

Caudal Epidural Steroid Injection in Pain Management

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ABSTRACT

Caudal epidural steroid injection is one of the most commonly performed procedures in pain clinic. It is effective and technically easy to perform. The rate of complications is higher when attempted blind. Fluoroscopically guided caudal approach is recommended and increases the efficacy and safety profile for depo steroid administration. This article reviews the anatomy of caudal space, technique of fluoroscopic-guided caudal steroid injection, and its advantages and disadvantages.

Keywords: Caudal, Epidural, Fluoroscopy

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INTRODUCTION

The caudal approach to the epidural space is the earliest known technique for epidural steroid injection. It was first reported in 1901. In 1925, Viner popularized its use for treating sciatica. It was in 1952 corticosteroid was added to the local anesthetic injectate mixture and used as the now-common epidural steroid injection for specifically acute and chronic pain. The popularity of the caudal approach to the epidural space in analgesia has changed over the decades.¹

The principle of epidural steroid injection is that the corticosteroid delivered into the epidural space attains higher local concentrations over an inflamed nerve root and will be more effective than a steroid administered either orally or by intramuscular injection. The present clinical rationale for steroid usage in caudal epidurals is primarily based on the benefits, which include pain relief outlasting by hours, days, and sometimes weeks, the pharmacological action of steroids, and local anesthetics.²

The mechanism of action of corticosteroid is by reduction of inflammation by inhibiting the synthesis or release of a number of proinflammatory substances or by

causing a reversible local anesthetic effect. Other effect of corticosteroid is by membrane stabilization, inhibition of neural peptide synthesis or action, blockade of phospholipase A2 activity, prolonged suppression of ongoing neuronal discharge, and suppression of sensitization of dorsal horn neurons.²

Local anesthetic provides short- to long-term symptomatic relief by suppression of nociceptive discharge, the block of axonal transport of the sympathetic reflex arch, and block sensitization.³

ANATOMY

The sacrum which is convex dorsally is comprised of five embryonic fused vertebrae. The coccyx is a triangular bone attached to the sacrum and consists of three to five rudimentary vertebral bones. The superior articular base attaches to the apex of the V-shaped sacrum at the sacrococcygeal joint bounded by the sacrococcygeal ligament. It extends dorsally in the midline to cover the sacral hiatus. The sacral hiatus is bordered by the sacral cornua laterally. This space is a natural defect in the union of the dorsal midline of the S5 vertebrae, where it meets the S4 vertebrae. Its floor is the vertebral body of S5. It contains the coccygeal nerve and the filum terminale (Fig. 1). The sacrum has two sets of foramen – the four posterior sacral foramina and the four anterior sacral foramina. The sacrum is laterally attached to the sacroiliac joint, superiorly forms the L5–S1 facet bilaterally, and also to L5–S1 disc. The sacral canal contains the epidural venous plexus down to the level of S4 and epidural fat.

The termination of the thecal sac varies depending on age, and varies between the lower border of the S1 foramen in adults and the S3 foramen in children. This is of significance to avoid the needle tip puncturing the dura.

The anterior sacral foramina allow for drug movement from the epidural space unlike posterior sacral foramina which are covered by tight bands of musculature.¹

FLURO ANATOMY

In Anteroposterior (AP) image shows sacrum, iliac bone, lumbar vertebra, coccyx, sacroiliac joint, sacral foramina, and sacral hiatus.

Lateral image shows anterior and posterior sacral plate, sacral bones, sacral hiatus, sacral canal, and coccyx (Fig. 2).

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Fig. 1: Sacral hiatus



Fig. 2: Lateral view pointing sacral hiatus

INDICATIONS³

- Herniated disk with or without radiculopathy below L4
- Discogenic back pain below L4
- Radiculopathy below L4
- Coccydynia
- Spondylolisthesis below L4
- Spinal canal stenosis
- Failed back surgery syndrome
- Epidurolysis
- Chemical neuritis: Internal disk disruption.

CONTRAINDICATIONS³

- Absolute:
 - Local/systemic infection
 - Coagulopathy
 - Patients on anticoagulant without adequate recommended drug-free period
- Relative:
 - patient unable to lie prone; a lateral decubitus position can be adopted in patients with colostomy, axial spine anomaly, or contractures of the extremity; spasticity of trunk with fixed deformity or the presence of ascites or a large abdominal mass
 - Patients with severe cognitive dysfunction
 - Allergy to any drug used for procedure.

ADVANTAGES

- Relative ease of entry
- Minimal risk of inadvertent dural puncture
- The effectiveness of caudal epidural steroid injections is superior to interlaminar epidural injection
- Epidural space can be accessed in difficult cases, such as postlumbar laminectomy syndrome
- To introduce a fiberoptic endoscope into the epidural space through the sacral hiatus.

DISADVANTAGES

- High volume of injectate is needed into the epidural space, which increases intraventricular pressure and can cause retinal hemorrhage
- Extra epidural/intravascular needle placement
- Higher risk of infection
- Unreliable spread of local anesthetic, patchy blocks
- Suitability limited only to lower lumbar and sacral pathology
- Potential causes of difficulty entering the caudal epidural space are short stature (height less than 5 feet), short sagittal dimension of sacrum, atypical anatomy within the sacral canal, including presence of a tethered cord, acute angle of sacral dorsal convexity, severe to morbid obesity blocking radiologic (fluoroscopic) visualization, deformity of sacrococcygeal area secondary to previous trauma or birth defect, sealed sacra; hiatus relatively long coccyx with “superior” location of sacral hiatus and developmental fusion of sacral canal.¹

DRUG DOSE AND VOLUME

A total of 5 ml to 15 ml of injectate is used, with the lower volume reserved for short-statured individuals, elderly cachectic and with canal stenosis.

Analgesia is obtained with 0.125% bupivacaine or 0.5% lidocaine mixed with 40 mg (5–6 mg/mL) of depo methylprednisolone or 6 to 12 mg of betamethasone sodium phosphate and betamethasone acetate.¹

Technique³

Position and Monitoring

- Patient in prone position
- A pillow may be placed under the iliac crest to correct lordosis

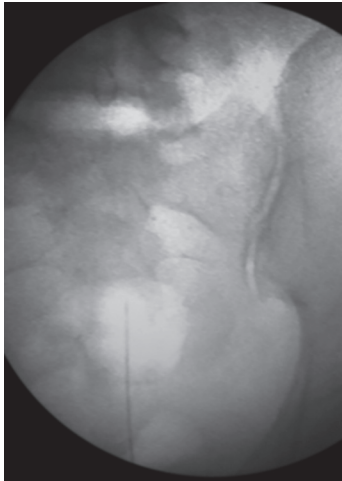


Fig. 3: Needle position in AP view

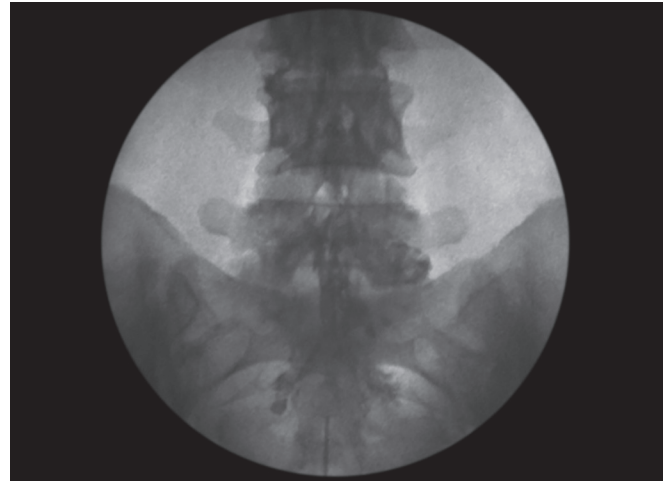


Fig. 4: Dye spread in epidural space

- Standard basic monitoring as recommended by American Society of Anesthesiologists is advised.

Procedural Steps

- With C arm showing AP image, midline of sacral hiatus is marked.
- Then C arm is turned to lateral view to identify the sacral hiatus.
- Needle entry point is selected few centimeters below the sacral hiatus so that the needle will hit the inferior part of sacral hiatus at an angle of 30 to 45°.
- Infiltrate the needle entry with 1% lignocaine.
- 20G epidural needle is inserted to hit the posterior surface of S5 vertebral body just below sacral hiatus and then insertion angle is decreased so as to slip into sacrococcygeal membrane.
- Needle is further inserted into sacral canal and C arm is moved to AP view and needle is advanced till upper border of S3 vertebra (Fig. 3).
- Contrast is injected after negative aspiration to achieve an inverted Christmas tree appearance on the image (Fig. 4).
- Repeated shots of image are taken to rule out intravascular, subdural, and subarachnoid needle placement.
- The desired quantity of local anesthetic with depo steroid is injected (Fig. 5).

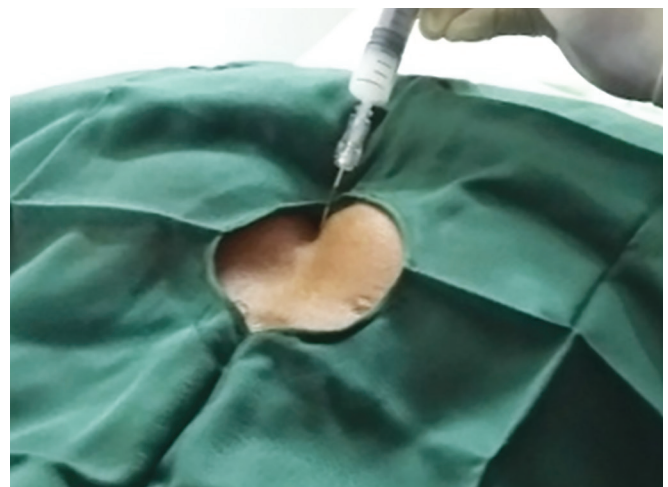


Fig. 5: Patient position, while drug administration

- Postinjection pain at the sacral hiatus site of entry
- Intrathecal injection can occur leading to prolonged and/or high subarachnoid block, respiratory distress or arrest, and total spinal anesthesia with risk of death
- Adhesive arachnoiditis due to solvent of depo steroid polyethylene glycol
- Nerve injury may occur, but is rare and most likely unrelated to the procedure when it is present. Intravascular or intraosseous injection.

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Postprocedure

The patient is observed for 10 minutes for hypotension inside the procedure room and once hemodynamic stability is assessed, patient can be shifted to postprocedure room.⁴

Complications¹⁻³

- Infection
- Bleeding
- Allergic reaction