Ligamentum flavum resection

Ligamentum flavum resection refers to the surgical removal of part or all of the ligamentum flavum, a yellow elastic ligament that connects the laminae of adjacent vertebrae from C2 to the sacrum. This ligament helps maintain upright posture and contributes to the stability of the spinal column.

Indications

Ligamentum flavum resection is typically performed in the context of spinal stenosis, especially lumbar spinal stenosis, where hypertrophy (thickening) of the ligament contributes to compression of:

The thecal sac (dura mater)

Cauda equina

Spinal nerve roots

It is also relevant in:

Decompression surgeries (e.g. laminectomy or laminotomy)

Minimally invasive spinal surgeries

Cases with ligamentum flavum cysts or calcification

Anatomical Considerations The ligamentum flavum is paired and located posterior to the dural sac.

It is thicker in the lumbar region.

It has a close relationship with the epidural space and can adhere to the dura, especially in cases of chronic compression.

Surgical Technique Overview Approach: Posterior midline (open or minimally invasive).

Exposure: After muscle dissection, the laminae and interlaminar space are identified.

Partial or complete resection:

Performed under the microscope or endoscope.

Requires careful dissection to avoid dural tear (especially in elderly or chronic cases).

Instruments: Kerrison rongeurs, micro-scissors, or ultrasonic aspirators may be used.

Adjuncts: May be combined with foraminotomy, facetectomy, or discectomy.

⚠ Risks & Complications Dural tear / CSF leak

Epidural bleeding

Nerve root injury

Postoperative instability if too much bone or ligament is removed

 Imaging MRI: Shows thickened ligamentum flavum as low-signal intensity on T1 and T2.

CT: Useful if there is calcification or ossification of the ligament.

Lumbar spinal stenosis is one of the most frequent causes of neurogenic claudication and back pain in aging populations. The advent of biportal endoscopic surgery has opened new avenues for minimally invasive management of this condition, but the ideal technique for resecting the hypertrophic ligamentum flavum remains undefined

Retrospective analysis of prospective studies

The article titled “Three types of ligamentum flavum resections for the treatment of lumbar central canal stenosis: BUTTERFLY retrospective study” by Kaen et al. presents a comparative analysis of three surgical techniques using a retrospective design based on prospectively gathered clinical data [1)].

The authors employed a retrospective analysis of a patient cohort operated between 2021 and 2023. Although the study initially adhered to a prospective protocol for data collection, the comparative nature and outcome analysis were performed post hoc. This hybrid design is commonly referred to as a retrospective analysis of a prospective study — a method that benefits from structured data collection while allowing for analytical flexibility.

The study focuses on patients who underwent the biportal endoscopic “Z” technique, with exclusion criteria designed to reduce confounding variables such as the presence of spondylolisthesis. The ligamentum flavum resections were classified into three techniques:

piecemeal resection

butterfly resection (one-piece, en bloc)

two_wings resection (a two-piece en bloc variant)

Primary endpoints included surgical time, complication rates (specifically dural tears), and clinical outcomes. The statistical methods and demographic balancing were appropriate, although the article does not fully elaborate on randomization or surgeon-specific variability.

A total of 90 decompression procedures across 70 patients were included, with no significant demographic differences between groups. The results highlighted the following:

Piecemeal resection was associated with significantly higher rates of dural tears and increased surgical times.

Both en bloc techniques (butterfly and two-wings) showed more favorable outcomes in terms of operative duration and safety.

The two-wings technique had the most efficient surgical time, with no added complications.

The statistical significance ($p<0.05$) supports these findings but must be interpreted cautiously due to the non-randomized nature of the comparison.

This study provides meaningful insight into the comparative efficacy and safety of different ligamentum flavum resection strategies during endoscopic decompression. However, several critical points must be considered:

Study Design Limitations

As a retrospective comparison of surgical subtypes, selection bias cannot be ruled out. Despite prospective data collection, the grouping into resection types might have been influenced by anatomical or intraoperative factors, which are not fully disclosed.

Lack of Functional Outcome Measures: While surgical time and complication rates are vital, the absence of long-term clinical outcome measures (e.g., ODI, VAS, or patient satisfaction) limits the study's applicability to broader clinical decision-making.

Single-Center Experience: The findings may reflect a high level of operator expertise in biportal techniques and may not generalize to centers with different levels of experience or surgical volume.

Terminology Confusion: The term “retrospective analysis of a prospective study” can be misleading. A more precise descriptor might be a “retrospective comparative analysis of prospectively collected surgical data.”

This study adds to the growing body of evidence favoring en bloc resection of the ligamentum flavum in endoscopic lumbar decompression. It suggests that both the butterfly and two-wings techniques may reduce surgical time and complications such as dural tears. Nevertheless, the authors rightly call for randomized controlled trials to validate these preliminary findings.

Given the current evidence, surgeons using biportal techniques should consider adopting en bloc resection methods, particularly in the absence of confounding spinal instability.

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Kaen A, Romero SR, Romero MJC, Durand F, Martin I. Three types of ligamentum flavum resections for the treatment of lumbar central canal stenosis: BUTTERFLY retrospective study. Asian Spine J. 2025 Apr 7. doi: 10.31616/asj.2025.0014. Epub ahead of print. PMID: 40195636.