Minimally Invasive Lumbar Laminotomy (MILL)

Definition

Minimally Invasive Lumbar Laminotomy (MILL) is a surgical technique aimed at relieving neural compression in the lumbar spine by removing a limited portion of the **lamina** and/or **ligamentum flavum** using small incisions and specialized instruments. It preserves paraspinal musculature and minimizes collateral tissue damage.

🛛 Goals

- Decompression of the spinal canal and/or lateral recess
- Relief of radicular symptoms or neurogenic claudication
- Preservation of:
 - 1. Paraspinal muscles
 - 2. Ligamentous structures
 - 3. Bony stability (facet joints, spinous processes)

Approaches

• Tubular Retractor-Based MILL

- 1. Uses sequential dilators
- 2. Operative microscope or exoscope for visualization
- Endoscopic MILL
 - 1. Full-endoscopic or biportal technique
 - 2. Continuous irrigation
 - 3. Requires endoscopic tower and instruments
- Mini-open MILL
 - 1. Direct midline approach with minimal soft tissue dissection
 - 2. No tubular system or endoscope required

Indications

- Lumbar spinal stenosis (central or lateral)
- Unilateral or bilateral radiculopathy
- Neurogenic claudication
- Mild degenerative spondylosis without instability

Last update: 2025/06/17 minimally_invasive_lumbar_laminotomy https://neurosurgerywiki.com/wiki/doku.php?id=minimally_invasive_lumbar_laminotomy 10:50

Advantages

- Smaller incisions
- Less postoperative pain
- Shorter hospital stay and recovery time
- Lower blood loss
- Preservation of spinal integrity

▲ Limitations and Risks

- Steep learning curve (especially endoscopic)
- Possible incomplete decompression
- Dural tear or nerve root injury
- Not indicated in:
 - 1. Severe deformity
 - 2. Segmental instability
 - 3. Multilevel complex stenosis

🛛 Tags

Full-endoscopic spine surgery (FESS) is a well-established procedure for herniated nucleus pulposus. It is a minimally invasive surgery that can be performed under local anesthesia through only an 8-mm skin incision. With improvements in surgical equipment such as high-speed drills, the indications for FESS have expanded to include lumbar spinal stenosis (LSS)¹⁾

Unilateral laminotomy with crossover,

Bilateral laminotomy.

Spinous process osteotomy.

No differences in clinical outcomes or complication rates were found among the 3 minimally invasive posterior decompression techniques used to treat patients with lumbar spinal stenosis ²⁾.

see also Lumbar microendoscopic spinal decompression surgery.

Minimally Invasive Lumbar Laminectomy via unilateral approach is one of the minimally invasive methods used for degenerative spinal stenosis.

Bilateral decompression through unilateral approach is an effective method without instability effect, which provides sufficient decompression in the degenerative stenosis and increases patient comfort in the postoperative period ³.

see Facetectomy

Microsurgical technique

Development of microsurgical techniques have provided innovations towards minimizing the surgical insult in surgical approaches to canal stenosis ⁴⁾.

The advantage of a microsurgical approach is the posibility of a wide bilateral decompression of spinal canal or foramen at one or multiple levels, through a minimal paraspinal muscular dissection. As a result, it is possible to preserve important soft tissues and bones, which are vital for the stability of the spinal column, while at the same time being able to remove bilateral pathologies encroaching upon the spinal canal or foramina ⁵⁾.

Several authors have developed various microdecompression procedures for lumbar canal stenosis, including microhemilaminotomy, interlaminar microdecompression, intersegmental microdecompression, resculpturing microlaminoplasty and segmental microsublaminoplasty ⁶.

Minimally Invasive Versus Open Laminectomy for Lumbar Stenosis

Relevant articles were identified from six electronic databases. Predefined endpoints were extracted and meta-analyzed from the identified studies.

Satisfaction rates were significantly higher in the minimally invasive group (84% vs 75.4%; P=0.03), while back pain VAS scores were lower (P<0.00001). Minimally invasive laminectomy operative duration was 11 minutes longer than the open approach (P=0.001), however this may not have clinical significance. However, there was less blood loss (P<0.00001) and shorter hospital stay (2.1 days; P<0.0001). Dural injuries and Cerebrospinal fluid fistulas were comparable, but reoperation rates were lower in the minimally invasive cohort (1.6% vs 5.8%; P=0.02) however this was not significant when only randomized evidence was considered.

The pooled evidence suggests ULBD may be associated with less blood loss and shorter stay, with similar complication profiles to the open approach. These findings warrant verification in large prospective registries and randomized trials ⁷.

Using a decision-analytic model from the Medicare perspective, a cost-effectiveness analysis was performed comparing mild® to ESI or laminectomy surgery. The analysis population included patients with LSS who have moderate to severe symptoms and have failed conservative therapy. Costs included initial procedure, complications, and repeat/revision or alternate procedure after failure. Effects measured as change in quality-adjusted life years (QALY) from preprocedure to 2 years postprocedure. Incremental cost-effectiveness ratios were determined, and sensitivity analysis conducted. The mild® strategy appears to be the most cost-effective (\$43,760/QALY), with ESI the next best alternative at an additional \$37,758/QALY. Laminectomy surgery was the least cost-effective (\$125,985/QALY)⁸.

Trumpet laminectomy fenestration

In the Japanese Neurosurgical Society, one of the common procedures for microdecompression of lumbar spinal canal is trumpet laminectomy fenestration.

see Trumpet laminectomy microdecompression.

Case reports

A 68-yr-old male entailing a 2-level minimally invasive lumbar laminectomy and foraminotomy at L2-L3 and L3-L4. The patient initially presented with symptoms of treatment-refractory lower extremity numbness and limited ambulation. His imaging demonstrated coronal scoliosis and severe lumbar central and foraminal stenosis at L2-L3 and L3-L4, with enlarged spinous processes, laminae, and facets. The patient consented to the procedure and publication of their image. The operation proceeded with the patient in a prone position with paramedian dissection to the lamina through a minimally invasive tubular retractor. Laminectomies and foraminotomies were performed at each level with high-speed drill and a Kerrison rongeur, with care to identify and protect the relevant spinal nerve roots. Postoperatively, the patient reported significantly reduced numbness and improved ambulation, with a well-healed surgical incision notably smaller than those produced in an open operation ⁹⁾.

References

1)

Kishima K, Yagi K, Yamashita K, Tezuka F, Morimoto M, Takata Y, Sakai T, Maeda T, Sairyo K. Transforaminal full-endoscopic ventral facetectomy: mid-term results and factors associated with poor surgical outcomes. J Neurol Surg A Cent Eur Neurosurg. 2022 Dec 8. doi: 10.1055/a-1995-1772. Epub ahead of print. PMID: 36482000.

2)

Hermansen E, Austevoll IM, Hellum C, Storheim K, Myklebust TÅ, Aaen J, Banitalebi H, Anvar M, Rekeland F, Brox JI, Franssen E, Weber C, Solberg TK, Furunes H, Grundnes O, Brisby H, Indrekvam K. Comparison of 3 Different Minimally Invasive Surgical Techniques for Lumbar Spinal Stenosis: A Randomized Clinical Trial. JAMA Netw Open. 2022 Mar 1;5(3):e224291. doi: 10.1001/jamanetworkopen.2022.4291. PMID: 35344046; PMCID: PMC8961320.

Yaman O, Ozdemir N, Dagli AT, Acar E, Dalbayrak S, Temiz C. 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):239-45. doi: 10.5137/1019-5149.JTN.8710-13.1. PubMed PMID: 26014006.

Caspar W, Papavero L, Sayler MK, Harkey HL. Precise and limited decompression for lumbar spinal stenosis. Acta Neurochir (Wien) 1994;131:130–136.

Guiot BH, Khoo LT, Fessler RG. A minimally invasive technique for decompression of the lumbar spine. Spine (Phila Pa 1976) 2002;27:432–438.

Young JP, Young PH. The textbook of spinal surgery. Bridwell KH, Dewald RLPhiladelphia: Lippincott;

7)

2012. pp. 101-109

Phan K, Mobbs RJ. Minimally Invasive Versus Open Laminectomy for Lumbar Stenosis - A Systematic Review and Meta-Analysis. Spine (Phila Pa 1976). 2015 Oct 17. [Epub ahead of print] PubMed PMID: 26555839.

Udeh BL, Costandi S, Dalton JE, Ghosh R, Yousef H, Mekhail N. The 2-Year Cost-Effectiveness of 3 options to Treat Lumbar Spinal Stenosis Patients. Pain Pract. 2014 Jan 3. doi: 10.1111/papr.12160. [Epub ahead of print] PubMed PMID: 24393198.

Srinivasan ES, Crutcher CL, Wang TY, Grossi PM, Than KD. Two-Level Minimally Invasive Lumbar Laminectomy and Foraminotomy: 2-Dimensional Operative Video. Oper Neurosurg (Hagerstown). 2021 May 6:opab134. doi: 10.1093/ons/opab134. Epub ahead of print. PMID: 33956988.

From: https://neurosurgerywiki.com/wiki/ - **Neurosurgery Wiki**

Permanent link: https://neurosurgerywiki.com/wiki/doku.php?id=minimally_invasive_lumbar_laminotomy



Last update: 2025/06/17 10:50