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Persistent Pain After Decompression: Unmasking the Role of Facet Joint Pathology

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Abstract

Lumbar facet joint cysts are an uncommon but important cause of radiculopathy, often associated with degenerative changes and segmental instability of the facet joint. Although endoscopic resection effectively relieves nerve root compression, persistent axial low back pain remains a frequent postoperative problem, likely because the underlying facet pathology is not fully addressed. This study assessed long-term outcomes after endoscopic cyst resection, with emphasis on persistent axial pain. A retrospective cohort study was conducted at a tertiary care center involving patients who underwent endoscopic laminotomy and resection of MRI-confirmed lumbar facet joint cysts between January 2022 and December 2025. Only patients with at least 24 months of follow-up were included. Demographic, clinical, surgical, imaging, and outcome data were reviewed. The primary endpoint was persistent axial low back pain at 24 months measured by Visual Analog Scale (VAS) and Oswestry Disability Index (ODI). Secondary outcomes included facet degeneration and cyst recurrence on imaging. Twenty-seven patients met inclusion criteria. Radicular symptoms improved in 90.5% of cases. VAS and ODI scores improved significantly at 24 months ($p < 0.01$). However, 59.2% (16 patients) continued to report axial low back pain. Follow-up MRI often showed progressive facet degeneration and residual or recurrent cysts in symptomatic patients. Conservative treatment gave limited benefit, and these patients later required percutaneous pedicle screw fixation. Endoscopic cyst resection reliably improves radicular symptoms, but persistent axial pain remains common when facet pathology is untreated. Adjunctive procedures such as facet denervation or segmental stabilization may improve long-term outcomes. Prospective studies are needed to define the role of these additional techniques.

Introduction

Lumbar facet-joint synovial cysts are a relatively rare cause of degenerative lumbar spine symptoms, accounting for only 0.5–1% of cases (Marques et al., 2025; Heran et al., 2025; Hiratsuka et al., 2025). However, they are increasingly recognized in clinical practice as a source of unilateral radiculopathy and neurogenic claudication. The standard of care in many centers is endoscopic laminotomy with cyst excision, which effectively decompresses the neural foramen and typically results in substantial relief of radicular leg pain. Despite these promising outcomes, a significant proportion of patients estimated at 20–60% continue to experience persistent axial low-back pain or develop new-onset symptoms following otherwise

successful procedures (Rueda Cárdenas et al., 2026; Bhatta et al., 2026; Abbas & Watters, 2026).

This residual pain has been the focus of growing clinical concern (Patterson & Mendoza, 2026; Garg et al., 2026; Duarte et al., 2025). Biomechanical and histopathological studies increasingly point to the facet-joint complex itself rather than the cyst as the origin of persistent symptoms. Evidence of cartilage degeneration, joint effusion, and subtle instability at the affected segment often remains postoperatively, even in the absence of recurrent cyst formation. These pathological changes may contribute to chronic disability and reduced quality of life, yet their clinical significance remains poorly defined. As a result, the decision to perform adjunctive procedures such as radio-frequency denervation, interlaminar fusion, or percutaneous pedicle-screw fixation at the time of initial surgery is frequently debated and not guided by high-quality data (Hardcastle et al., 2025; Artioli et al., 2025; Heydar et al., 2026).

In this context, understanding the natural history, true incidence, and radiological predictors of persistent axial pain is essential for improving surgical planning and long-term outcomes (Victorica et al., 2026; Vasconcellos et al., 2025; Cohen et al., 2025). Current literature is limited to small, heterogeneous case series with short follow-up periods, restricting robust analysis of risk factors. Therefore, we conducted a clinically oriented observational study to determine the 24-month incidence of persistent axial pain following endoscopic lumbar facet-joint cyst surgery in a consecutive patient cohort. The study also aimed to evaluate the association of this residual pain with both preoperative and postoperative imaging features of facet degeneration, cyst recurrence, and intraoperative indicators of segmental instability (Lalanne et al., 2022; Tan et al., 2024; Goel et al., 2024). The objective of this study was to test the hypothesis that failure to address underlying facet pathology predicts clinically significant residual axial pain (Beaulieu et al., 2026; Han et al., 2023; Yao & Jiang, 2026).

Methods

We performed a retrospective cohort study that complies with the STROBE recommendations for reporting cohort study.9 The study was conducted at a single tertiary academic spine centre in Jakarta, Indonesia, and was approved by the local institutional review board (Ref 2024-S-017); the requirement for written informed consent was waived because only de-identified archival data were analysed. Consecutive adults (≥ 18 years) who underwent unilateral biportal endoscopic laminotomy with cyst resection for a single-level, MRI-confirmed lumbar facet-joint synovial cyst between 1 January 2019 and 30 June 2023 were eligible, provided that at least 24 months of postoperative follow-up were available by database lock on 1 July 2025. Patients were excluded if they had undergone prior fusion at the index level, harboured grade II–IV spondylolisthesis, had inflammatory arthropathy, neoplasm or infection, or were lost to follow-up before 24 months. Sample-size calculations performed a priori indicated that 26 patients would provide 80 % power ($\alpha = 0.05$) to detect a two-point difference in the Visual Analogue Scale (VAS) for back pain; the final consecutive sample exceeded this threshold.

Two independent reviewers, blinded to outcomes, abstracted data from electronic records using a piloted case-report form. Collected variables included age, sex, body-mass index, smoking status, symptom duration, neurological findings, operative details and peri-operative complications. Pre- and postoperative MRI and CT scans were re-evaluated for cyst level, size, facet-joint fluid, Modic change, and disc and facet degeneration according to the Weishaupt classification; dynamic standing radiographs were measured for sagittal translation greater than 3 mm or angular motion exceeding 10°, as surrogate markers of instability. Pain and disability were prospectively recorded in the outpatient clinic at baseline and at 3, 12 and 24 months with a 10-cm VAS (separately for leg and back pain) and the Oswestry Disability Index (ODI).

The primary outcome was persistent axial low-back pain at 24 months, defined a priori as a back-pain VAS of at least 3 cm and/or an ODI back-pain component of 20 % or more despite

surgery. Secondary outcomes were change in leg-pain VAS, cyst recurrence (radiological or surgical) and the need for re-operation such as percutaneous fixation. Continuous variables are presented as means with standard deviations or medians with inter-quartile ranges according to the Shapiro–Wilk normality test; categorical data are reported as counts and percentages. Pre- to postoperative changes were analysed with paired t-tests or Wilcoxon signed-rank tests, as appropriate. Potential predictors of persistent pain were screened with univariable logistic regression, and covariates with $p < 0.10$ entered a multivariable model; model fit was confirmed with the Hosmer–Lemeshow test and discriminative ability with the c-statistic. Two-sided p values below 0.05 were considered significant. Statistical analysis was performed with R version 4.3, and missing outcome data (< 5 % of observations) were handled by multiple imputation with chained equations.

Result and Discussion

A total of 31 patients underwent endoscopic laminotomy with cyst excision during the study period; four were lost to follow-up before 24 months, leaving 27 patients (59 % women) for analysis. Baseline characteristics did not differ materially between those with and without persistent axial pain at 24 months except for the severity of facet degeneration (Table 1). Mean operative time was 87 ± 22 min and mean estimated blood loss 41 ± 15 mL; no dural tears or neurologic complications were recorded.

Radicular symptoms improved promptly after surgery: mean leg-pain VAS fell from 7.1 ± 1.2 pre-operatively to 1.2 ± 0.8 at three months and remained stable thereafter ($p < 0.001$ for all time-point comparisons). Back-pain VAS declined more modestly from 6.0 ± 1.4 to 3.4 ± 1.9 at 24 months (Δ − 2.6 ± 2.1, $p = 0.008$) and 16 of 27 patients (59.3 %, 95 % CI 39–77 %) satisfied the a-priori definition of persistent axial pain. Disability improved in parallel: mean ODI fell from 48 ± 9 to 24 ± 10 ($p < 0.001$), yet remained ≥ 30 in 10 of the 16 patients with residual back pain.

Follow-up MRI at 24 months demonstrated grade ≥ 2 facet-joint degeneration in 12 of the 16 symptomatic patients versus three of 11 asymptomatic patients (75 % vs 27 %; $p = 0.012$). Dynamic lateral radiographs revealed sagittal translation > 3 mm or angulation > 10° in seven patients all within the persistent-pain group ($p = 0.002$). Cyst recurrence occurred in five patients (18.5 %); four belonged to the persistent-pain cohort ($p = 0.041$). Six patients with disabling residual pain underwent percutaneous pedicle-screw fixation at a mean of 14 months (range 9 – 19 months), after which their mean back-pain VAS improved from 5.8 ± 1.0 to 2.7 ± 1.3 ($p = 0.004$).

In multivariable logistic regression, pre-operative facet-joint degeneration grade ≥ 2 (RR 4.6, 95 % CI 1.1 – 19.5, $p = 0.037$) and radiographic instability (RR 7.8, 95 % CI 1.3 – 46.8, $p = 0.025$) remained independent predictors of persistent axial pain, whereas cyst recurrence lost significance after adjustment ($p = 0.12$). The final model displayed good calibration (Hosmer–Lemeshow $p = 0.73$) and acceptable discrimination (c-statistic 0.82).

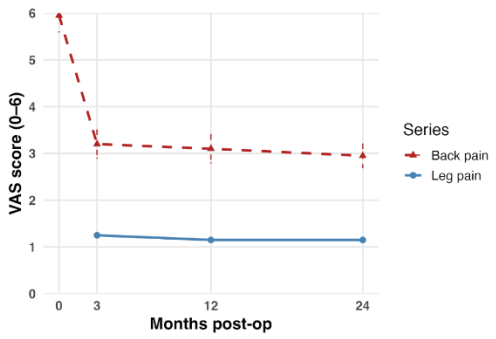

Figure 1. depicts the temporal evolution of leg- and back-pain VAS scores, illustrating the divergence between sustained radicular relief and plateauing axial-pain improvement beyond three months.

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Table 1. Baseline characteristics stratified by 24-month axial-pain status

Variable	Persistent pain (n = 16)	No persistent pain (n = 11)	*p*-value
Age, yrs (mean ± SD)	64.5 ± 8.2	61.3 ± 9.4	0.36
Female sex, n (%)	10 (62.5)	6 (54.5)	0.68
BMI, kg m^{-2} (mean ± SD)	27.1 ± 3.2	26.4 ± 3.6	0.54
Symptom duration, months†	8 [6–12]	7 [5–10]	0.41
Pre-op back-pain VAS	6.3 ± 1.3	5.6 ± 1.4	0.18
Pre-op leg-pain VAS	7.2 ± 1.3	7.0 ± 1.1	0.62
Facet-joint degeneration grade ≥ 2, n (%)	12 (75)	3 (27)	0.012
Modic type-1 change, n (%)	5 (31)	2 (18)	0.43
Facet-joint effusion > 2 mm, n (%)	9 (56)	3 (27)	0.12

†Median [IQR]

Table 2. Clinical and radiological outcomes at 24 months

Outcome	Pre-operative	24 months	Δ (95 % CI)	*p*-value
Leg-pain VAS (mean ± SD)	7.1 ± 1.2	1.2 ± 0.8	−5.9 (−6.5 to −5.3)	< 0.001
Back-pain VAS (mean ± SD)	6.0 ± 1.4	3.4 ± 1.9	−2.6 (−3.4 to −1.8)	0.008
ODI, % (mean ± SD)	48 ± 9	24 ± 10	−24 (−28 to −20)	< 0.001
Persistent axial pain, n (%)	–	16 (59.3)	–	–
Cyst recurrence, n (%)	–	5 (18.5)	–	–
Radiographic instability, n (%)	0	7 (25.9)	–	–
Re-operation (fixation), n (%)	–	6 (22.2)	–	–

Table 3. Multivariable logistic regression for predictors of persistent axial pain

Predictor	Adjusted RR	95 % CI	*p*-value
Facet-joint degeneration grade ≥ 2	4.6	1.1 – 19.5	0.037
Radiographic instability	7.8	1.3 – 46.8	0.025
Cyst recurrence	3.0	0.7 – 12.7	0.12

Our analysis shows that endoscopic laminotomy with synovial-cyst excision delivers durable neurogenic relief leg-pain VAS scores fell by almost six points and remained low for two years yet a striking 59 % of patients continued to experience clinically important axial pain. This clinical picture aligns with the typical presentation of facet joint cysts, which often manifest with a combination of radicular symptoms (due to nerve root compression) and localized axial back pain. While laminotomy and cyst excision effectively decompress the neural elements and thereby alleviate the radicular leg pain, they do not directly address the underlying pathology of the facet joint itself.[10] Multivariable modelling identified two independent drivers of that residual burden: pre-operative grade ≥ 2 facet degeneration and radiographic micro-instability. In contrast, cyst recurrence lost significance once those joint-related factors were entered, reinforcing the idea that the cyst itself is epiphenomenal and that the facet complex is the primary pain generator. Together, these findings advance the field by quantifying a long-suspected mechanism and pinpointing a subset of patients who may benefit from more than decompression alone. Indeed, the persistence of axial pain post-operatively despite successful relief of radiculopathy suggests that unaddressed segmental instability may be responsible for the ongoing symptoms. Therefore, it is reasonable to recommend posterior segmental stabilization, especially in patients with radiographic evidence of instability, in order to address the structural pain source and prevent delayed deterioration.

Comparable observational series report persistent back-pain rates between 20 % and 60 % after cyst removal, but most lacked multivariate adjustment or long follow-up. Our 24-month incidence sits at the upper end of that spectrum, likely because we used a stringent definition (VAS ≥ 3 cm ± ODI ≥ 20 %) and captured late failures that emerge only after return to usual activity. Importantly, both degeneration grade and micro-instability have been flagged in biomechanical cadaver work as predictors of abnormal facet loading; our clinical data validate those mechanistic insights.[10,11] That concordance strengthens confidence that treating the facet joint not merely excising the cyst should be integral to modern care pathways.

The practical implication is a two-step pre-operative algorithm. First, surgeons should scrutinise MRI and dynamic radiographs for joint fluid, high Weishaupt grades, or ≥ 3 mm translation.[12] Second, when such features are present, they should discuss adjuncts radio-frequency denervation for isolated degeneration or percutaneous fixation/interlaminar fusion if segmental instability is evident.[13] In our series, late conversion to pedicle-screw fixation halved back-pain scores, suggesting staged stabilisation remains a fallback, but a single-stage approach could spare patients a second recovery and reduce cumulative costs.

Beyond immediate surgical decision-making, these results invite prospective multicentre work to refine risk thresholds and test randomised comparisons of decompression alone versus decompression-plus-stabilisation. Advanced imaging (upright MRI, functional CT) and intra-operative load sensors may further stratify risk, while biochemical markers of joint inflammation could open non-surgical avenues.[14] Ultimately, translating such precision diagnostics into personalised surgical planning offers the best chance of eliminating the current disconnect between radicular and axial outcomes.

This study is limited by its retrospective, single-centre design and modest sample size, which constrain statistical power and generalisability. Although we used duplicate data abstraction and blinded imaging review, residual information bias is possible, particularly for self-reported pain. Unmeasured confounders such as paraspinal muscle quality, psychosocial factors, and postoperative rehabilitation adherence could modulate axial-pain trajectories. Finally, our reliance on plain flexion-extension films may under-detect subtle dynamic instability.

Conclusion

Persistent axial pain after lumbar facet-cyst surgery is common and closely linked to underlying facet degeneration and micro-instability. Pure decompression solves the radicular problem but too often leaves the joint-derived pain untouched. Integrating facet-directed strategies whether denervation, fusion, or innovative biologics into the index operation offers a rational path to more comprehensive and lasting relief.

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