Transforaminal Endoscopic Decompression in the Setting of Lateral Lumbar Spondylolisthesis

Albert E. Telfeian, Adetokunbo Oyelese, Jared Fridley, Ziya L. Gokaslan

■ BACKGROUND: **Lateral subluxation of the vertebra is commonly seen in degenerative lumbar scoliosis. Transforaminal endoscopic spine surgery is an emerging technique in spine surgery but has never been described as a treatment option for lumbar radiculopathy in the setting of lateral lumbar spondylolisthesis.**

■ METHODS: **A technique for endoscopic treatment of lumbar disc herniation in the setting of lateral spondylolisthesis is presented. We retrospectively reviewed 199 cases of patients who underwent transforaminal endoscopic surgery in a 3-year period with a minimum follow-up of 1 year.**

■ RESULTS: **Between 2014 and 2017, 4 patients (average age, 74.8 years; range, 69–82 years) underwent transforaminal endoscopic discectomy procedures for disc herniations at the level of lateral subluxation. One patient whose lateral subluxation was above an instrumented fusion required an extension of fusion to the operated level 5 months after endoscopic surgery for a reherniation. For the other 3 patients, mean visual analog scale score for radicular pain improved from an average pain score of 8.3 before surgery to 3.0 1 year after surgery, and Oswestry Disability Index improved from 26.7 to 4.7.**

■ CONCLUSIONS: **Transforaminal endoscopic surgery for lumbar disc herniation in the setting of lateral subluxation of vertebral bodies is a unique minimally invasive approach for treatment of lumbar radiculopathy that might be considered as an alternative treatment to deformity correction surgery in older patients.**

INTRODUCTION

Degenerative lumbar deformities occur and progress in elderly patients. Patients may present clinically with only a radiculopathy referable to a single nerve root. When conservative treatment fails, spine surgeons typically have to choose between lumbar decompression surgery or single-level or multilevel fusion surgeries. Although patients may have symptomatic pathology that originates simply from a herniated disc, the patient's treatment may involve a multilevel deformity correction surgery with the thinking that any other surgery would further destabilize the already transitioning spine.

Transforaminal endoscopic lumbar discectomy is a minimally invasive spinal surgery procedure that was introduced by Kambin and Gellman in 1973.[1] Advances in endoscopic visualization and instrumentation have led to increased popularity of the technique; however, endoscopic spine surgery presents challenges to surgeons considering adopting the technique in terms of novel targeting and visualization. In this article, we describe a novel technique for addressing symptomatic lumbar disc herniations seen in the setting of lateral lumbar spondylolisthesis via a transforaminal approach that allows for successful simple decompression surgery without requiring a destabilizing facet removal that could further accelerate a coronal deformity.

MATERIALS AND METHODS

Patient Selection

A retrospective patient review was performed on 199 patients who underwent transforaminal endoscopic surgery procedures. Four patients during that period were found to have lateral lumbar spondylolisthesis. Preoperative and 1-year postoperative visual analog scale (VAS) scores and Oswestry Disability Index data were collected.

Key words
- Coronal imbalance
- Endoscopic spine surgery
- Minimally invasive
- Scoliosis
- Spondylolisthesis
- Transforaminal

Abbreviations and Acronyms
SAP: Superior articulating process

Department of Neurosurgery, Rhode Island Hospital, The Warren Alpert Medical School of Brown University, Providence, Rhode Island, USA

To whom correspondence should be addressed: Albert E. Telfeian, M.D., Ph.D. [E-mail: atelfeian@Lifespan.org]

Citation: World Neurosurg. (2018) 117:321-325.
https://doi.org/10.1016/j.wneu.2018.06.106

*Journal homepage: **www.WORLDNEUROSURGERY.org***

*Available online: **www.sciencedirect.com***

1878-8750/$ - see front matter

Transforaminal Endoscopic Operative Technique

The procedures were performed under local anesthesia and intravenous sedation; the level of anesthetic was titrated so the patient was able to communicate with the surgeon throughout the procedure. Patients were positioned prone on a Jackson table and Wilson frame. The TESSYS endoscopic system (Joimax, Inc., Irvine, California, USA) was used for the procedure. Percutaneous entry was established entering through the skin 11–13 cm lateral to the midline. Using intermittent fluoroscopic guidance, alternating between lateral and anteroposterior views, a 15-cm 18-gauge needle was advanced, and the tip was placed on the superior endplate of the inferior vertebral body first by touching the superior articulating process (SAP) and being deflected ventrally. "Hugging" the SAP allowed for maximal removal of ventral SAP bone to open the foramen for visualization. Sequential reamers were used to remove the ventral aspect of the superior facet. A 7-mm beveled tubular retractor was then placed in Kambin's triangle (triangle defined by the exiting and traversing nerve roots and the superior endplate of the inferior vertebra). Endoscopic grasping forceps were used to remove the herniated disc material. The patients were able to communicate during the surgery when their pain had completely resolved. After the working channel and endoscope were removed, pressure was held on the 5-mm incision for 5 minutes, and the wound was closed with a single interrupted suture.

Postoperative Course

The surgeries were performed under monitored anesthesia care, so the patients were examined in the operating room immediately and were found to be full strength and with no radicular pain at rest or with straight leg raise. Patients were seen for follow-up at 2 weeks, 6 weeks, 3 months, and 1 year postoperatively.

RESULTS

Between 2014 and 2017, 4 female patients with an average age of 74.8 years (range, 69–82 years) underwent transforaminal endoscopic discectomy procedures for disc herniations at the level of lateral subluxation. Each patient presented with radicular symptoms that were refractory to physical therapy and interventional pain management. Each patient had also undergone previous spine surgery and were seeking minimally invasive surgical options for their symptoms. **Table 1** lists clinical and radiographic features as well as outcomes for all patients. Levels treated where there was a lateral spondylolisthesis were at L2-3 (1 case) and L3-4 (3 cases). The amount of lateral spondylolisthesis was on average 8.75 mm (range, 6–12 mm). One patient whose lateral subluxation was above an instrumented fusion (L4-5 transforaminal lumbar interbody fusion) required an extension of fusion to the operated level 5 months after endoscopic surgery for a reherniation. For the other 3 patients, the mean visual analogue scale score for radicular pain improved from an average pain score of 8.3 before surgery to 3.0 1 year after surgery, and the Oswestry Disability Index improved from 26.7 to 4.7.

In each case, lateral spondylolisthesis was associated with a coronal deformity curve that resulted in the symptomatic side, the treated side, being on the concave or the convex side and associated with a deformity that was open or closed (**Table 1** and **Figures 1** and **2**). Three of the patients treated were symptomatic at the convex portion of the curve and required needle targeting through an "open" deformity. **Figure 3** illustrates the step-by step approach and challenges to targeting in an open deformity case. Preoperative magnetic resonance imaging is shown in **Figure 3A–C**. The superior vertebra is translated laterally over the inferior vertebra, and the disc herniation is extruded medial to the inferior pedicle. An attempt at a normal trans-isthmus approach to the pathology is shown in **Figure 2D** and **E**. The lateral translation of the superior vertebra makes it impossible to access the medial pathology from an oblique trajectory. **Figure 2F–I** illustrates the inferior-to-superior needle approach to access the pathology medial to the pedicle. The trans-isthmus approach is typically used to allow maximal removal of the ventral SAP to enhance anatomic visualization and access to the foramen. In the open deformity cases with lateral subluxation of the superior vertebra, the surgeon had to navigate the reamer drills freehand in a more superior-to-inferior direction to accomplish the same bony removal. **Figure 4A** and **B** illustrates the excellent endoscopic visualization of the herniated disc fragment achieved after reaming. In the single case of a closed

Table 1. Patient Clinical Details, Radiographic Features, and Outcomes

Patient	Age (Years)/Sex	Level	Side	Deformity	Pathology	Preop VAS	1-Year Postop VAS	Preop ODI	1-Year Postop ODI
1	69/F	L3-4	Left	Closed-concave (superior vertebra medially displaced by 6 mm)	Herniated disc (previous L2-5 laminectomy)	9	4	26	6
2	71/F	L3-4	Left	Open-convex (superior vertebra laterally displaced by 8 mm)	Herniated disc (previous L3-S1 laminectomy)	8	4	28	2
3	77/F	L3-4	Left	Open-convex (superior vertebra laterally displaced by 9 mm)	Herniated disc/adjacent segment disease (previous L4-5 TLIF)	10	L3-4 TLIF 5 months after endoscopic surgery for reherniation	34	L3-4 TLIF 5 months after endoscopic surgery for reherniation
4	82/F	L2-3	Left	Open-convex (superior vertebra laterally displaced by 12 mm)	Herniated disc (previous L4-5 laminectomy)	8	1	26	2

Preop, preoperative; VAS, visual analog scale; Postop, postoperative; ODI, Oswestry Disability Index; F, female; TLIF, transforaminal lumbar interbody fusion.