

Inadvertent Dural Puncture in Interventional Pain Management (Caudal Epidural Block)

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ABSTRACT

Caudal epidural steroid injection (CESI) is one of the most common interventions in management of lumbar radicular pain of the patients who fail to respond to conservative treatment. Complications related to caudal epidural injections are rare. However, occasional complications may become worrisome. This report presents the inadvertent dural puncture during caudal epidural injections in two patients who were suffering from spinal-related radicular pain.

Keywords: Caudal; epidural steroid injection; inadvertent dural puncture; radicular pain; complications (Siriraj Med J 2017;69:40-43)

INTRODUCTION

Spinal-related leg pain is one of the most common presentation of lumbar spinal pain (LSP).¹ The effect of caudal epidural steroid injections showed good evidence for short and long-term relief of chronic pain secondary to disc herniation with radiculitis. However, the evidence is fair for chronic axial or discogenic pain, spinal stenosis, and post laminectomy pain syndrome. It is superior when compared to lumbar interlaminar epidural injections and lumbar transforaminal epidural injections, specifically in reference to spinal stenosis and post laminectomy pain syndrome.²

Accidental dural puncture and subarachnoid injection have been described with epidural injections, even though there are no specific descriptions relating to caudal epidural injections.³ We report two cases of inadvertent intrathecal injection in patients with spinal-related radicular pain. The first case was unrecognized inadvertent intrathecal injection and the second case was recognized inadvertent dural puncture. The procedures of both cases were performed under fluoroscopic guidance.

CASE REPORT

CASE A

A 62-year-old woman presented with chronic radicular pain to posterior part of her left leg more than right leg for over one year. Her underlying disease was hypertension. She did not have relevant past history of spine surgery. On clinical neurological examination, all sensory and motor tests were intact apart from straight leg raising test was positive on her left leg. MRI report revealed herniated nucleus pulposus of L4-5, L5-S1 intervertebral disc with prominent sacral venous plexuses. Although she was currently treated with gabapentin 1200 mg/day and etoricoxib 60 mg/day, her pain scores was still severe (pain score average of 9/10) and there was reduced quality of daily activities. Therefore, the patient was scheduled for CESI with transforaminal epidural steroid injections (TFESI) at left L5 nerve root for treatment of her chronic radicular pain.

On the day of procedure, after securing intravenous line and under standard monitoring, caudal epidural procedure (16G Tuohy epidural needle and 16G epidural

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catheter) was done in prone position under fluoroscopic guidance. Imaging with contrast showed that the tip of the needle and catheter were at about S4 and S1 level, respectively. Because of no distribution of contrast along the sacral nerve roots (i.e. absence of Christmas tree pattern) on antero-posterior (AP) view of fluoroscopic image, the epidural fibrosis was suspected. A mixture of 2 ml of 0.5% plain bupivacaine and 10 ml of 3% hypertonic saline was injected via the epidural catheter after negative aspiration of blood and CSF for epidural neurolysis. The needle and catheter were left in place for the next caudal steroid injection. After doing the TFESI at left L5-S1 intervertebral foramen, a mixture of 4 ml solution containing normal saline (2 ml), 0.5% bupivacaine 7.5 mg (1.5 ml) and methylprednisolone 20 mg (0.5 ml) was injected again via caudal epidural catheter, before the epidural catheter and Tuohy needle were subsequently removed together.

About three minutes after the last caudal steroid injection (about 30 min after the first caudal injection of hypertonic saline and local anesthetic solution), the patient complained of dizziness, numbness below her chest and difficulty in moving her lower limbs. Her blood pressure dropped from 140/80 mmHg to 70/30 mmHg without changing of heart rate and consciousness level. Free flow of intravenous crystalloid and intermittent bolus of vasopressor (norepinephrine) were administered for resuscitation until her blood pressure was stable. After the patient's condition was stable, the fluoroscopic imaging was reviewed again. The contrast pattern revealed a glass-like smooth appearance in her central canal as opposed to a more honeycomb appearance typically seen with normal epidurogram (Fig 1 A1-A3). Therefore, the subarachnoid injection was suspected from caudal injection. The patient was observed overnight in intensive care unit. Her vital signs were stable and norepinephrine was continuously dripped intravenously 2-8 mcg/kg/min. Norepinephrine could be weaned off in the following day. Her sensory and motor power became within normal limits. She was discharged from hospital on the first post-procedural day.

On the second week weeks and the sixth weeks after procedure on the follow-up session, she had no apparent complications such as subarachnoiditis and post-dural puncture headache. Her left leg pain was significantly improved with more than half of pain relief (Average pain score reduced from 9/10 to 4/10). She was maintained on the pharmacological treatment with the abdominal and back muscle strengthening exercises.

CASE B

A 77-year-old woman, diagnosed as spinal stenosis had left lumbar radiculopathy (pain score average of 6/10) along anterior part of her left leg and dorsum of left foot after walking for a short distance even though taking pregabalin 75mg/day. Her underlying diseases were old cerebrovascular accident, diabetes mellitus and hypertension. On clinical neurological examination, there was reduced pinprick sensation on left L4 and L5 dermatomes, reduced cold sensation on left L3-S2, and motor power was grade 3/5 on left extensor hallucis longus. MRI revealed mild spinal stenosis at L3-4 level, bilateral posterolateral disc herniation with facet hypertrophy, thickened ligamentum flavum with bilateral foraminal narrowing with L4 nerve root compression. She was scheduled to undergo caudal epidural injection with or without transforaminal steroid injection at left L4 nerve root.

Under routine monitoring of vital signs and fluoroscopy, caudal epidural procedure was done as usual technique. After confirmation of Tuohy epidural needle at S4 level and epidural catheter at about S2 level, the epidurogram showed the homogenous appearance at the central canal resembling the shape of cone at level of L5-S1 without distribution of contrast to sacral nerve roots (Fig 1 B1-B4). This image was recognized as an inadvertent dural puncture with intrathecal spreading of contrast media.

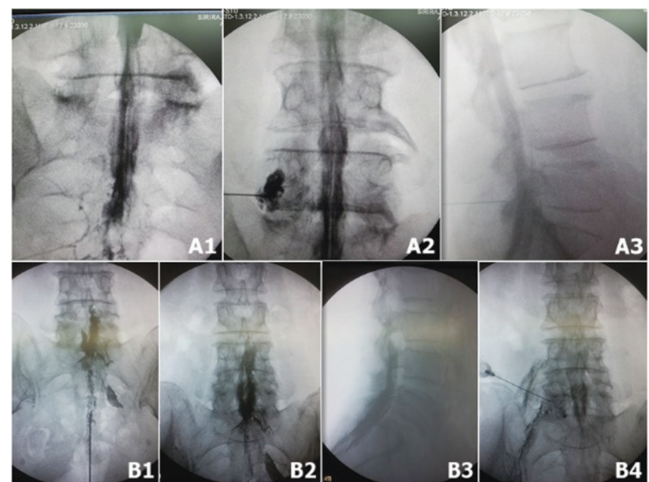


Fig 1. Fluoroscopic imaging with contrast media of the case A (A1-A3) and case B (B1-B4) illustrates the anteroposterior (AP) and lateral pattern of intrathecal injection during caudal epidural block. For the AP view, contrast media confines in the dural sac (ended at S1 level) without nerve root distribution. The lateral views also show homogeneous spreading thoroughly in the spinal canal rather than linear spreading ventrally or dorsally.

Therefore epidural needle and catheter were withdrawn to terminate the caudal block. The fluoroscopic guided transforaminal injections at L4 and L5 root levels were preceded uneventfully. Vital signs were stable throughout and after the procedure without additional sensory and motor deficit.

On the second weeks after procedure at the follow up session, there was less radicular pain (Average pain score reduced from 6/10 to 2/10) on walking. She did not suffer from headache and was maintained on her treatment taking pregabalin 25 mg/day.

DISCUSSION

Epidural steroid injection (ESI) is the most commonly performed procedure throughout the world, with the injection rates quadrupling in the 1990s.⁴ Caudal block is considered to be an easy and reliable technique. However, inaccurate placement of epidural needles into veins, ligaments, and the subarachnoid space occurs in 25-52% of caudal approach and 30% of interlaminar lumbar approach.⁵ Therefore, the fluoroscopic guidance is essential to confirm the needle placement.

Accidental intrathecal injection occurs in about 5-6% of epidural procedures, during caudal adhesiolysis, particularly if the catheter is advanced along midline, and subdural catheter placement is a risk.⁵

Although there are rare complications of caudal block, the existence of anatomical variations of dural sac and pathological conditions should be taken into consideration. Determination of anatomical variation of dural sac tip and caudal space were done in many studies using magnetic resonance imaging, myelography and dry sacral bone. Mostly dural sac terminates at S1-S2 level, but its termination can occur at S2-S3 (3.8%)⁶ or S3 (0.8⁶-8.2%⁷).

The distance between the sacral hiatus and the lower margin of the 3rd sacral vertebral body is about 3.0 cm.⁶ The mean (SD) distance between apex of hiatus and dural sac is 31.6 (11.8) mm⁷ to 35.4 (10.4) mm.⁸ Once the needle is introduced into the canal after penetrating the sacrococcygeal ligament, it should not be advanced more than 5 mm to prevent dural puncture.⁷ The pathological conditions that should be considered in the caudal block are posterior sacral meningocele and perineural cyst.⁶ The chance of accidental injection is increased when Tarlov cysts (S1 to S4 regions) are present because the subarachnoid space extends into root cuffs.⁵

There are case reports concerning unanticipated dural tap during caudal block. They discussed that the dural termination was located more distally and associated

with morphological abnormalities of the lumbosacral region which were present in the potential dural puncture.⁹ Cerebral spinal fluid (CSF) flashback is typically used to recognize a dural puncture. Recognition of epidural versus subdural and subarachnoid contrast spread patterns is essential because dural penetration may not be accompanied by CSF flashback in the transforaminal and caudal epidural injection through catheter.¹⁰ Thus, caudal epidural steroid injection (CESI) under blind technique is not recommended.

In both cases of this report, the insertion of caudal epidural needle and catheter was attempted once and the tip of the needle was at the level of S4. Although the pre-procedural MRI (Case A) reported the level of the conus medullaris (L1-2 level) and no abnormal paraspinal soft tissue, there was no remark for the level of termination of the dural sac. It also reported that there was extradural lesion, along the posterior vertebral body from L5 to S4 level, causing the anterior indentation narrowing of the thecal sac favoring prominent sacral venous plexus. Therefore, these may suggest the possibilities of inflammation and fibrosis in the sacral canal, leading to dural tear or dural leakage during or after the large volume of the first caudal injection. Another possibility may be the anatomical variation of the dural sac termination.

Complications of inadvertent dural puncture are related to either the needle placement or the drugs used. In this case report, neither patients suffered postdural puncture headache. In the first case of accidental intrathecal injection, the patient developed signs of total spinal blockade immediately after the injection of solution containing the local anesthetic. Fortunately, due to the low concentration of bupivacaine injected, the patient developed mild motor blockade and could retain adequate spontaneous breathing.

Although several studies implicated intrathecal methylprednisolone as a potential cause of arachnoiditis or other neurological complications, most of the evidence for intrathecal depo-medrol is circumstantial and most complications followed multiple, large-dose, or frequent injections.¹¹

For the Case A, no apparent clinical neurological deficit occurred within 12 months after the procedure. This may be due to single small dose of methylprednisolone and also negligible amount of preservative. However if a patient develops unexplained neurological symptoms within 2 years after the procedure, it may require evaluation by radiological imaging (MRI myelography) and serial biochemical measure of cerebrospinal fluid to detect the sequels of intrathecal steroid.

CONCLUSION

Even though caudal epidural steroid injections are simple, safe, and effective techniques for managing chronic spinal radicular pain, inadvertent dural puncture may happen even in experienced hands or under fluoroscopy. Most, if not all, complications can be avoided by careful technique with accurate siting of needle placement, sterile precautions, and a thorough understanding of the relevant anatomy and contrast patterns on fluoroscopic imaging. It is also important to note that all intervention procedures should be under adequate monitoring and emergency resuscitation facilities.

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