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Original Article

Experience of using a 3-blade LES-Tri retractor over 5 years for lumbar decompression microdiscectomy

Kingsley R. Chin[a,b,c,d,*], Fabio J.R. Pencle[c,e], Jason A. Seale[d,e], Frank K. Pencle[e,f]

[a] *Herbert Wertheim College of Medicine at Florida International University, USA*
[b] *Charles E. Schmidt College of Medicine at Florida Atlantic University, USA*
[c] *University of Technology, JA, WI, Jamaica*
[d] *Less Exposure Surgery Specialists Institute (LESS Institute), Jamaica*
[e] *Less Exposure Surgery (LES) Society, Jamaica*
[f] *Cornwall Regional Hospital, JA, WI, Jamaica*

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ABSTRACT

Background: Lower back pain is the fifth most common reason for visiting a physician in the United States. Degenerative disc disease, degenerative spondylolisthesis, arthritis, and facet arthrosis are leading causes for lumbar spinal stenosis. The previous gold standard involved open laminectomy combined with medial facetectomy and foraminotomy. The advent of minimally invasive surgery (MIS) and endoscopic technologies has led to less invasive and targeted interventions. In this study, the authors aim to show a five-year experience using a three-blade retractor for lumbar decompression and microdiscectomy.
Methods: A database review of a single spine surgeon over the last 5 years with a total of 306 patients undergoing single-level lumbar decompression with and without microdiscectomy.
Results: The average age was 47 ± 12 years and the average BMI was 29.7 ± 5.7 kg/m2 with a total of 52% male patients. Operative levels included L3-4, L4-L5, and L5-S1, with 65% of procedures at the L5-S1 level and follow-up was for two years. Overall mean VAS back scores decreased from 7.9 ± 1.6 to 2.5 ± 1.1 at two-year follow-up, p = 0.001. Preoperative ODI scores improved from 32.1 ± 5.1 to 17.9 ± 4.3 at two-year follow-up, p = 0.002. The mean EBL and surgeon time was 21 ± 15 ml and 35 ± 17 min, respectively.
Conclusion: This less exposure surgery technique can be performed to allow lumbar decompression, with or without microdiscectomy. This is an anatomy preserving technique with improved outcomes.

1. Introduction

Lower back pain affects 28% of adults and is the fifth most common reason for visiting a physician in the United States.[1–3] Lumbar spine stenosis is a highly prevalent condition that often results from degenerative disc disease, degenerative spondylolisthesis, arthritis, and facet arthrosis which are major contributory pathologies for lower back pain4. In patients greater than 60 years of age, lumbar stenosis can lead to impaired ambulation with increased morbidity secondary to lower back pain and lower extremity neuropathy.[5]

The previous standard treatment of lumbar stenosis has traditionally been open laminectomy, often combined with medial facetectomy and foraminotomy, in patients without instability. Foley and Smith introduced microscopic endoscopic decompression (MED) in 1997.[6] A tubular Metre system was used to perform discectomy in a minimally invasive manner.[6] In recent years, less invasive procedures have emerged with microdecompression being more frequently performed through smaller incisions.[7]

Outpatient procedures have shown an increasing trend in anterior cervical fusions and lumbar microdiscectomy within the US.[8,9] The evolution of a tubular system has been shown in a study by Chin et al.[10] where a tubular dilator with the ability to open like a speculum was used. As spine surgery continues to advance with minimally invasive surgery (MIS) and less exposure surgery techniques (LES).[11–14] The authors aim to demonstrate a technique based on the use of a three-blade retractor system over five years.

* Corresponding author. Clinical Orthopedics, Less Exposure Surgery Specialists Institute (LESS Institute), 3816 Hollywood Blvd. Ste #102, Hollywood, FL, 33021, Jamaica.

E-mail address: kingsleychin@thelessinstitute.com (K.R. Chin).

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2. Methods

The database of a single spine surgeon was reviewed over the last 5 years. IRB approval was granted for this study and informed consent was obtained. The charts of 306 patient undergoing lumbar decompression with and without microdiscectomy in the outpatient setting were reviewed. Patients were only considered for surgery after they failed conservative management for at least three months. Indications for surgery included lumbar disc herniation, with or without radiculopathy. Exclusion criteria for this study included acute severe trauma, fractures, malignancy, infection, unstable chronic medical illnesses, prior lumbar fusions and a BMI >42.[15] All patients were assessed preoperatively and narcotics were discontinued.[16] Patients with chronic but stable medical conditions, including hypertension, diabetes mellitus, asthma, hypercholesterolemia, and heart disease were medically cleared by their family practitioner and/or cardiologist where applicable.

2.1. Statistical analysis

Values are expressed as counts or means ± standard error as appropriate. Intergroup comparisons were made using a *t*-test. Data were analyzed using the SPSS statistical software version 22 (IBM Corp, New York, USA). Power analysis was performed based on mean VAS scores, to obtain a statistical power of 80% and a confidence interval of 5%. A sample size of 135 was required.[17] Tests were considered significant if $p < 0.05$.

2.2. Summary of operative technique

Steps in the Less Exposure Surgery (LES) decompression and microdiscectomy included preparation, positioning, incision, fascial opening, dissection, retractors, bone identification, deprioritization, decompression, microdiscectomy, and closure.

The patient was brought to the operating room and placed in the prone position on the Wilson frame. All bony prominences were well padded. After all appropriate anesthesia monitors were attached, the patient underwent general endotracheal anesthesia and the lumbar spine was prepped and draped in a standard sterile surgical fashion and the preoperative surgical site was marked was visible ink in the operative field. The Wilson frame was elevated to open the spinous processes of the affected level.

2.2.1. Step 1: Access/exposure

Using standard surgical landmarks, the pedicles were identified and the position was confirmed using a 22G needle[18] and AP and lateral intraoperative fluoroscopy. An approximately 1.0-inch midline incision was made at the target level over the spinous process for single level decompression. Dissection using electrocautery on the left side of the spinous process was performed, allowing a cuff of tissue for anatomic closure. The rectus spinal muscles were elevated laterally and dissected in the subperiosteal and avascular plane of the lamina of the superior and inferior vertebral levels on the left.

2.2.2. Step 2: Decompression

An initial 6.5 mm dilator was placed in the disc space and subsequent 9.3 mm and 12 mm dilators were then placed with the three blade LESspine Tri Formation cannula-retractor system (LESspine, MA) placed over dilators (Fig. 1) and confirmed using fluoroscopy guidance. The left superior vertebrae inferior facets and lamina were identified, and a #15 blade was used to make an incision to the lateral aspect of the ligamentum flavum. A curette was used to take down ligamentum flavum off the underside of the superior vertebrae lamina and the posterior side of the inferior vertebrae lamina. The curette was used to separate the ligamentum flavum from the facet capsule. Kerrison ronguers were used to perform a left hemilaminotomy, foraminotomy, and partial facetectomy until the surgeon was satisfied that the lateral recess was adequately decompressed (Fig. 2). Bone wax and surgi-flo was then placed to control bleeding.

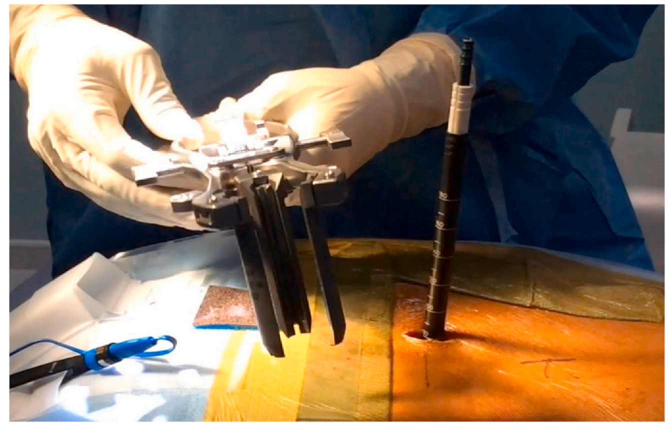

Fig. 1. Demonstrates use and placement of three-blade retractor.

2.2.3. Step 3: Discectomy

Careful retraction of the nerve root was performed medially using a nerve root retractor with the ligamentum flap completed to show the affected disc. A microdiscectomy was performed to remove the soft, loose and unhealthy disc using multiple pituitaries (Fig. 3). The disc space was irrigated to remove any remaining free disc fragments.

2.2.4. Step 4

Steps 1–3 were repeated on the right if the procedure was for bilateral decompression with or without microdiscectomy. If the procedure was only unilateral, then just the affected side was treated. Final fluoroscopy was taken with Freer elevator in disc space was taken for confirmation. Fig. 1 shows final photograph after completion of decompression.

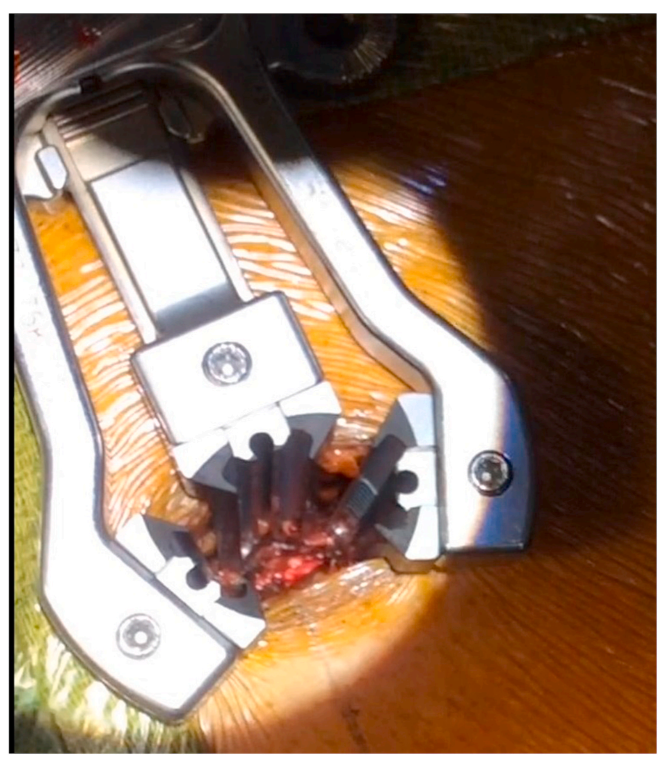

Fig. 2. Procedure of bony decompression using Kerrison Ronguers.

Fig. 3. Demonstrates the use of pituitary to remove the herniated disc.

2.2.5. Step 5: Closure

Hemostasis was achieved using bone wax and surgi-flo to control bleeding. The wounds were then irrigated copiously. A #1 Vicryl figure-of-eight was then placed to re-approximate the muscle and fascia. A 2-0 Vicryl was placed in the subcutaneous tissue and then a 3-0 monocryl was placed in the skin. A dry sterile dressing was applied.

2.3. Discharge and follow-up

Patients were discharged using the standard outpatient protocol of completing surgery after being deemed oriented and neurologically intact by the anesthesiologist and operating surgeon.[11,12,19,20] Outpatient postoperative instructions were discussed with patients and caregivers with written copies provided.[11,12,15,19,20]

No major complications were reported in our series and there were no unplanned postoperative admissions for pain, nausea or any other complaints.

3. Results

A total of 306 charts were reviewed over the 5-year period. The average age was 47 ± 12 years and the average BMI was 31.3 ± 8.9 kg/m^2 with a total of 52% male patients.

Operative levels included L3-4, L4-L5, and L5-S1, with 65% of procedures at the L5-S1 level and follow-up was for two years. Overall mean VAS back scores decreased from 7.9 ± 1.6 to 2.5 ± 1.1 at two years follow-up, $p = 0.001$.

Preoperative ODI scores improved from 32.1 ± 5.1 to 17.9 ± 4.3 at two-year follow-up, $p = 0.002$. The mean EBL and surgeon time was 21 ± 15 ml and 35 ± 17 min, respectively.

Over the five-year period, there were three patients who had dural tears which were recognized intraoperatively and repaired. There was one patient who presented after two weeks of their surgery with symptoms of a headache and was found to have a dural tear. We had no revisions, however, two patients required fusion within a two-year period at the affected level where they had prior decompression.

4. Discussion

The interest in MIS continues to increase for patients, surgeons and commercial industries alike. MIS provides surgeons with the ability to intervene in the patient's disease process and provide adequate symptomatic relief with shorter recovery times. Since the introduction of MIS, spine surgery has adapted to performing percutaneous as well as open outpatient procedures. Initially, percutaneous decompressions showed higher rates of complications and overall success rates that were variable, ranging from 50% to 89%.[21–23] Improved surgeon proficiency and access to improved technologies demonstrated that percutaneous methods could have satisfactory results compared to traditional open decompressions while exposing the patient to less trauma and providing a promotional value.[24] Furthermore, microdecompression and open MIS techniques have proven promise in decreasing trauma during surgery and providing quality patient outcomes in a cost-effective manner.[25–27,23] The use an LES technique with the utilization of a three-blade retractor coupled with a classical surgical approach can provide the surgeon with direct visualization of the affected level to perform adequate decompression while also reducing the overall incision size required to perform the decompression [10,28,29, 26,27].

In this study, the three-blade retractor system used in single-level lumbar decompressions demonstrated substantial patient outcomes. VAS back scores improved by an average of 5.4 and ODI scores improved by an average of 14.2 at two years of follow-up with statistically significant evidence. Such results should not be overlooked when considering that patients have an expectation of improving regardless of surgical approach. It is important to maintain comparable outcomes with LES versus MIS versus traditional open approaches, as demonstrated by previous studies.[24,27] In addition to improving pain scores and disability, the method also proved successful in objective measurements for MIS with an EBL of about 21 ml and surgery time of about 35 min. Such results are superior to previous tubular retractor systems.[26] Patient safety was also preserved with a low rate of complications, re-admission and subsequent same-level operations.

The authors of this study recognize that there were several limitations to the study design. Foremost, the results included in this analysis are comprised of the experiences of a single surgeon. It would be ideal to evaluate outcomes from several different operators with varying degrees of experience using a three-blade retractor system. Nonetheless, the study included a sample size (306) far greater than the minimum number indicated by the power analysis (135) with a fair distribution of male and female participants (52% male). However, there were limitations in the sample size with an average age of 47 and an average BMI of 31.3. Further evidence is required to determine the efficacy of the surgical technique on elderly patients who may have with herniated disc disease or on patients who have a lower BMI since bone mineral density can be proportionally related to BMI in the axial spine.[30] Future studies should take such limitations into consideration when studying the three-blade retractor for lumbar decompression and consider incorporating other objective measurements to determine the overall efficacy of LES such as cost per case and days to return to work.

5. Conclusion

The authors demonstrated the feasibility and outcomes with the use of three blade speculum in lumbar decompression and microdiscectomy. We, therefore, recommend this technique as an option for surgeons.

Declaration of competing interest

We did not seek or receive any funding from the National Institutes of Health (NIH), Wellcome Trust, Howard Hughes Medical Institute (HHMI), or others for this work. KRC is a shareholder in and receives other benefits from KICVentures Inc. None of the other authors (FJRP, KAQ, and JAS) or any member of his or her immediate family has the funding or commercial associations (e.g., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted article.

References

1 Chou R, et al. Diagnosis and treatment of low back pain: a joint clinical practice guideline from the American College of Physicians and the American Pain Society. *Ann Intern Med*. 2007;147(7):478–491.
2 Blackwell DL, Lucas JW, Clarke TC. Summary health statistics for U.S. adults: national health interview survey. *Vital Health Stat*. 2012;10(260):1–161, 2014.
3 Gaskin DJ, Richard P. *The Economic Costs of Pain in the United States*. 16. SRC - GoogleScholar; 2015.
4 Boden SD, et al. Orientation of the lumbar facet joints: association with degenerative disc disease. *J Bone Joint Surg Am*. 1996;78(3):403–411.
5 Suri P, et al. Does this older adult with lower extremity pain have the clinical syndrome of lumbar spinal stenosis? *Jama*. 2010;304(23):2628–2636.
6 Foley KT SM. Microendoscopic discectomy. *Tech Neurosurg*. 1997;3:301–307.
7 Perez-Cruet MJ, et al. Microendoscopic lumbar discectomy: technical note. *Neurosurgery*. 2002;51(5 Suppl):S129–S136.
8 Pencle FJR, et al. Trends in inpatient versus outpatient lumbar microdiscectomy in the United States of America: an epidemiologic and economic analysis. *W Indian Med J*. 2017;66(3):404–408.
9 Pencle FJR, et al. Trends in inpatient versus outpatient Anterior cervical discectomy and fusion in the United States of America: an epidemiologic and economic analysis. *W Indian Med J*. 2017;66(3).
10 Chin KR, Michener TA. Prospective evaluation of a 3-blade speculum cannula for minimally invasive lumbar microdiscectomy. *J Spinal Disord Tech*. 2006;19(4): 257–261.
11 Chin KR, et al. Lateral lumbar interbody fusion in ambulatory surgery centers: patient selection and outcome measures compared with an inhospital cohort. *Spine*. 2016;41(8):686–692.
12 Chin KR, et al. Clinical outcomes with midline cortical bone trajectory pedicle screws versus traditional pedicle screws in moving lumbar fusions from hospitals to outpatient surgery centers. *Clin Spine Surg*. 2017;30(6):E791–E797.
13 Chin KR, et al. Avoidance of wrong level surgery in the lumbar spine: a technical report. *J Spine*. 2015:257, 04(05).
14 Chin KR, et al. A psoas splitting approach developed for outpatient lateral interbody fusion versus a standard transpsoas approach. *J Spine Surg*. 2018;4(2):195–202.
15 Chin KR, Coombs AV, Seale JA. Feasibility and patient-reported outcomes after outpatient single-level instrumented posterior lumbar interbody fusion in a surgery center: preliminary results in 16 patients. *Spine*. 2015;40(1):E36–E42.
16 Lawrence JT, et al. Preoperative narcotic use as a predictor of clinical outcome: results following anterior cervical arthrodesis. *Spine*. 2008;33(19):2074–2078.
17 Carneiro AV. Estimating sample size in clinical studies: basic methodological principles. *Rev Port Cardiol*. 2003;22(12):1513–1521.
18 Fabio JR, Pencle KRC, André JK, Coombs V, Neel Desai JAS. Avoidance of wrong level surgery in the lumbar spine: a technical report. *J Spine*. 2015:257, 04(05).
19 Chin KR, et al. Eligibility of outpatient spine surgery candidates in a single private practice. *Clin Spine Surg*. 2017;30(10):E1352–E1358.
20 Chin KR, et al. Clinical outcomes of outpatient cervical total disc replacement compared with outpatient Anterior cervical discectomy and fusion. *Spine*. 2017;42 (10):E567–E574.
21 Gill K. Percutaneous lumbar diskectomy. *JAAOS - J Am Acad Orthopaedic Surg*. 1993; 1(1):33–40.
22 Mathews HH, Long BH. Minimally invasive techniques for the treatment of intervertebral disk herniation. *J Am Acad Orthop Surg*. 2002;10(2):80–85.
23 Deen HG, Fenton DS, Lamer TJ. Minimally invasive procedures for disorders of the lumbar spine. *Mayo Clin Proc*. 2003;78(10):1249–1256.
24 Pan L, Zhang P, Yin Q. Comparison of tissue damages caused by endoscopic lumbar discectomy and traditional lumbar discectomy: a randomised controlled trial. *Int J Surg*. 2014;12(5):534–537.
25 Salerni AA. A minimally invasive approach for posterior lumbar interbody fusion. *Neurosurg Focus*. 2002;13(6):e6.
26 Palmer S. Use of a tubular retractor system in microscopic lumbar discectomy: 1 year prospective results in 135 patients. *Neurosurg Focus*. 2002;13(2):E5.
27 Nerland US, et al. Minimally invasive decompression versus open laminectomy for central stenosis of the lumbar spine: pragmatic comparative effectiveness study. *BMJ*. 2015;350:h1603.
28 Guiroy A, et al. How to perform the Wiltse posterolateral spinal approach: technical note. *Surg Neurol Int*. 2018;9:38.
29 Yaman O, et al. A comparison of bilateral decompression via unilateral approach and classic laminectomy in patients with lumbar spinal stenosis: a retrospective clinical study. *Turk Neurosurg*. 2015;25(2):239–245.
30 Felson DT, et al. Effects of weight and body mass index on bone mineral density in men and women: the Framingham study. *J Bone Miner Res. Off J Am Soc Bone Mineral Res*. 1993;8(5):567–573.