Radiologist's Guide to Lumbar Spine Pain Interventions: Indications, Techniques, and Complications

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Author affiliations, funding, and conflicts of interest are listed at the end of this article.
See the slide presentation here.

Low back pain presents diagnostic and therapeutic challenges. Lumbar pain interventions (LPIs) result in durable pain control in about two-thirds of appropriately selected patients. Approximately 10 million LPIs are performed annually in the United States. Despite their expertise in image interpretation and image-guided interventions, radiologists perform only 35% of LPIs.

LPIs are indicated for neuroforaminal stenosis caused by disk herniation or facet joint pathologic conditions, as well as for degenerative canal stenosis. Other indications include postlaminectomy syndrome, failed low back surgery, and residual pain after low back surgery or kyphoplasty. In addition to anti-inflammatory action, other mechanisms of action of LPI include reduction of venous congestion, reduced nociception, washout of the inflammation, lysis of perineural adhesions, and neuroplastic inhibition of the conversion of acute to chronic pain. Generally safe with few contraindications, LPIs offer better prognoses for patients with a clear inciting event, good clinical-radiologic correlation with pathologic conditions, and short duration of symptoms.

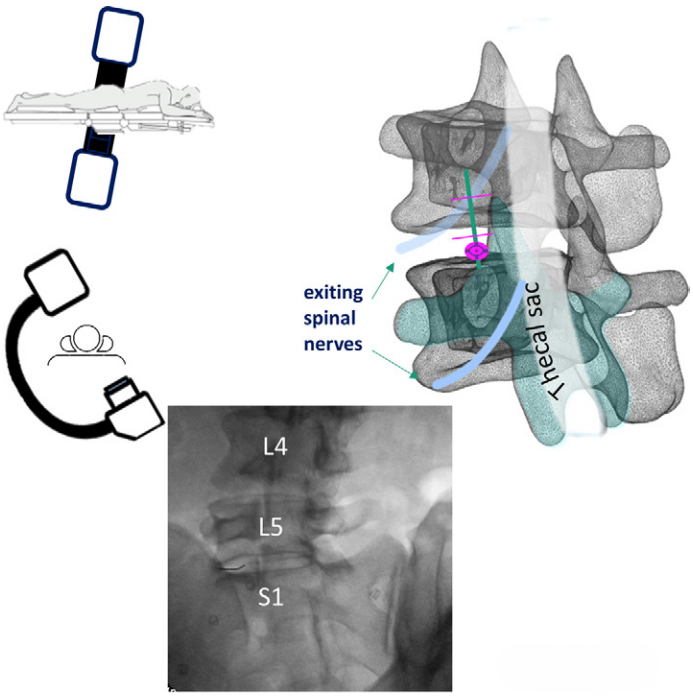

Figure 1. Technique used to perform an infraneural transforaminal epidural injection. Left: The C-arm is angled in the craniocaudal plane to profile the endplates at the level to be injected, then rotated in the transverse plane to profile the foramen being targeted. Right: The "Scotty dog" sign is visible, as demonstrated by the blue-green overlay. The thecal sac is denoted by white shading, and the nerve roots are denoted by blue lines. The neural foramen, or interpedicular space, is divided into thirds. The needle (pink) should be located in the inferior third of the neural foramen and oriented with the hub in line with an x-ray beam. Infraneural injections are also called retrodiscal injections. Bottom: Fluoroscopic image shows infraneural needle placement in the L5-S1 interspace.

For most cases, no special equipment is required. Multiple steroid formulations are available. Nonparticulate steroids are indicated for transforaminal injections due to the risk of vascular embolization, while particulate and nonparticulate steroids may be used for interlaminar injections. Blunt needles are used for interlaminar injections, while sharp-tipped needles are used for transforaminal injections, facet joint injections, medial branch blocks, and synovial cyst ruptures.

The neural foramen lies in the interpedicular space and can be targeted using specific fluoroscopic views (Fig 1). The accompanying slide presentation shows how supra- and infraneural transforaminal injections target the specific structures responsible for radicular pain, are performed in a location within or close to the neural foramen, and involve different needle locations and contrast agent flow patterns (Fig 1). Dorsal S1 transforaminal injection is a technically challenging procedure used for multilevel lumbar stenosis. Interlaminar injections, while also targeting the epidural space, have limited drug delivery to the specific root due to scant ventral flow of the injectate. Patients with predominant axial pain benefit from interlaminar or facet joint injections, while patients with predominant radicular pain are suitable for transforaminal injections. When axial and radicular pain are equal, the choice of procedure depends on the pain generator and local anatomy. Prior surgery, large perineural cysts, and severe stenosis result in altered anatomy and may require a different route or level of injection.

Lumbar spine synovial cysts often accompany degenerative arthritis and can cause compressive radiculopathy. Direct and indirect cyst ruptures lead to immediate decompression

Slide Presentation

RadioGraphics 2025; 45(3):e240188
https://doi.org/10.1148/rg.240188
Content Codes: CT, MK, NR

Abbreviation: LPI = lumbar pain intervention

TEACHING POINTS

- The type and prognosis of LPIs are determined by a thorough review of imaging findings and their correlation with clinical findings. Radicular back pain often results from neural foraminal pathologic conditions and is best treated with transforaminal injections, while predominantly axial back pain primarily results from spinal stenosis or facet joint pathology and is best treated with interlaminar injections or facet joint–directed interventions.
- LPIs also have a diagnostic value in addition to their therapeutic role because transient relief pinpoints the pain generator among the myriad causes of low back pain.
- While less invasive than surgery, LPIs may result in severe complications. Prompt recognition and management are crucial to avoid devastating injuries.

of the affected area, providing durable symptom relief (Fig 2). Techniques used to treat medial branch blocks target innervation of the lumbar facet joint and often help confirm the arthritic facet as the pain generator. Radiofrequency ablation is performed after successful treatment of medial branch blocks and can help selectively denervate the painful facet joint, resulting in medium-term pain relief.

Complications, though infrequent, can be catastrophic and require prompt recognition. Injections inadvertently performed in the subarachnoid, intrathecal, or intravascular spaces can be identified by distinct contrast agent flow patterns. Infections and hematoma are very infrequently seen, while glucocorticoid arachnoiditis, described in the classic literature, is now rarely encountered.

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Disclosures of conflicts of interest.—The authors, editor, and reviewers have disclosed no relevant relationships.

Suggested Readings

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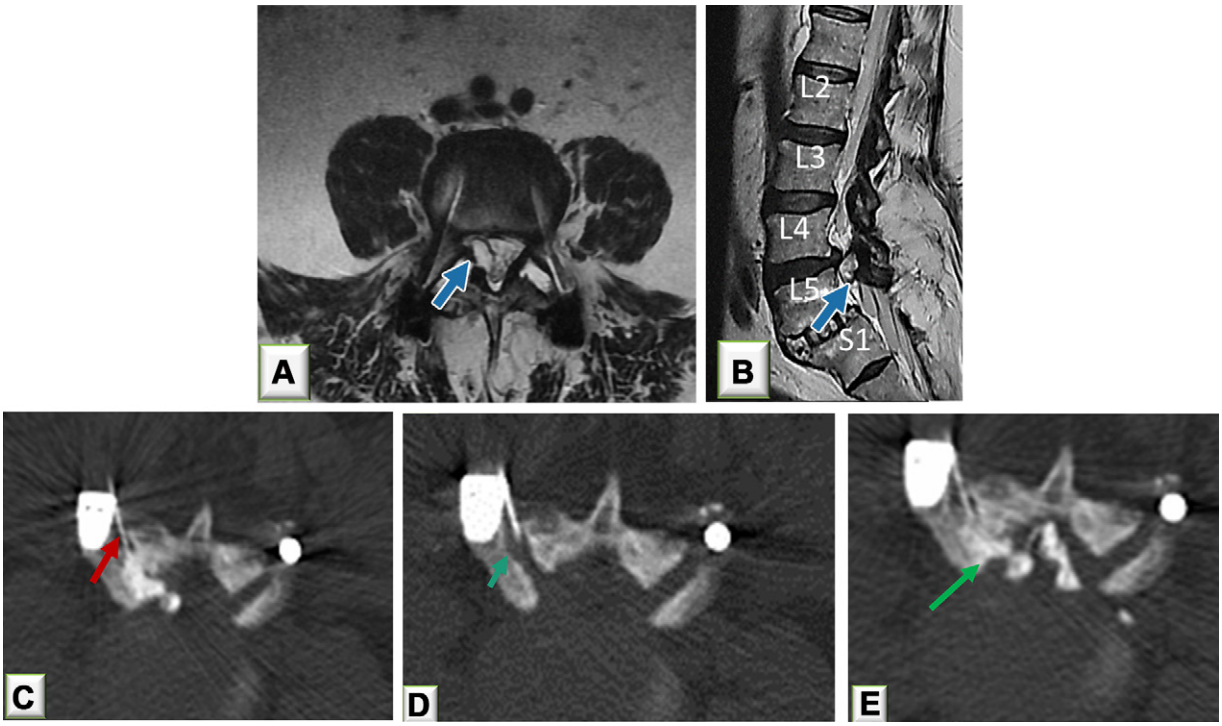

Figure 2. Treatment of lumbar spine synovial cyst. **(A, B)** Axial **(A)** and sagittal **(B)** lumbosacral spine T2-weighted MR images show a right synovial cyst (arrow) with facet joint arthropathy. Note the pedicle screw instrumentation. **(C)** Axial image of CT-guided indirect rupture of the synovial cyst shows the needle tip (arrow) in the right facet joint capsule. **(D)** Axial CT image shows contrast agent filling the facet joint and the communicating synovial cyst (arrow). **(E)** Axial CT image shows that continued pressurization during contrast agent injection results in cyst rupture, which is confirmed by the epidural flow of contrast agent spilled from the cyst (arrow).