Lumbar Epidural Steroid Injections

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KEYWORDS

• Lumbar epidural steroid injections • Transforaminal • Interlaminar
• Epidural steroid injections techniques • Evidence

KEY POINTS

- Lumbar epidural steroid injections under fluoroscopic guidance are frequently used as part of the treatment of low back pain, especially with radicular component.
- Evidence shows these procedures are relatively safe and effective, especially for the short-term treatment of radicular pain.
- An adequate understanding of the relevant anatomy is important to be able to consistently deliver the injectate in the expected target and for safety considerations.
- Interlaminar and transforaminal approaches can be used to reach the epidural space. Each has different technical considerations that are discussed.

Low back pain is the leading cause of activity limitation and work absence throughout much of the world, imposing a high economic burden on individuals, families, communities, industry, and governments.[1] In the United States, back pain is the fifth most common reason individuals seek medical care and $30 to $50 billion in health care are spent on the treatment of this condition annually, with about 3% of emergency rooms visits.[2] Many of these subjects will develop chronic low back pain, adding to the individual and social cost. Globally, chronic low back pain has been estimated to have a prevalence of 4.2% in individuals aged between 24 and 39 years old and 19.6% in those aged between 20 and 59 years.[3] Point prevalence in different studies ranges from 12% to 33%, the 1-year prevalence ranged from 22% to 65%, and the lifetime prevalence ranges from 11% to 84%.[4]

Low back pain with radicular components is also very common and carries a worse prognosis in terms of pain, disability, chronicity, loss of productivity, quality of life, and use of health care resources, especially if the pain radiates to below the knee, indicating radiculopathy.[5,6] The annual prevalence in the general population, described as low back pain with leg pain traveling below the knee, varied from 9.9% to 25%, which means that it is presumably the most commonly occurring form of neuropathic pain.[7]

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Radicular pain is not always secondary to mechanical nerve compression as evidenced by patients with resolution of pain despite MRI findings of nerve compression, patients with no symptoms and abnormal studies, and patients without improvement in radicular pain after surgical decompression. The radicular nerve pain can be attributed to inflammatory and neurochemical mediators that act as principal modulators, if not precipitators, of the symptoms. These include phospholipase A2, neuropeptides such as substance P, vasoactive intestinal peptide, and calcitonin gene-related peptide that can be release from an injured nucleus. Increased local concentrations of these neuropeptides are thought to sensitize the free nerve endings, generating painful discharges, and producing back pain. It is also likely that these neuropeptides sensitize the adjacent nerve root and dorsal root ganglion, generating nerve root symptoms.[8] Treatment generally includes modifying activities, different exercise modalities, oral analgesics and neuropathic medications, physical therapy, manual manipulations, the use of epidural steroid injections, and, in certain, cases surgical interventions. Epidural injections can be performed via interlaminar, transforaminal, and caudal approaches injecting in isolation local anesthetic solutions, steroids, or a combination of both, and are commonly given to relieve pain and improve function and mobility, buying time for healing to occur. The exact mechanism of action of the drugs is not known and probably is multivariate, including an antiinflammatory effect, neural membrane stabilization effects, and the modulation of the peripheral nociceptor input.[9] In this article we will discuss the interlaminar and the transforaminal approaches.

ANATOMIC CONSIDERATIONS

- Understanding the anatomy of the lumbar spine is essential to perform accurate and safe lumbar epidural steroid injections. Special attention has to be given to the neurovascular structures in and around the epidural and foraminal areas.
- The epidural space is subdivided in a posterior and an anterior compartment.[9]
  - The anterior compartment is bordered anteriorly by the vertebral body, intervertebral disc, and the posterior longitudinal ligament, and posteriorly by the thecal sac; the posterior epidural space is bordered anteriorly by the thecal sac and posteriorly by the ligamentum flavum and the laminae. The diameter of the posterior space is about 5 to 6 mm from L2 to L5.
  - The contents of the epidural space include adipose tissue, loose areolar tissue, arteries, lymphatics, and an abundant venous plexus.
    - Fat cells are abundant in the dura that forms the sleeves around spinal nerve roots, but they are not embedded within the laminas that form the dura mater of the dural sac.[10]
    - Drugs stored in fat, inside dural sleeves, could have a greater impact on nerve roots than drugs stored in epidural fat, given that the concentration of fat is proportionally higher inside nerve root sleeves than in the epidural space, and that the distance between nerves and fat is shorter.[10]
- The intervertebral foramen
  - The intervertebral foramen is bordered anteriorly by the lower half of the upper of the 2 vertebral bodies, the intervertebral disc, and the upper half of the lower vertebral body, posteriorly by the facet joint, the lamina and ligamentum flavum, and superiorly and inferiorly by the pedicles of the adjacent vertebrae.
  - The exiting nerve root, lies high in the foramen (above the disc and below the pedicle) and is surrounded by the dural sleeve, which is composed of dura and arachnoid mater as far as the foramen.