Minimally Invasive Lumbar Decompression in Lumbar Stenosis: A Literature Review

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Background

Lumbar spinal stenosis (LSS) is a prevalent condition in older adults, characterized by neurogenic claudication, back pain, leg pain, and functional disability. Etiologies include degenerative spondylosis, herniated discs, tumors, and ligamentum flavum hypertrophy. Initial management typically involves conservative approaches such as pharmacologic therapies, physical therapy, and epidural injections. However, these modalities often provide only temporary relief. While surgery is effective for refractory cases, it is associated with significant risks due to its invasiveness and relatively high complication rates. Minimally invasive procedures, such as the Minimally Invasive Lumbar Decompression (MILD) procedure, present a viable alternative for patients who are not candidates for conventional surgery. The MILD procedure targets neural compression by selectively removing small portions of the hypertrophied ligamentum flavum without the need for implants. Utilizing a 5.1-mm port and specialized instruments, the procedure is performed under imaging and fluoroscopic guidance to ensure precision. Bone and ligament fragments are meticulously removed, enabling decompression of the affected spinal levels, either unilaterally or bilaterally. Recovery is rapid, with most patients resuming normal activities within 24 hours.

Methods

A comprehensive scientific literature search was conducted through specialized databases such as MEDLINE, EMBASE, CINAHL, PubMed, MedlinePlus, PsycINFO, and Cochrane Library. The search terms used to retrieve the relevant literature in each of these databases were “Minimally invasive lumbar decompression” AND “MILD” AND "lumbar spinal stenosis”.

Results/Evidence Table

Study	Therapy or Exposure	Outcome/Results
Double-Blind Randomized Controlled Trial- MILD vs ESI	- 38 participants, 21 in MILD group and 17 in ESI group	- For MILD patients, average VAS fell from 6.3 at baseline to 3.4 at 12-week follow-up. Average ODI was reduced from 38.8 at baseline to 18.6 at 12-week follow-up. An average ZCQ of 1.8 at 12-week follow-up was reported. At 12-week follow-up, patients treated with MILD reported significantly greater pain decrease, and significantly greater functional mobility improvement than ESI patients.
Multi-center Randomized Controlled Trail MILD vs ESI	- 302 patient, 149 in MILD group and 153 in ESI group	- Average ODI improved by 16.2 ± 1.6 for the MILD Group vs. 4.5 ± 1.1 for the ESI Group. Average NPRS improved by 2.8 ± 0.3 for the MILD Group vs. 0.7 ± 0.2 for the ESI Group. All 3 ZCQ domains demonstrated statistically significant superiority of MILD versus ESI. The ODI responder rate of 58% in the MILD group was higher than the responder rate of 27.1% in the ESI group. There is no difference in safety between MILD and ESIs.
Multi-center Randomized Controlled Trail MILD vs ESI	- 302 participants, 143 in MILD group and 131 in ESI group	- At 2 years, ODI improved by 22.7 points, NPRS improved by 3.6 points and ZCQ symptom severity and physical function domains improved by 1.0 and 0.8 points, respectively. No between-group comparison results at 2-year follow-up were mentioned in the article.
Randomized Controlled Trial MILD + CMM vs CMM	- 138 patients 69 patients in MILD + CMM group and 69 patients in CMM group	- For MILD + CMM Group, ODI improvement was 16.16 ± 19.0. NRPS improvement was 2.3 ± 2.7 for back pain and 3.6 ± 3.1 for leg pain. Results from all primary and secondary outcome measures showed statistical significance in favor of MILD + CMM.
Multi-center descriptive case series	- 58 participants - All underwent MILD	- The average VAS was reduced from 7.4 (95% CI ±0.5) at baseline to 4.5 (95% CI ± 0.8) at one-year post-treatment. The ODI was reduced from 48.6 at baseline to 38.7 at one-year post-treatment. Patients’ satisfaction rate was 74%.
Retrospective Longitudinal Observational Cohort Study	- 75 participants - All underwent MILD	- Three patients were lost to follow-up, three patients were deceased, and one patient resides outside of the United States. Nine patients out of 75 (12%) required open surgical decompression within the 5-year follow-up. Average NPRS was reduced from 6.7 ± 2.2 at baseline to 3.7 ± 2.8 at 1-year follow-up. The MME was reduced from 15.5 ± 35.6 at baseline to 7.4 ± 20.9 at 1-year follow-up.

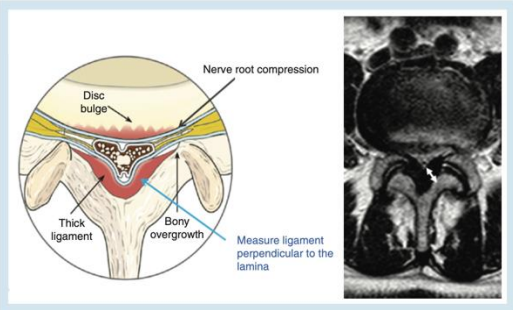

Figure 1. Axial cross-section of spinal cord depicting ligamentum flavum hypertrophy. (A) LF thickness (AP) measured perpendicular to the border of the lamina corresponding to the intervertebral disc. **(B)** MRI cross-sectional image demonstrating LSCS. Arrow demonstrates LFH measurement.

Discussion and Conclusions

In conclusion, the reviewed studies consistently demonstrate that MILD is an effective and safe procedure for patients with lumbar spinal stenosis and neurogenic claudication, offering significant improvements in pain, functional mobility, and quality of life. MILD shows superiority over conservative treatments like epidural steroid injections, with durable outcomes maintained for up to five years. Furthermore, MILD is associated with minimal complications and offers a viable option for patients who are high-risk surgical candidates due to age, comorbidities, or contraindications to invasive procedures. Given its minimally invasive nature, excellent safety profile, and proven efficacy, MILD should be prioritized as an early interventional therapy before considering more invasive surgical options.

References

Yuan H, Yi X. Lumbar Spinal Stenosis and Minimally Invasive Lumbar Decompression: A Narrative Review. J Pain Res. 2023 Nov6; 16:3707-3724. doi: 10.2147/JPR.S428112. PMID: 37954472; PMCID: PMC10637222.
Lawrence MM, Hayek SM. Minimally invasive lumbar decompression: a treatment for lumbar spinal stenosis. Curr Opin Anaesthesiol. 2013 Oct;26(5):573-9. doi: 10.1097/01.aco.0000432520.24210.54. PMID: 23963231.
Jain S, Deer T, Sayed D, Chopra P, Wahezi S, Jassal N, Weisbein J, Jameson J, Malinowski M, Golovac S. Minimally invasive lumbar decompression: a review of indications, techniques, efficacy and safety. Pain Manag. 2020 Sep; 10(5):331-348. doi: 10.2217/pmt-2020-0037. Epub 2020 Jul 1. PMID: 32609052.
Pryzbylkowski P, Bux A, Chandwani K, Khemlani V, Puri S, Rosenberg J, Sukumaran H. Minimally invasive direct decompression for lumbar spinal stenosis: impact of multiple prior epidural steroid injections. Pain Manag. 2022 Mar; 12(2):149-158. doi: 10.2217/pmt-2021-0056. Epub 2021 Aug 4. PMID: 34344197.
Deer T, Kim C, Wahezi SE, Qu H, Sayed D, Investigators MS. Objective real-world outcomes of patients suffering from painful neurogenic claudication treated with the mild((R)) procedure: interim 6-month report of a randomized controlled trial. J Pain Res. 2021;14: 1687–1697. doi:10.2147/JPR.S312573
Chopko B, Caraway DL. MiDAS I (mild Decompression Alternative to Open Surgery): a preliminary report of a prospective, multi-center clinical study. Pain Physician. 2010;13(4):369–378. doi:10.36076/ppj.2010/13/369