

Original Article

Endoscopic foraminotomy for recurrent lumbar radiculopathy after TLIF: Technical report

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Abstract

Background: Transforaminal lumbar interbody fusion (TLIF) is a well-accepted fusion technique that uses unilateral facet removal as an oblique corridor for inserting an interbody spacer. This manuscript focused on five cases of endoscopic foraminotomy for patients presenting with recurrent radiculopathy after TLIF procedures.

Methods: After Institutional Review Board approval, charts from five patients with lumbar radiculopathy and instrumented TLIF procedures who underwent subsequent endoscopic procedures between 2011 and 2013 were reviewed.

Results: The average pain relief 1 year postoperatively was reported to be 63.8%, good results as defined by MacNab. The average preoperative visual analog scale (VAS) score was 9.5, indicated in our questionnaire as severe and constant pain. The average 1 year postoperative VAS score was 3.5, indicated in our questionnaire as mild and intermittent pain.

Conclusion: Transforaminal endoscopic discectomy and foraminotomy could be used as a safe, yet, minimally invasive and innovative technique for the treatment of lumbar radiculopathy in the setting of previous instrumented lumbar fusion.

IRB approval: Lifespan: IRB Study # 600415

Key Words: Endoscopic discectomy, minimally invasive, transforaminal, transforaminal lumbar interbody fusion

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INTRODUCTION

Since the development of screw fixation by Michele and Krueger in 1949^[1] and metallic rod stabilization by Harrington in 1953,^[5] arthrodesis of the lumbar spine has seen an ever-increasing number of new technologies to enhance fusion rates and with these technologies more minimally invasive approaches that might spare tissue damage but might also be limited in their effectiveness in achieving nerve root decompression

or complete discectomy. There is very little literature available regarding recurrent radiculopathy after instrumented lumbar fusion procedures. Possible causes for lumbar radiculopathy postinstrumented fusion include pseudoarthrosis,^[3] incomplete disc removal,^[4] and inadequate contralateral decompression after transforaminal lumbar interbody fusion (TLIF).^[6]

Transforaminal endoscopic discectomy and foraminotomy is described here as an ultra-minimally invasive solution

to the problem of lumbar radiculopathy in the setting of a previous instrumented spinal fusion.

MATERIALS AND METHODS

Participants

After Institutional Review Board Approval, charts from five consecutive patients (mean age 57.0, 2 women and 3 men) with lumbar radiculopathy TLIF underwent endoscopic procedures between 2011 and 2013 were reviewed [Table 1]. Data are only presented for patients who underwent endoscopic decompression at the level of arthrodesis—no cases of adjacent level disease are included.

Operative technique

Patients were selected for treatment based on the results of their magnetic resonance imaging (MRI), computed tomography (CT), physical exam, and dermatomal pain pattern. All patients considered for endoscopic surgical treatment had already exhausted more conservative treatments, which included but were not limited to physical therapy and epidural steroid injections.

Patients were positioned prone on the Wilson frame. The procedure was done under local and intravenous sedation; the level of anesthetic was titrated so the patient was able to communicate with the surgeon throughout the procedure. The Joimax TESSYS endoscopic system was used for the procedure. Percutaneous entry was established entering through the skin 12–16 cm lateral

to the midline. Using intermittent fluoroscopic guidance, alternating between lateral and anterior-posterior (AP) view, a 25 cm 18 gauge needle was advanced and placed in the disc space through Kambin's triangle, between the exiting and traversing nerves. An AP fluoroscopic view was used so the disc space was not entered before the needle was past medial border of the pedicle.

Sequential reamers were used to enlarge the neural foramen by removing the ventral aspect of the superior facet. Three technical innovations were utilized to expand the neural foramen (foraminoplasty): (i) "Joystick" reaming, (ii) endoscopic drilling, and (iii) endoscopic chiseling. "Joystick" reaming was performed by inserting a large caliber reamer over a smaller caliber dilator. The free room between the larger reamer and smaller dilator allowed the reamer to be toggled posteriorly to over-ream the superior articulating process and enlarge the foramen and better decompress the exiting nerve [Figure 1]. Endoscopic drilling was often performed at an oblique angle targeting the junction of the superior articulating process and the pedicle to unroof the traversing nerve [Figure 1]. The endoscopic chisel was used to unroof the exiting [Figure 1] and traversing nerve roots after reaming and endoscopic drilling.

Discectomy was performed with straight, up going, and bendable graspers [Figure 2]. After foraminoplasty techniques, the semi-bendable grasper could be observed reaching under the exiting nerve root in the epidural space with endoscopic and fluoroscopic visualization [Figure 2]. By rotating the beveled canula working channel and endoscope, a 360° visualization of the annulus and exiting and traversing nerve roots was possible. The technical success of the foraminotomy procedure was determined by the visualization of the exiting and traversing nerve root and visualizing the ball probed dilator passing freely under the nerve and over the inferior pedicle [Figure 3]. After adequate discectomy and foraminotomy, the patient was asked prior to terminating the procedure the status of his or her radicular symptoms. The working channel and scope were removed, pressure was held on the 5 mm

Table 1: Patient data

Sex	Age	Fusion levels	Level treated	Preoperative VAS	Postoperative VAS	Fixation device
F	75	L4-S1	L5-S1	10	5	Interspinous
F	75	L4-S1	L4-5	10	6	Pedicle screw
M	46	L4-S1	L4-5	9	2.5	Pedicle screw
M	39	L4-S1	L4-5	9	2.0	Interspinous
M	50	L5-S1	L5-S1	9.5	2.0	Pedicle screw

VAS: Visual analog scale

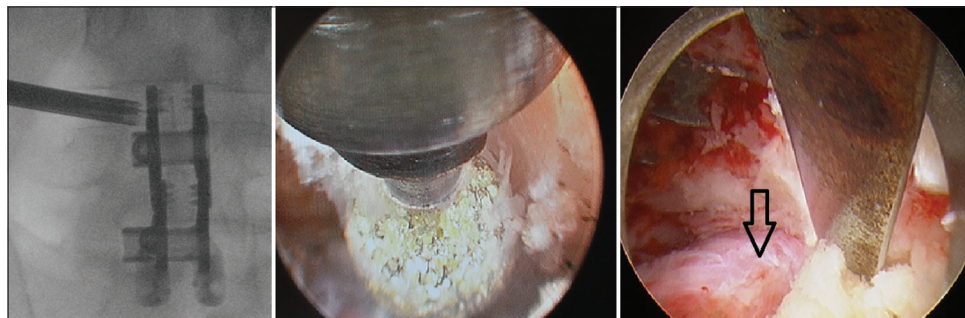


Figure 1: An AP fluoroscopic view (far left) illustrates the technique of "joystick" reaming. An intraoperative photograph (middle) shows endoscopic drilling, which was performed at the junction of the superior articulating process, and the pedicle also to expand the foraminotomy. An intraoperative photograph (far right) shows an example of endoscopic chiseling of the SAP as it encroaches on the exiting nerve (down arrow) with the threads of the pedicle screw clearly evident lateral to the nerve

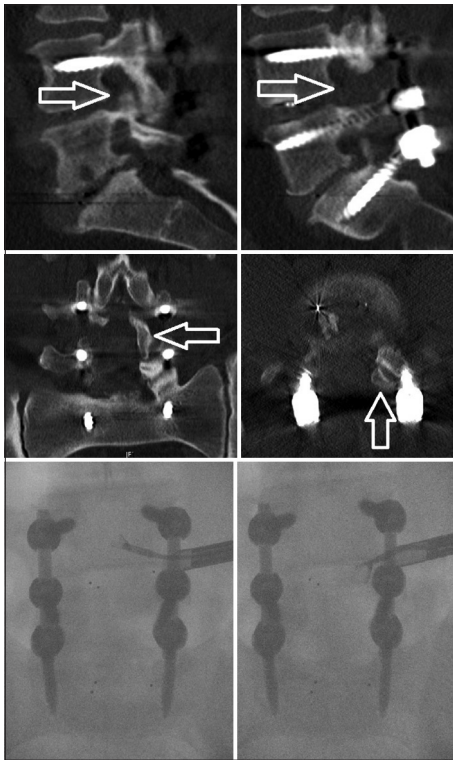


Figure 2: Sagittal CT reconstruction illustrating the narrowed right L4-5 neural foramen (top left) and open left L4-5 neural foramen (top right). Coronal CT reconstruction (middle left) illustrates the difference in foraminal decompression when restricted by minimally invasive technique (arrow indicates residual impinging left facet). Axial CT (middle right) illustrates the impinging facet on the left (arrow). AP fluoroscopic views (bottom left and right) depicts the semi-bendable grasper reaching under the traversing L5 nerve root cranial and caudad in the epidural space

incision for 5 min, and the wound was closed with a single interrupted suture and a band aid.

RESULTS

Five patients underwent single level endoscopic discectomy and foraminotomy. Four patients treated had a total of 8 levels fused: All L4-S1 instrumented fusions. Three of these patients underwent endoscopic foraminotomies at L4-5 and one at L5-S1. A fifth patient presented after a L5-S1 TLIF and was treated at that level. The average time interval between fusion surgery and endoscopic foraminotomy was 3.5 years. The average pain relief 1 year postoperatively after endoscopic treatment was reported to be 63.8%, good results as defined by MacNab. The average preoperative visual analog scale (VAS) score was 9.5, indicated in our questionnaire as severe and constant pain. The average 1 year postoperative VAS score was 3.5, indicated in our questionnaire as mild and intermittent pain. The details of each case are presented in Table 1.

There were no reports of infection, dural tear, thrombophlebitis, spinal instability, or vascular injury.

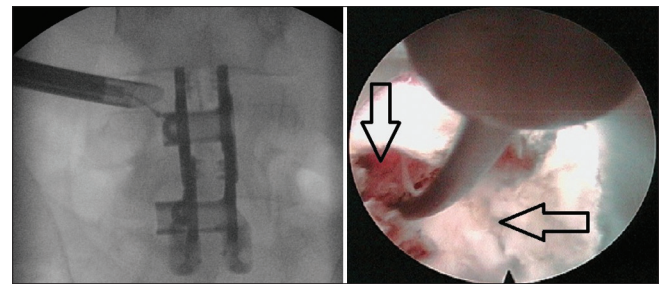


Figure 3: Intraoperative views obtained in transforaminal endoscopic discectomy and foraminotomy illustrating the use of the ball probe dissector. Simultaneous fluoroscopic (right) and endoscopic (left) views are shown of the curved ball probe dissector placed under the traversing L5 nerve root (down arrow) feeling the medial wall of the pedicle to determine the extent of the foraminotomy (left pointing arrow indicates the disc)

There were no serious complications such as cauda equina syndrome or nerve damage resulting in paralysis. There were no issues with postoperative instability during this 1 year follow-up, but surveillance flexion-extension X-rays were not performed. Previously reported complications can include infection, dysesthesia, thrombophlebitis, dural tear, vascular injury, and death.^[4]

DISCUSSION

Technological advances in spine interventions have seen a boom in the past 2 decades, and in the most recent decade, secondary to more minimally invasive surgical options. But as these new techniques are applied in clinical practice, we must be ready with new solutions to the complications that subsequently arise. One difficulty with any minimally invasive fusion approach is performing an extensive enough discectomy and bilateral foraminal decompression when restricted by a narrow minimally invasive incision or retractor system. For patients with continued or recurrent radicular pain after surgery, the options presented may include lifelong interventional pain management, dorsal column stimulation, and/or chronic oral or intrathecal narcotic usage.

Other studies have shown that endoscopic spine surgery is an effective procedure for treating multiple pathologies in the lumbar spine including lateral, paracentral, central, extruded and even contralateral herniated discs as well as lateral recess stenosis.^[2,6-9] In this series, transforaminal endoscopic discectomy and foraminotomy is proposed as a novel “rescue” technique in the setting of lumbar disc reherniation and foraminal stenosis after instrumented lumbar fusion. Posterior hardware such as interspinous fixators, large pedicle screw heads, and crosslinks between rod fixators pose a strategic challenge to offering patients minimally invasive posterior surgeries to repair unintended complications of instrumented fusion procedures. Here a transforaminal approach that avoids a repeat posterior approach, is truly minimally invasive,

and does not require general anesthesia is suggested as a helpful addition in the minimally invasive spine surgeon's armamentarium.

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