

S1 Transforaminal: Technique and Troubleshooting

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ABSTRACT

Role of interventions in pain medicine is one of the important aspects. Even if we diagnose the condition correctly but if we are not familiar with the interventions and their troubleshooting we may land up in a problem. Every patient is different; every procedure is a challenge to the pain physician. S1 transforaminal is such a procedure which every pain physician should know including its troubleshooting. We must be thorough with the technical aspects of the interventions. In this article of practitioner's corner, the technique and troubleshooting is being discussed to increase our clinical and intervention accuracy.

Keywords: Epidural steroid injection, S1 foramina, Transforaminal.

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INTRODUCTION

Transforaminal epidural steroid injection is commonly performed for management of radicular pain syndromes with demonstrated pain relief. Radicular pain is assumed to arise from inflammation of nerve roots caused by mechanic or chemical irritation often from a herniated intervertebral disk. It is postulated that the application of corticosteroid directly around the inflamed nerve would have greater benefit than a less direct approach (interlaminar or caudal). Transforaminal access to the epidural space requires image guidance.¹ Fluoroscopic guidance and injection of contrast during transforaminal epidural steroid injections (ESIs) are used to ensure proper needle placement and medication administration.

At times, we find difficulty in visualizing the S1 foramen and if we demonstrate S1 foramen, the contrast spread is not the area where we desire to administer medications.

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Anatomy of S1 Foramen

Each sacral foramen from S1–S4 consists of dorsal sacral foramina and ventral sacral foramina and in between there is a nerve root canal from where the sacral nerve enters and leaves through ventral foramina. Dorsal foramina is relatively smaller than the ventral foramina. Aligning the dorsal and ventral foramina in fluoroscopy is the key to the successful.^{2,3}

Fluoroscopic View⁴

Confirm the level [with the anteroposterior (AP) view] before obtaining the trajectory view (Fig. 1). In up to 15% of the population¹, a transitional segment may occur. Transitional segments are typically described as involving the lumbarization of the 1st sacral segment or the sacralization of the 5th lumbar segment. It is most important to correlate the patient's clinical symptoms with the pathoanatomy visualized on the imaging that is obtained.

Technique

Line up the sacral endplate by tilting the beam cephalo-caudal. Squaring off the endplate provides an initial starting point for optimizing visualization. Try to superimpose dorsal and ventral foramina so that it looks like a single opening.

At times, it is difficult to superimpose both the foramina and leads to confusion in the entry point.

In such case, the goal is to optimize visualization of the dorsal S1 foramen.



Fig. 1: Anteroposterior view showing dorsal and ventral foramina of S1

Slight ipsilateral oblique is desirable as we want to spread medication medially into the epidural space.

Needle Entry Point: AP and Slight Ipsilateral Oblique

The target needle entry point is at the dorsal S1 foramen, just inferior to the S1 pedicle and more medial in the foramen as the nerve runs inferolateral (Figs 2A to C).

Lateral View: Target the S1 Canal

Lateral image (Fig. 3) is obtained to verify needle depth. In true lateral, the iliopectineal line is a single straight line rather than two separate lines. The use of the wig-wag of the fluoroscope allows this view to be optimized.⁴

Target depth should be just beyond the ventral epidural space. The needle should not be advanced to the floor of the sacral canal. It should not exit the ventral S1 foramen. Avoid the viscera ventral to the sacrum.

Anteroposterior View

In AP view, contrast should outline the S1 nerve root and flow into the epidural space medial to the pedicle

and should reach the suspected site of pathology (Fig. 4).

Suboptimal Positions

Dorsal Spread

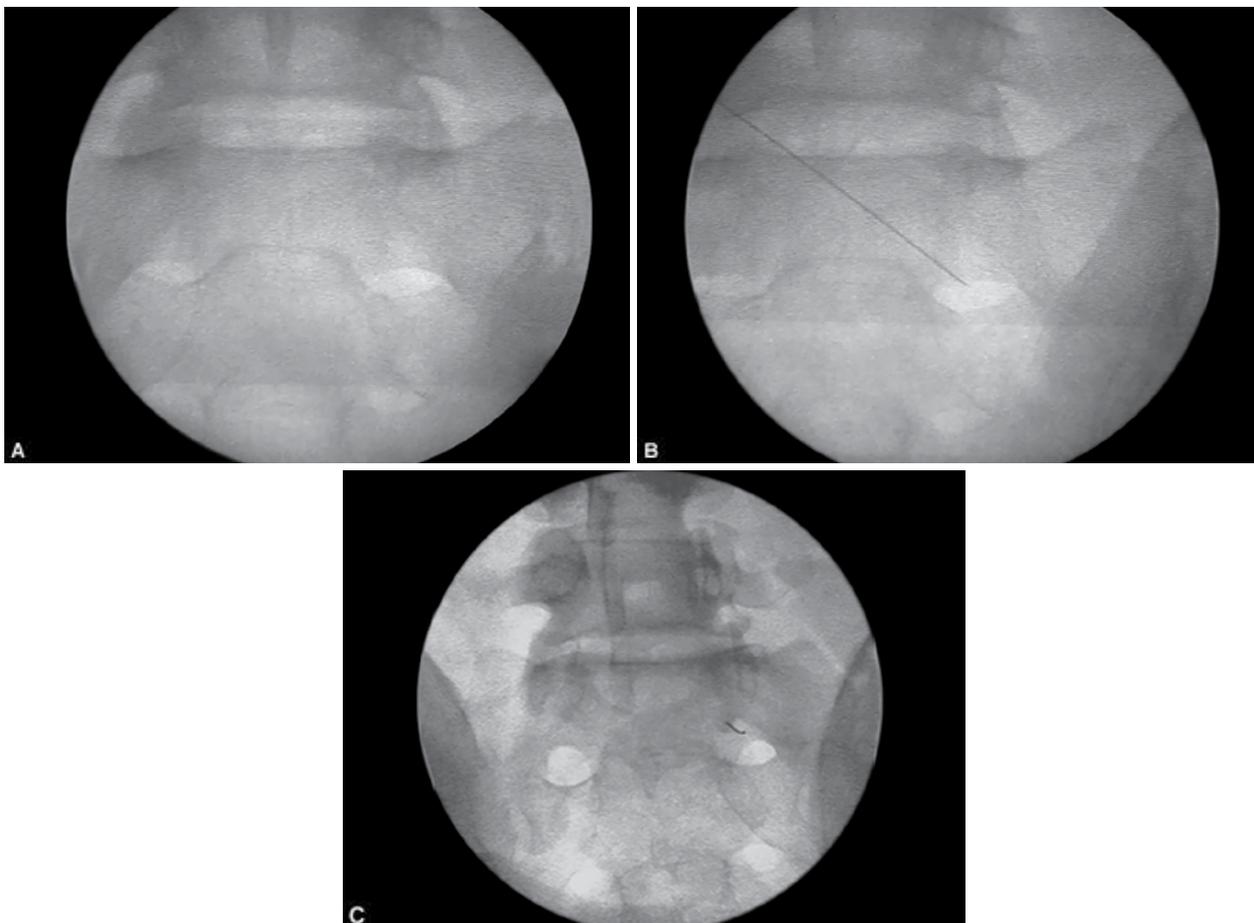
If the needle is dorsal to S1 canal, the contrast will come out of dorsal foramina. In such case, needle needs to be advanced more ventral in lateral view (Figs 5A and B).

Ventral Spread

If the needle crosses the nerve canal, the contrast will be seen coming out of ventral foramina and will spread anteriorly. In such case, withdraw the needle slightly till you get a optimal contrast spread.

Vascular Uptake

A lack of flash in the needle hub or the absence of the return of blood on aspiration does not confirm the absence of vascular flow.³ The contrast rapidly dissipates when this is observed under live fluoroscopy (Fig. 6). Reposition the needle and replace the stylet and wait for 2 minutes. Reinject the contrast under live fluoroscope to get desired spread.



Figs 2A to C: (A) Cephalocaudal tilt to superimpose ventral and dorsal foramina, (B) needle entry point just below the pedicle and more medial in the foramen, and (C) dorsal and ventral foramina are not superimposed. Select the foramina just below the pedicle

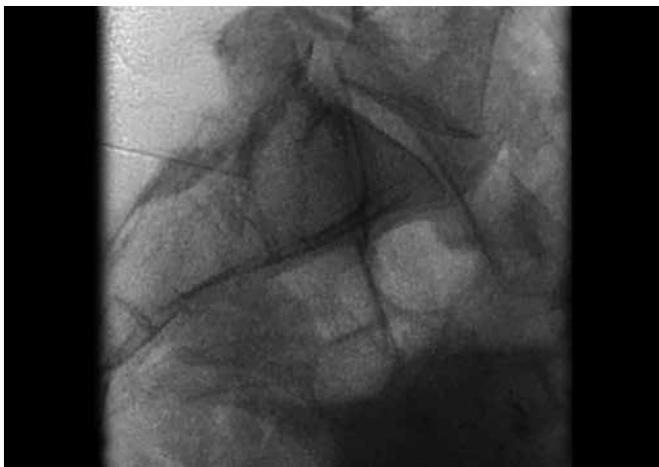
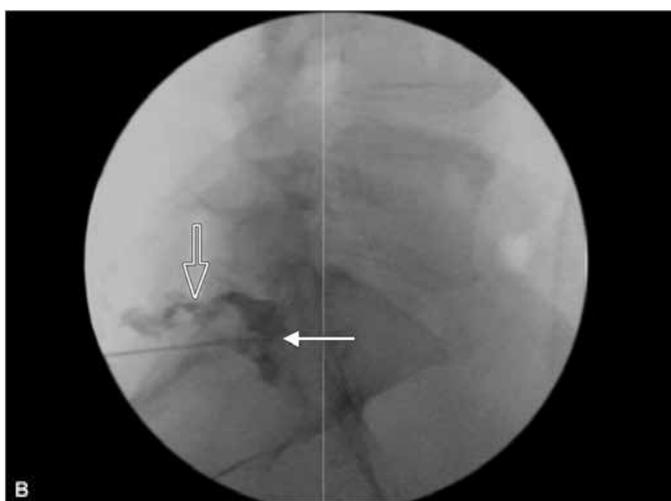


Fig. 3: Lateral fluoroscopic image of right S1 transforaminal injection with 1 cc of contrast. Note the spread of contrast into epidural space



Fig. 4: Anteroposterior view to confirm the spread of contrast along the nerve root



Figs 5A and B: Suboptimal spread of contrast coming out of Dorsal foramina

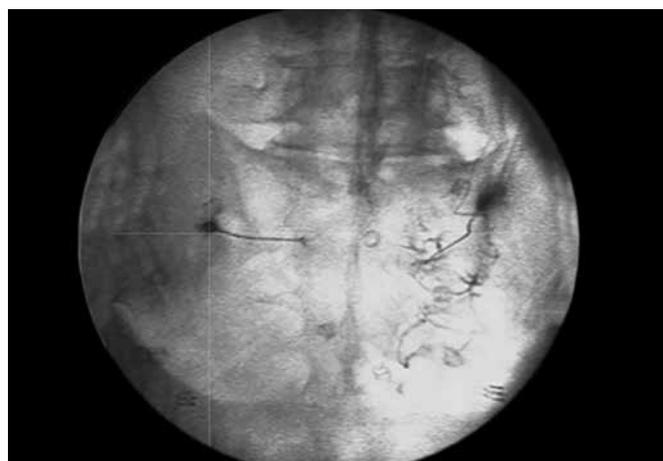


Fig. 6: Vascular uptake picked on live fluoroscope

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New Section

We have added this new section keeping in mind the need of physicians practicing in the field of pain, the practical tips, the do's and don'ts and similar kind of helpful information. We hope that this effort will be appreciated by the physicians. We will be expecting the feedback in the form of "Letter-to-the-Editor" to make this journal more beneficial to the readers across the world.