patients	Reposition
Needle in epidural vein	Reposition
Needle in subarachnoid space	Remove needle and reschedule procedure for one week or more later

TECHNIQUE – Lumbar epidural injection

LEVEL SELECTION If there is an adequate posterior epidural space on the cross sectional study, we prefer to perform a lumbar ESI as close to the pathology as possible. The most common level injected is L4-L5 followed by L3-L4. It is important to note that the posterior epidural space at L5-S1 is typically small and much less suitable for injection. The patient is positioned prone with head flat on the table and a bolster under the level selected in an effort to open the spinous processes as much as possible. The importance of proper abdominal bolster placement cannot be overemphasized.

APPROACH SELECTION The approach selected for a lumbar/interspinous, either interspinous or interlaminar, will depend on the operator's preference and experience. We routinely use the interspinous approach; however the interlaminar approach is the standard at many institutions and can be helpful in patients with severe narrowing of the interspinous space (Baastrup's disease).

INTERSPINOUS APPROACH

1. For the midline interspinous approach, the skin entry site should be over the upper half of the more inferior spinous process.
2. Often the fluoroscopic tube must be angled to center the spinous processes between the pedicles.
3. If there the space between the spinous processes is narrow, this can often be improved with the addition of a second bolster. In this situation, it helps to check the angle of approach in the lateral view before skin preparation to be certain that the selected skin site will allow a direct path to the target.
4. The 25G, 3.5 inch spinal needle which should be directed slightly cephalad to intersect the posterior epidural space at the level of the disc space. Occasionally patients require no cephalad needle angulation at all to reach the target. If a 6 inch needle is required due to patient size, a 22 gauge spinal needle is used for greater directional control.

5. Because the posterior epidural space is relatively narrow, the needle tip should be kept in the midline and not allowed to deviate laterally beyond the cortex of the spinous processes. Once the needle engages the interspinous ligament, it is less likely to deviate laterally and the needle is advanced with lateral fluoroscopic control.
6. The needle is stopped when it crosses the posterior margin of the facets. Needle position is rechecked in the AP view to ensure it is in the midline.
7. The needle is then slowly advanced in 1 mm increments with intervening checks utilizing the "air release technique" for entry into the posterior epidural space. The air release technique is performed by attaching a glass or low-resistance plastic syringe (such as a Terumo 3-cc syringe) to the needle and attempting to inject 0.5-1.0 cc of air. If the needle tip is within the ligamentum flavum, the syringe plunger will bounce back. Once the needle tip enters the epidural space, air will freely inject without resistance. If we attempt air injection three times without release, we typically reinsert the stylet to ensure that the tip of the needle is not plugged and then resume advancement.
8. Contrast is then instilled via IV hep lock extension tubing, under continuous AP fluoroscopy. When the needle is appropriately within the epidural space, injected contrast pools around the tip of the needle on the AP view. Alternatively, contrast in the thecal sac quickly diffuses and does not pool at the needle tip. If the tip is in a vein, contrast whisks away into branching or tortuous venous structures.
9. Positioning is confirmed in the lateral projection, which should show contrast collecting along the fat within the posterior epidural space posterior to the thecal sac.
10. When proper positioning is assured, 2 cc Kenalog mixed with 5 cc preservative-free 0.5% lidocaine is injected. Intermittent fluoroscopic checks are made to ensure dilution of the contrast pool by the radiolucent medication. It is not unusual to elicit the patient's typical pain with the injection; this can usually be improved with slowing the injection rate or deep, slow respirations (Figures 6 and 7).

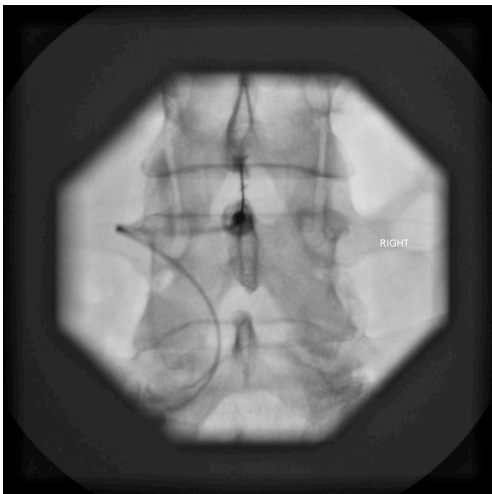


Fig 6: Lumbar epidural injection, AP.



Fig 7: Lumbar epidural injection, lateral.

11. Standard images obtained during the procedure include AP and lateral images documenting contrast in the posterior epidural space and dilution of the contrast by the medication. These images often aid the next operator if the patient returns for another injection.

INTERLAMINAR APPROACH

1. Patient preparation, anesthesia, and level selection are as described above for the interspinous approach. Place patient prone. Do not place a pillow under the abdomen to straighten the lordosis because it will push back the dural sac and compress the posterior epidural fat.
2. Angle the tube about 10-15° toward the side you are going to work on, so that the small foramen formed between the adjacent laminae is well seen. Mark the position to maximize visualization of this opening. If you want to go in just on the left side of midline, angle the image intensifier to the left side of the patient by 10-15°(Figure 8).

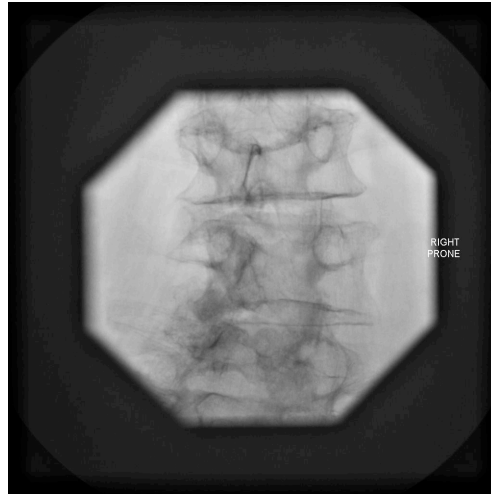


Fig 8: Lumbar epidural paramedian approach, oblique.

3. Skin entry site is the midportion of the lamina of the vertebra below the level selected e.g. for the L4-5 level, the midportion of the right L5 lamina is targeted. A 22 gauge Tuohy needle is inserted with slight cephalad and medial angulation under AP fluoroscopic control into the interlaminar space aiming for the base of the spinous process of the same vertebra.
4. The tube is rotated to the contralateral oblique projection, approximately 45 degrees opposite the side of needle entrance, until the laminae take on a shingled appearance. Insert 22G spinal or Tuohy needle in line with the tube and check proper position with intermittent fluoro. As the needle is advanced, its position should be checked in the AP projection periodically, to verify that it is appropriately directed towards the midline. The needle is stopped just posterior to the spinolaminar line where it has engaged the ligamentum flavum. Make sure not to advance too far, or you will enter the thecal sac. Aim for the bone on the caudal aspect of the interlaminar foramen.
5. Put the tube in a lateral position and check for needle tip. When the tip is just dorsal to the spinolaminar line, attach low-resistance syringe. The remainder of the procedure including post procedure care is as described in detail for the interspinous approach. The needle is incrementally advanced in 1 mm steps, utilizing the "air release" technique and a small injection of iodinated contrast to confirm epidural positioning (Figure 10b). This is followed by injection of the mixture of 2 cc Kenalog-40 (80 mg) and 5 cc of preservative free 0.5% lidocaine.

POTENTIAL PITFALLS LUMBAR ESIS

1. **Intrathecal Needle Placement:** Contrast injected into the intrathecal space will layer on the dependent ventral margin of the thecal sac immediately posterior to the vertebral bodies. If there is a question of a possible intrathecal injection, the table can be tilted to attempt to demonstrate free flow of intrathecal contrast. If the thecal sac is entered, the injection is terminated at that site as injection would result in a spinal anesthetic block. A second attempt at another site can be made if the needle is 25-gauge, but reschedule the patient if it is 22-gauge needle (Figure 9).

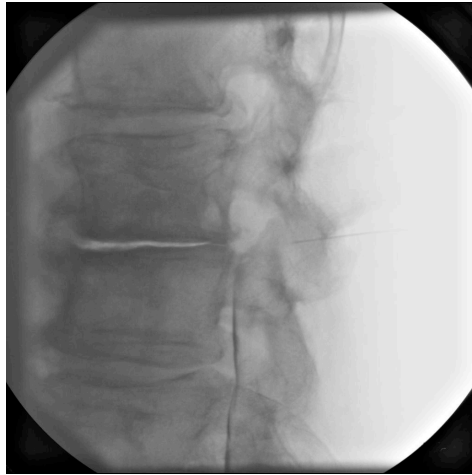


Fig 9: Intrathecal injection, lateral

2. **Partial Air Release:** Occasionally, as the needle is advanced with the air-release technique, there is only a partial air release. This is also a sign of entry into the epidural space, and further advancement may result in entry into the thecal sac.
3. **Early Air Release:** If an air release occurs before expected, the position may be posterior to the ligamentum flavum, a space that can accept air insufflation. On contrast injection in this location, contrast will flow between the spinous processes posteriorly. In our experience, once contrast has been injected through a needle, the air release technique is no longer reliable and further checks for entry into the epidural space should be performed with contrast injection.
4. **Post Operative Spines:** The postoperative levels are typically avoided due to extensive scar tissue formation. We will typically place our medication at the closest non operated level or select the caudal route for these patients.