Review Article

Case presentation and short perspective on management of foraminal/far lateral discs and stenosis

Nancy E. Epstein¹,²

¹Professor of Clinical Neurosurgery, School of Medicine, State University of N.Y. at Stony Brook, ²Chief of Neurosurgical Spine and Education, Winthrop NeuroScience, NYU Winthrop Hospital, Mineola, New York, USA

E-mail: *Nancy E. Epstein - nancy.epsteinmd@gmail.com
*Corresponding author

Received: 27 February 18 Accepted: 27 February 18 Published: 23 April 18

Abstract

Background: The management of lumbar foraminal/far lateral discs (FOR/FLD) with stenosis remains controversial. Operative choices should be based on each patient's preoperative dynamic X-ray findings, magnetic resonance (MR), and computed tomography (CT) studies. Here we reviewed several options for decompression alone vs. decompression with fusion.

Methods: Safe excision of FOR/FLD with stenosis should begin at the level above the disc herniation, as identification of the superior, foraminally, and far laterally exiting nerve root is critical. Performing an undercutting laminectomy and utilizing an operating microscope usually preserves the facet joints, and in many cases, avoids the need for fusion. Other decompressive techniques include; the intertransverse (ITT), and Wiltse approaches. Fusions following complete unilateral full facetectomy may be; noninstrumented (e.g., older, osteoporotic patients) vs. instrumented (e.g., posterolateral fusion or occasionally transfemoral lumbar interbody fusion). Here we present a patient with L2-L5 stenosis, and a left L3-L4 FOR/FLD, and multiple synovial cysts who was successfully managed with an L2-L5 laminectomy, left L3-L4 FOR/FLD diksectomy without fusion.

Results: Postoperatively, the patient was neurologically intact, and stability was maintained. Adjunctive measures for FOR/FLD diksectomy should include; intraoperative monitoring, use of the operating microscope, and an intraoperative film with a radiopaque marker in the correct disc space to confirm the correct level of diskectomy.

Conclusions: There are multiple approaches to the excision of FOR/FLD with stenosis. These include; decompression alone vs. decompression with non-instrumented vs. instrumented fusion. Surgical choices must be based on individual patient’s X-ray, MR, and CT findings. The aim should be to maximize the safety of disc excision with decompression of stenosis, and to preserve stability, reducing the need for fusion, while minimizing morbidity.

Access this article online
Website: www.surgicalneurologyint.com
DOI: 10.4103/sni.sni_66_18
Quick Response Code:

How to cite this article: Epstein NE. Case presentation and short perspective on management of foraminal/far lateral discs and stenosis. Surg Neurol Int 2018;9:87.

http://surgicalneurologyint.com/Case-presentation-and-short-perspective-on-management-of-foraminal/far-lateral-discs-and-stenosis/

© 2018 Surgical Neurology International | Published by Wolters Kluwer - Medknow
INTRODUCTION

There are many techniques available for treating lumbar foraminal/far lateral disc (FOR/FLD) herniations with stenosis. The choice of surgical procedures must be based on each patient’s preoperative dynamic X-ray, MR, and CT findings. Decompressive procedures may vary, and can include; laminotomy/laminecetomy alone, the intertransverse approach (ITT), and Wiltse’s far lateral technique. Where full unilateral facetectomy is warranted, patients may require noninstrumented vs. instrumented fusions (e.g., pedicle screws with posterolateral lumbar fusion (PLF), or rarely, transforaminal lumbar interbody fusion (TLIF)). No matter what operative approach is chose, adjunctive measures should include; continuous intraoperative physiological monitoring (e.g., somatosensory evoked potentials and electromyography), the use of an operating microscope, and an intraoperative radiograph with a marker within the disc space to confirm the correct level of disc removal.

MATERIALS AND METHODS

Symptoms and signs of foraminal/far lateral discs
The symptoms and signs for patients with lumbar FOR/FLD vary.[2-6] As these discs typically directly compress the dorsal root ganglion (DRG) of the superior/foraminally/far laterally exiting nerve root (e.g. within the axilla), these patients typically exhibit a superior unilateral radiculopathy. For example, at the L4-L5 level, the patient may demonstrate a predominant L4 root syndrome. Additional pathology may include; stenosis, ossification of the yellow ligament (OYL), and synovial cysts. These degenerative changes may further contribute to thecal sac and inferior L5 root compression at the index level (e.g., L4-L5).

Evaluation of FOR/FLD with dynamic X-rays, MR, and CT studies
Dynamic X-rays, MR, and CT studies contribute to the correct diagnosis, localization, and management of lumbar FOR/FLD and attendant stenosis.[2-6] Dynamic X-rays document whether there is active motion at the level of the FOR/FLD. If there is instability, additional noninstrumented vs. instrumented fusion may be warranted. On axial MR studies, typically localized to the disc spaces, FOR/FLD extending to the mid-vertebral level may be under diagnosed or missed. Here, careful evaluation of the parasagittal MR images may better demonstrate FOR/FLD extension (e.g. laterally/foraminally, and inferiorly). However, CT studies, with contiguous axial 2 mm cuts, may more readily pick up the full extent of FOR/FLD, while also documenting the presence of accompanying limbus vertebral fractures. Further, MR and CT studies combined should better confirm the extent of stenosis, OYL, and/or the presence of accompanying synovial cysts.

History of decompressive surgery for lumbar FOR/FLD

FLD: Wiltse far lateral approach to lumbar FLD
Wiltse and Spencer in 1988 described a purely far lateral approach to lumbar disc herniations [Table 1].[10] This procedure involved dissection/exposure focused lateral to the canal, and the facet joint. The Wiltse procedure became known for: “Specifically, its use for removing a far lateral disc, decompressing a far out syndrome, (and) inserting pedicle screws...” In some cases, it also required resection of the lateral one-third of the facet joint to attain more extensive exposure of the lateral foramen. Taking down the intertransverse ligament and fascia, the Wiltse approach offered far lateral exposure of the cephalad/foraminally/far laterally exiting nerve root, but no access to the medial spinal canal and/or proximal or mid portion of the neural foramen. Therefore, in the presence of significant stenosis or other spondyloarthritic pathology within the spinal canal and proximal/mid foramen, this approach will typically not suffice.

Decompressions for 170 Lumbar FOR/FLD
In 1995, Epstein initially evaluated the surgical procedure/outcomes for 170 MR/CT confirmed FOR/FLD (1984–1994) [Table 1].[2] These patients were managed with three different decompressive operative approaches: complete facetectomy (n = 73), laminotomy with medial facetectomy (n = 59 patients), and intertransverse discectomy (ITT: Intertransverse Approach) (n = 58 patients). Patients were followed on an average of 5 years. Of interest, outcomes were comparable for all three groups; good/excellent results were obtained in 79% intertransverse approach (ITT), 70% facetectomy group vs. 68% laminectomy/laminotomy. Therefore, the optimal lumbar FOR/FLD decompressive procedure should offer the best exposure for that specific patient, irrespective of the need for more extensive facet resection. Of interest, outcomes across all groups were comparable with very rare requirements for fusion.

SF-36 outcome study for FOR/FLD lumbar discs
In 1997, Epstein and Hood utilized the Medical Outcome Trust’s SF-36 Short Form to assess outcomes for 76 (45% of the original sample of 170 patients) patients undergoing the three different operative
approaches enumerated above for lumbar FOR/FLD (1984 and 1994) [Table 1].[3] Patients averaged 60.1 years of age. SF-36 evaluations were obtained an average of 9.1 months (direct assessment), and 2.8 years postoperatively (phone interviews). Outcomes were excellent (n = 32), good (n = 24), fair (n = 12), and poor (n = 8). As outcomes were comparable for all three procedures, this patient-based outcome study confirmed that the decompression chosen for any patient with a lumbar FOR/FLD should best be tailored to their specific requirements, irrespective of the extent of facet resection.

2007: Minimally invasive endoscopic discectomy/FOR/FLD; increased morbidity
In 2007, Sasani et al. evaluated the safety/efficacy of percutaneous minimally invasive (MI) endoscopic discectomy for FOR/FLD in 66 patients (1998–2005) [Table 1].[8] They determined from the literature that FOR/FLD constituted 11% of all lumbar disc herniations. Discs were respectively located at: L4-5 (n = 42; 64%), L3-4 (n = 19, 28%), and the L2-3 levels (n = 5, 8%). Patients were followed for 6–12 postoperative months. There were nine complications. For two patients (n = 1, L4-5 and n = 1, L4), the FLD could not be accessed using this technique; rather, discectomy with microscopic visualization was required (e.g. secondary surgery). Three (n = 3, L4-5) patients required additional operations 3-6 months later. Furthermore, 2 patients (n = 2, L4-5) sustained partial nerve root injuries attributed to operative dissection, and another 2 patients (n = 2, L4-5) sustained neural injuries due to malpositioning of the working channel itself. At six postoperative months, the authors found all patients had improved, but voiced the following concerns: “Percutaneous

| Author [Ref] year | Number of patients surgery for/FLD | Data | Data | Data | Data/Complications |
|------------------|-----------------------------------|------|------|------|-------------------|
| Wiltse[10] 1988  | Wiltse paraspinal                   | Far lateral lumbar discs | NA   | NA   | NA                |
| Epstein[2] 1995  | 170 FOR/FLD followed avg. 5 years  | FAC  | N=73 | ITT  | MacNab’s criteria: Excellent/good |
| Epstein and Hood[3] 1997 | SF-36 outcomes trust data 1984-1994 | 76 FOR FLD (45% Responded) | Followed 9.1 mos. | 73 FAC 39 LAM 58 ITT (45%) | MacNab’s Excellent/good (32/24), fair (12), poor (8) All results comparable |
| Sasani[8] 2007  | MI PERC MI ED for FOR/FLD 66 patients | 1998-2005 Followed 6-12 mos. | 42 L4-L5 Followed 19 L3-L4 5 L2-L3 | Comp 2-No access 2 Rec Disc 4 root deficit | REOP 9 (13.6%) of 66 FOR FLD |
| Liu[7] 2012     | 3 MI to 52 FLD 2000-2006 Followed Avg. 13.5 mos. | 25 MI ED 13 METRx 14 X-Tube discectomy | L2-L3-L4 12 L3-L4 15 L4-L5 | MacNab’s outcomes: 4 Fair | Excellent outcomes 84%, 84.6%, 92.8% Comparable VAS scores |
| Celikoglu[1] 2014 | 33 FLD ITT | 2006-2011 | 5 Reop 1 FLR out of 34 FLR | Comp 5 or 539 Reop | Excellent outcomes 1 of 34 FLD |
| Wang[6] 2016    | MI TLIF for FLD 539 5 Reop 1 FLR out of 34 FLR | 5 Reop 1 recurrent disc 3 DS | Excellent outcomes 0% fusions 0% neurodeficits 0% reoperations 0% infections |
| Epstein[6] 2017 | 2-3 Level Lam (n=58) 20 Synovial cysts 1 DS 48 HNP (12 FLR) | 4-5 Level Lam (n=79) 36 synovial cysts 26 DS 39 Discs (16 FLR) | 1 Reop Seroma (postop) | CT/XT 2 pseudarthrosis | 97% Fusion COMP |
| Epstein[6] 2017 | 9 Lam (Avg. 4 levels) 1.2 levels | Nanoss BMA Lamina autograft Followed Avg. 1.3 years | 51 DS 2 Lysis 32 synovial cysts 21 Discs (10 FOR/FLD) | 97% Fusion CT/XT Avg. 4.9 mos. Postop (comorbidities: osteoporosis, morbid obesity, smokers) | Excellent outcomes
endoscopic discectomy is a minimally invasive method and offers many benefits to the patient, but extensive surgical practice is needed to become a capable surgeon.” Notably, the total morbidity for this MI endoscopic approach was 13.6% (9 patients) of the 66 cases. These data should prompt one to ask whether the time has not come for MI endoscopic surgery for lumbar FOR/FLD.

2012: Three different minimally invasive decompressions for FOR/FLD
Liu et al. (2012) documented comparable results for three different MI procedures addressing 52 (2000–2006) FLD [Table 1]. They noted FLD comprised 2.6–11.7% of all lumbar disc herniations. Procedures included MI endoscopic discectomy (n = 25), METRx discectomy (n = 13), and X-tube discectomy (n = 14). Patients were followed or a mean of 13.5 months. Postoperatively, excellent outcomes were seen in 84.0, 84.6, and 92.8% patients respectively. Visual analog scale (VAS) scores were also comparable across all three groups. Note in this study, the number of patients in each operative group was relatively small. Therefore, any conclusions regarding the safety of these minimally invasive procedure, based on this study, are of limited value.

2014: Extraforaminal intertransverse (ITT) approach to lumbar FLD (far lateral lumbar disc herniation)
In 2014, Celikoglu et al. evaluated the extraforaminal surgical management of 33 far lateral lumbar discs utilizing an intertransverse approach (ITT) (e.g. with median or paramedian incisions) (2006–2011) [Table 1]. Patients averaged 51.2 years of age, and had surgery at L3-4 (12 patients) or L4-5 (15 patients) utilizing median paramuscular (20 patients, 61%) or paramedian intermuscular (13 patients, 39%) approaches. With MacNab's criteria, the outcomes were graded as excellent/good (29), and fair/poor (n = 4). They concluded the ITT procedure for far lateral lumbar disc herniations was a safe and effective surgical alternative that avoided spinal instability. Furthermore, it was preferable to a laminectomy with medial or total facetectomy. Hypothetically, the ITT approach sounds ideal. However, it limits visualization and may increase the risk of injury to the mid-foraminal portion of the cephalad foraminaly and far laterally exiting nerve root. Furthermore, it typically requires more extensive facet resection both medially and far laterally, leaving the intervening facet weakened and subject to fracture.

**Efficacy of laminectomy alone for excision of FOR/FLDs**
Over two postoperative years, Epstein (2017) observed low complication and reoperation rates for 58 patients undergoing 2-3 level and 79 patients undergoing 4-6 level lumbar laminectomies without fusions, including those with FOR/FLD [Table 1]. The 2-3 level procedures addressed; 20 synovial cysts, 1 degenerative spondylolisthesis (DS), and 48 herniated discs. Twelve of the 48 discs were FOR/FLD discs involving the L2-3 (n = 1), L3-4 (n = 1), L4-5 (n = 6), and L5-S1 (n = 4) levels. The 4-6 level operations additionally addressed; 35 synovial cysts, 26 with DS, and 39 lumbar discs. Sixteen of 39 were FOR/FLD discs located at the L2-3 (n = 1), L3-4 (n = 2), L4-5 (n = 10), L5-S1 (n = 3) levels. Of interest, no patient in either series developed a new neurological deficit. Furthermore, there were no infections, and none warranted readmission. Only one patient in the 4-6 level laminectomy group required secondary surgery (e.g., 7 days postoperatively for a seroma). Notably, although a total of 28 (20.4%) of 137 patients with lumbar stenosis additionally had FOR/FLD, none developed postoperative lumbar instability requiring a fusion.

**CASE REPORT**
A patient with a history of low back pain, presented with 10 days of severe left lower extremity numbness, tingling, and weakness. The dynamic X-rays, MR, and CT studies demonstrated moderate stenosis/OYL L2-L5, bilateral synovial cysts at L4-L5, a left L3-L4 synovial cyst, and a massive left L3-L4 FOR/FLD with limbus fracture. The FOR/FLD disc herniation extended all the way to the L2-L3 level (e.g. markedly compressing the axilla of the L3 root) [Figures 1-4]. Surgery required an L2-L5 laminectomy, resection of bilateral L4-L5, and the left L3-L4 synovial cysts, plus resection of a massive left L3-L4 FOR/FLD with limbus fracture using the down-biting curette/mallet technique. Utilizing the operating microscope and the undercutting technique, allowed for preservation of the facet joints and stability. The operating microscope and intraoperative monitoring helped avoid neural injury. At surgery, an intraoperative lateral X-ray clearly documented a Penfield elevator

![Figure 1: The axial T2-weighted MR scan obtained just above the L3-L4 level documented the foraminal and far lateral extent of the L3-L4 disc herniation (arrow), which migrated superiorly. Note the obliteration of the left-sided cephalad L3 root](image-url)
correctly located within the L3-L4 disc space (e.g. this is used to avoid wrong-level disectomy) [Figure 5]. Postoperatively, the patient was neurologically intact, and never demonstrated instability.

Noninstrumented and instrumented fusion alternatives for lumbar FOR/FLD

Lumbar laminectomy with in situ fusion for stenosis and including FOR/FLD

In 2017, 59 patients underwent multilevel laminectomies (average 4.0 levels) and noninstrumented fusions (average 1.2 level) [Table 1]. Epstein documented high noninstrumented fusion rates utilizing lamina autograft and Nanoss (RTI Surgical Alachua, FL, and USA) combined with autogenous bone marrow aspirate [Table 1]. Prior to surgery, patients exhibited OYL/stenosis, DS (n = 51), spondylolysis (n = 2), synovial cysts (n = 32), and disc herniations (n = 21). Ten of the 21 discs were FOR/FLD: L2-3 (n = 1), L3-4 (n = 2), L4-5 (n = 6), L5-S1 (n = 1). Postoperatively, patients were followed an average of 3.1 years. The X-ray/CT studies documented a 97% postoperative fusion rate occurring an average of 4.9 months postoperatively (57 of 59 patients). Two patients with severe osteoporosis, morbid obesity, and smoking histories had pseudarthroses that were not sufficiently symptomatic to warrant additional surgery.

Decompression with instrumented fusion for far lateral lumbar discs

A unilateral full facetectomy may be required for excision of FOR/FLD, particularly when combined with severe spondyloarthrosis, DS, and/or spondylolisthesis/lysis. Here, a full facetectomy provides excellent visualization of the entire course of the cephalad, foraminal, and

---

**Figure 5:** Penfield elevator in the L3-L4 disc space itself to confirm the correct localization. Note the Penfield/dental tool at the cephalad L2 and caudal L5 extent of the lumbar decompression.
far laterally exiting nerve root along with the ipsilateral thecal sac and inferiorly exiting nerve root. In these cases, patients may require a posterolateral fusion (PLF) utilizing pedicle/screw instrumentation, or in select cases, a TLIF. Nevertheless, the addition of an interbody device may require increased manipulation of the thecal sac and/or nerve roots increasing perioperative morbidity (e.g., neurological root deficits, increased cerebrospinal fluid leak, etc.).

2016 Dorsal root ganglion (DRG) injury for MI TLIF for FLD

In 2016, Wang et al. observed that 5 (0.9%) of 539 patients exhibited postoperative dysesthesias (POD) attributed to DRG injury following MI TLIF (2010–2014) [Table 1].[9] One of these five cases involved a complication attributed to a FLD; in toto, this meant there was 1 (3%) complication out of a total 34 patients with FLD. Here, the exposure provided by the MI TLIF may not have afforded adequate visualization of the cephalad foraminally/far laterally exiting nerve root, making it more susceptible to injury. Of interest, the remaining four injuries were due to: 1 recurrent lumbar disc herniation (1/56 recurrent discs; 3%), and 3 instances of DS (5 out of 201 with DS; 1%).

**DISCUSSION**

There are multiple alternative operative approaches for the management of lumbar FOR/FLD with stenosis. Preoperative assessment requires dynamic X-rays, MR, and CT studies to document the full extent/location of the FOR/FLD and accompanying stenosis and other degenerative pathology. When performing a medial intracanalcular decompression, one should utilize the operative microscope and the undercutting technique to preserve the lateral 2/3 of the facet joint, and maintain stability. Further, the extent of facet resection should be minimized by utilizing the operative microscope. The use of intraoperative monitoring should help avoid neural injury. Performing any one of the various MI techniques (e.g., endoscopic discectomy or MI TLIF) may unnecessarily add morbidity (e.g., root injury, retained disc, residual stenosis). Finally, no matter what the operative approach, it is critical to obtain an intraoperative lateral radiograph with an instrument in the correct disc space to avoid wrong level surgery.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**

1. Celikoglu E, Kiraz I, Is M, Cecen A, Ramazanoğlu A. The surgical treatment of far lateral lumbar disc herniation: 33 cases Acta Orthop Belg 2014;80:468-76.
2. Epstein NE. Evaluation of varied surgical approaches used in the management of 170 far-lateral lumbar disc herniations: Indications and results. J Neurosurg 1995;83:648-56.
3. Epstein NE, Hood DC. A comparison of surgeon’s assessment to patient’s self analysis (short form 36) after far lateral lumbar disc surgery. An outcome study. Spine (Phila Pa 1976) 1997;22:2422-8.
4. Epstein NE, Hollingsworth RD. Nursing review section of Surgical Neurology International: Part 1 lumbar disc disease. Surg Neurol Int 2017;8:301.
5. Epstein NE. High lumbar noninstrumented fusion rates using lamina autograft and Nanoss/bone marrow aspirate. Surg Neurol Int 2017;8:153.
6. Epstein NE. Tisseel’s impact on hemostasis for 2-3 and 4-6-level lumbar laminectomies. Surg Neurol Int 2017;8:299.
7. Liu T, Zhou Y, Wang J, Chu TW, Li CQ, Zhang ZF, et al. Clinical efficacy of three different minimally invasive procedures for far lateral lumbar disc herniation. Chin Med J (Engl) 2012;125:1082-8.
8. Sasani M, Ozer AF, Okstenoglu T, Canbulat N, Sarioglu AC. Percutaneous endoscopic discectomy for far lateral lumbar disc herniations: Prospective study and outcome of 66 patients. Minim Invasive Neurosurg 2007;50:91-7.
9. Wang H, Zhou Y, Zhang Z. Postoperative dysesthesia in minimally invasive transforminal lumbar interbody fusion: A report of five cases. Eur Spine J 2016;25:1595-600.
10. Wiltse LL, Spencer CW. New uses and refinements of the paraspinal approach to the lumbar spine. Spine (Phila Pa 1976) 1988;13:696-706.