



# How I do it? Endoscopic discectomy using a new trocar “Endospine Plus” for lumbar prolapsed intervertebral disc

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## Abstract

**Background** Endoscopic spine surgery is a promising minimally invasive technique and use of trocars like Metrx (Neurosurgery 51(5):S129–36, 2002), Destandau (Neurol Res 21:39–42, 1999), and Easy go (Acta Neurochir (Wien) 151:1027–33, 2009) has revolutionized this field. However, the steep learning curve makes this procedure elusive to many parts of the world.

**Methods** The authors describe the technique of pure endoscopic discectomy using a specialized trocar devised by the senior author “Endospine Plus” which makes the technique easy to learn along with the advantages and complications of the procedure.

**Conclusions** Endoscopic lumbar discectomy is a safe and effective technique for the treatment of prolapsed intervertebral disc.

**Keywords** Endoscopic spinal surgery · Prolapsed intervertebral disc · Endospine Plus · Endoscopic discectomy

## Relevant surgical anatomy

The correct anatomical orientation of the lumbar spine in the endoscopic view is paramount to an amateur endoscopic surgeon (Fig. 1). Before beginning of the fenestration, adequate dissection of the paraspinal muscles is essential to keep the proper orientation of the lamina (superior, inferior, lateral, and medial), medial facet, and inferior edge of the ligamentum flavum. Identifying the pars interarticularis to limit the fenestration is important to prevent iatrogenic instability. High magnification in the initial stages is obscuring and should be avoided.

## Description of the technique

### Instruments

Endoscope and video equipment and standard spine instruments including Kerrison rongeurs, disc forceps, blunt hook, and high speed diamond drill.

### Room setup and patient positioning

The procedure is performed under general anesthesia. The patient is placed prone with abdomen free over radiolucent transverse bolsters, one placed below chest at the level of xiphisternum and the other at the level of ASIS (anterior superior iliac spine). Fluoroscopic confirmation of the diseased level along with angle of direction of the endoscope is done using two-pronged level locator, arms of which are superimposed on the required disc space level (Fig. 2c).

### Endoscopic sheath insertion

A skin incision of about 1.5 cm, 5 mm lateral to midline at the lateral edge of the spinous process, is made on the symptomatic side (Fig. 2a). Fascia is opened adjacent to the spinous process along the length of the skin incision followed by dissection of the paraspinal muscles subperiosteally off the laminar edge. Insertion of the endoscopic sheath along with an obturator in a twisting motion is done touching the

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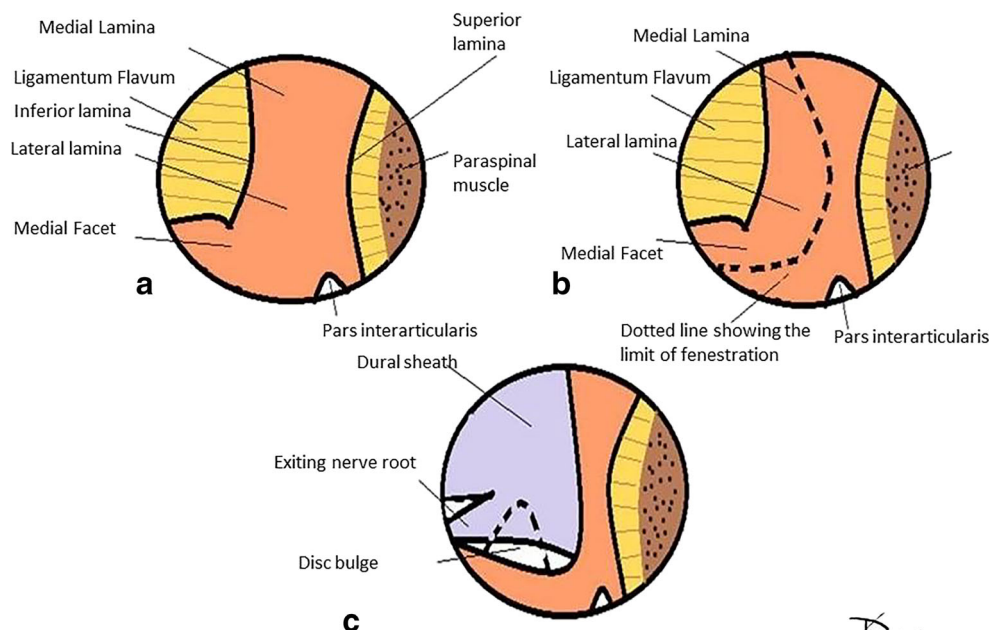
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**Fig. 1** **a** Endoscopic view of the lumbar lamina (right side) and the facet after dissection and retraction of the paraspinal muscle. **b** Figure showing the limit of fenestration and medial facetectomy. **c** Figure showing the structures post fenestration and removal of ligamentum flavum along with the position of the prolapsed intervertebral disc



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laminofacetal joint. The endoscope is inserted into sheath and secured with the left hand (Fig. 2b). Final placement of the sheath at the diseased level is then confirmed with biplanar fluoroscopy (Fig. 2d).

### Endospine Plus

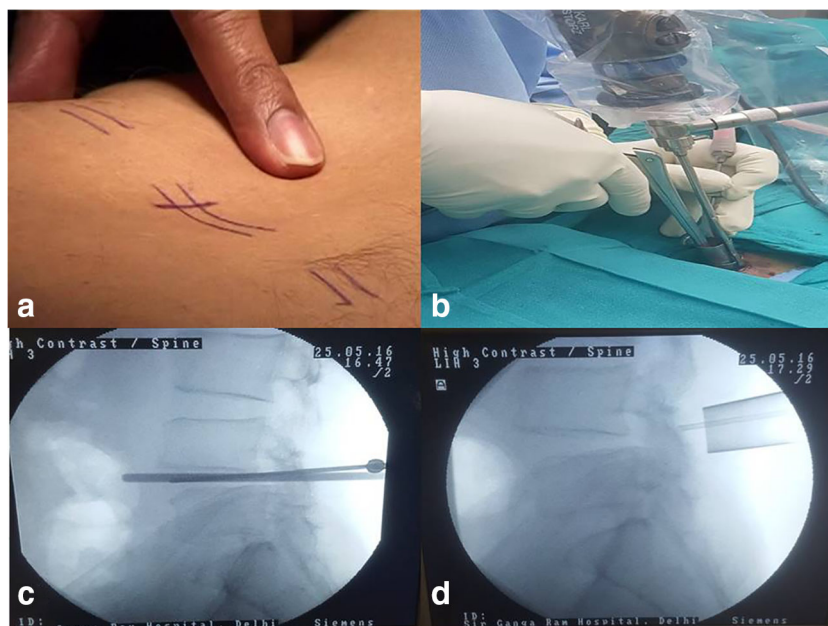
A specialized sheath “Endospine Plus” (Figs. 3 and 4) designed by the senior author (AVM surgicals) is a conical tube with elliptical area in transverse section but smaller in diameter than the Destandau tube. It

accommodates a 4-mm-diameter telescope and has a single working channel of 15 mm. Unlike the Destandau tube, there are no fixed channels which provide more free space for working and maneuvering instruments. It is used free hand and does not require fixation as in the Metrx and the Easy Go tubes.

### Fenestration and ligamentum flavum removal

Soft tissue overlying the lamina and inter laminar space is removed to define the superior lamina and yellow ligament.

**Fig. 2** **a** Skin incision of 15 mm, 5 mm lateral to midline. **b** Intraoperative position of the endoscopic sheath with free hand working and use of standard instruments. **c** Superimposition of the arms at the diseased disc fluoroscopically marks the proper level and working angle. **d** Confirmation of the level intraoperatively





**Fig. 3** Endospine Plus; actual photograph (a) obturator, (b) outer sheath, (c) inner sheath, (d) nerve root retractor

Fenestration of the superior lamina is done to initially medially and then continued laterally, along with medial facetectomy by high speed drill and various angled and sized Kerrison punches. Care should be taken at this stage to not fracture or drill the pars which may result in iatrogenic instability (Fig. 5).

### Dura and nerve root exploration

Ligament flavum is opened with an angled hook using a twisting motion, peeled back caudally and dorsally and then resected with a Kerrison punch which exposes the dural sheath. Resection of its lateral extension and the

medial articular mass exposes the nerve root which should be decompressed till its outer edges. Dural tear can be a potential complication at this stage which can be prevented by proper dissection of the ligamentum flavum from the underlying dura by the angled hook before its resection (Figs. 5 and 6). These tears can be repaired using muscle graft or gelatin sponge in most cases; however, larger tears may have to be repaired under direct vision after extending the skin incision.

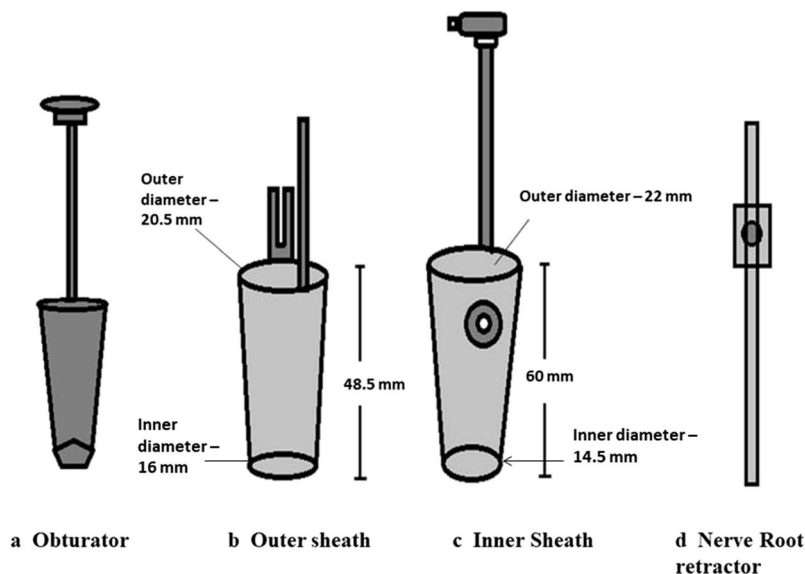
### Discectomy

The dura and the exiting nerve root are secured by medial retraction using a specialized nerve root retractor which can be fixed in the Endospine Plus. This brings the bulging annulus of the prolapsed intervertebral disc into view. The annulus is incised and disc fragments are removed using disc forceps. Angled hook is helpful for the mobilization of the migrated disc fragments which can be subsequently teased out and removed. Saline irrigation is then done to remove any free fragments (Fig. 6).

### Foraminotomy and nerve root decompression

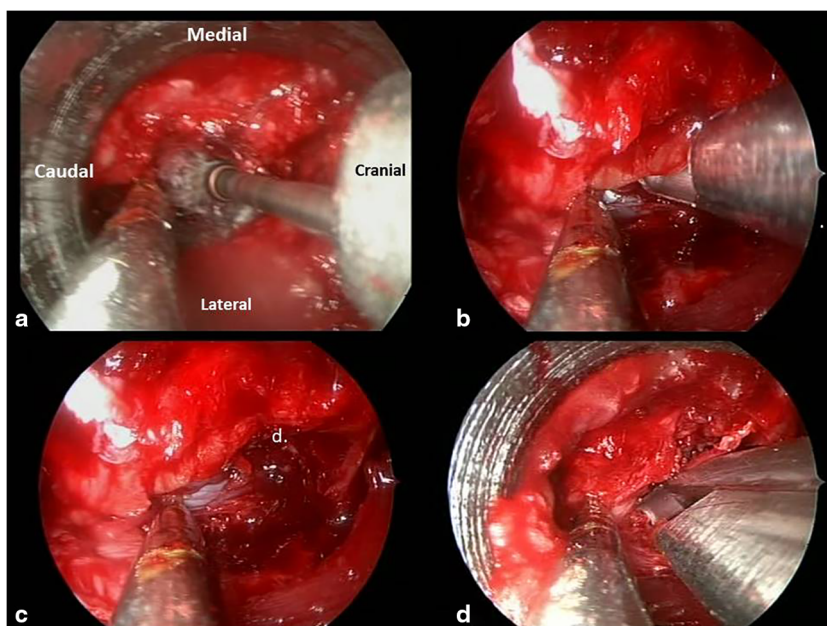
Foraminotomy is achieved by drilling the part of the medial facet and sometimes the part of the superior lamina of the inferior level followed by removing the hypertrophied ligamentum flavum encasing and compressing the nerve root. Contralateral foraminotomy if required can also be achieved from the same side by

**Fig. 4** Endospine Plus; schematic diagram



*Dr. J. J. J.*

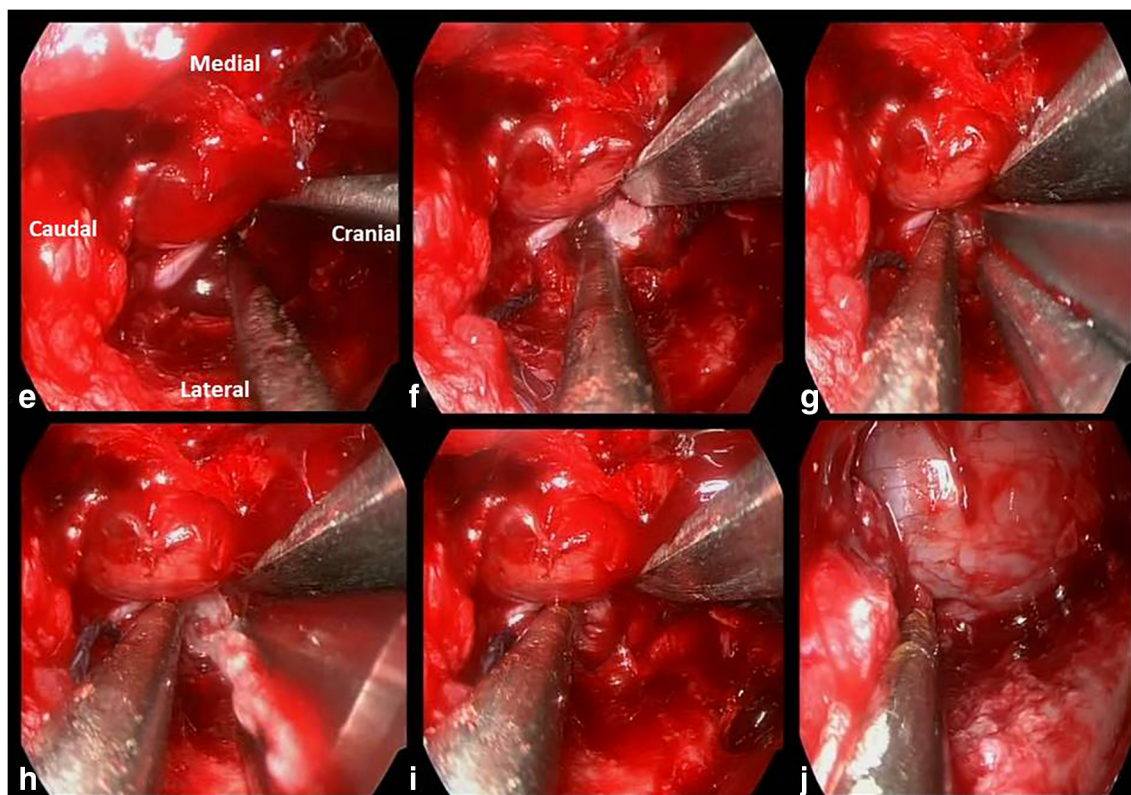
**Fig. 5** Steps of endoscopic discectomy using Endospine Plus (right side) (a–d). **a** Drilling of the lamina and the medial facet. **b** Fenestration of lamina done using Kerrison punch. **c** Separation of ligamentum flavum and removal of ligamentum flavum. **d** Foraminotomy to expose the exiting root



orienting the scope medially and undercutting the spinous process and contralateral medial facet using the high speed drill and punches. Care should be taken at this stage to prevent root injury.

### Hemostasis and closure

Hemostasis is done using bipolar diathermy, cotton patties, bone wax, and sometimes oxidized cellulose (surgical). An



**Fig. 6** Steps of endoscopic discectomy using Endospine Plus (right side) (e–j). **e** Medial retraction of nerve root and dura by dissector. **f** Placement of the nerve root retractor to expose the disc bulge. **g** Incision of the

annulus. **h** Removal of the disc material. **i** Completion of discectomy. **j** Complete decompression of dural sac and exiting nerve root

epidural mini drain is placed and the wound is closed in layers preferably without any skin sutures.

## Indications

1. Symptomatic lumbar PIVD (prolapsed intervertebral disc) refractory to medical management for a period > 6 weeks
2. Central, lateral, and foraminal stenosis as bilateral decompression can also be achieved by a single incision.

## Limitations

1. Large central herniated disc causing cauda equina syndrome as central decompression is required
2. Spinal instability which require fusion along with decompression

## How to avoid complications

1. In severe stenosis, complete bony decompression is achieved with ligamentum flavum in place, to prevent dura from injury.
2. Careful dissection of ligament and adhesions from the dura if any, is done using blunt hook patiently without applying excessive traction to prevent dural tear.
3. Nerve root is identified carefully in order to avoid any injury.

## Specific perioperative considerations (pre and postop workup, instructions for the postop care)

Preoperative MRI scan and dynamic X-rays of lumbar spine are essential to determine the feasibility of this technique in an individual patient.

## Specific information to give to the patient about surgery and potential risks

The advantages and limitations are explained to the patients along with alternative surgical techniques. Complications such as temporary dermatomal numbness or tingling and CSF leak due to dural tear are explained.

## A summary of 10 key points is required at the end of the manuscript

1. Proper level marking by fluoroscopy along with the proper angle of orientation of the endoscope is important to reach directly to the overlying lamina.
2. Paraspinal muscles are preserved by subperiosteal resection and optimal retraction by the endoscopic sheath
3. “Endospine Plus” provides a single channel with increased free space for working and maneuvering instruments. It is used free hand and does not require fixation.
4. Fenestration of the overlying lamina and medial facet is done using a high speed drill and various angled Kerrison punches with special care in preservation of the pars interarticularis.
5. Care should be taken to free the ligamentum flavum off the dural sheath using a hook to avoid the complication of dural tear.
6. Dural tear is the most common possible complication most of which can be repaired by using a muscle patch or/and gelatin sponge.
7. Adequate contralateral decompression can be achieved and bilateral foraminotomies can be done via a single incision which prevents opposite paraspinal muscle trauma.
8. The learning curve can be shortened by proper patient selection, knowledge of the endoscopic anatomy, and attending teaching programs and workshops.
9. Main indications: Single- or two-level lumbar PIVD or canal stenosis.
10. Adequate hemostasis is paramount to prevent epidural hematoma and re-exploration. An epidural mini-drain for 24 h also prevents this complication.

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

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