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Original Article

Functional Outcomes of Laminectomy and Discectomy in Lumbar Disc Herniation: A Prospective Observational Study Using the Japanese Orthopaedic Association Score

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ABSTRACT

Background & Objectives: Lumbar disc herniation (LDH) is a leading cause of low back pain, radiculopathy, and functional disability. Surgical decompression via laminectomy and discectomy remains the standard intervention when conservative treatment fails. This study evaluated the functional outcomes of laminectomy and discectomy in LDH using serial Japanese Orthopaedic Association (JOA) scoring.

Methods: A prospective observational study was conducted at Government General Hospital, Kurnool, Andhra Pradesh (June 2023–June 2025). Thirty consecutive patients (n = 30) with radiologically confirmed LDH who underwent laminectomy and discectomy were enrolled. JOA scores (15-point Low Backache Score) were recorded preoperatively and postoperatively, and outcomes were graded using Hirabayashi's recovery-rate formula. The paired t-test was applied, with $p < 0.05$ considered significant.

Results: The mean age was 44.80 ± 11.91 years, and 66.7% were male; L4–L5 was the most common level (80%). The mean JOA score improved significantly from 6.30 ± 1.91 to 12.57 ± 1.78 postoperatively ($p < 0.001$). Good outcomes were achieved in 83.3%, fair in 13.3%, and poor in 3.3%. Neurological recovery occurred in 91.3% (sensory) and 94.7% (motor) of affected patients. Complications occurred in 13.3%, with no permanent sequelae. Outcome showed no significant association with age, sex, or symptom duration ($p > 0.05$).

Conclusions: Laminectomy and discectomy yield a statistically significant and clinically meaningful improvement in JOA scores. A success rate of 83.3% with an acceptable complication profile supports this procedure for lumbar disc herniation in Indian tertiary-care settings. The JOA score is a reliable, objective tool for comparative spine research.

Keywords: Lumbar disc herniation; Laminectomy; Discectomy; JOA score; Functional outcome; Spine surgery; India

INTRODUCTION

Lumbar disc herniation (LDH) is one of the most prevalent musculoskeletal conditions encountered in orthopaedic practice worldwide and a major structural cause of low back pain and radiculopathy — the leading global contributor to years lived with disability — with a peak incidence in the fourth and fifth decades of life.[1,2]

The pathophysiology involves posterior or posterolateral displacement of the nucleus pulposus through a compromised annulus fibrosus, resulting in mechanical compression and biochemical irritation of the adjacent nerve roots and producing the characteristic syndrome of low back pain, dermatomal radiculopathy, motor weakness, and sensory deficits.[3]

Surgical decompression by laminectomy with or without discectomy remains the cornerstone of management for patients refractory to adequate conservative therapy. Since its standardisation by Mixter and Barr in 1934, open discectomy has been regarded as the gold standard, with reported success rates of 70–90%.[4,5,6]

The Japanese Orthopaedic Association (JOA) Low Backache Score — a validated 15-point scale encompassing subjective symptoms (0–9 points) and clinical signs (0–6 points) — is among the most widely used outcome measures for lumbar spine surgery. The recovery-rate formula derived from JOA scores, described by Hirabayashi and colleagues, enables categorical outcome grading and cross-study comparison.[7]

Despite substantial published data from Western and East Asian cohorts, outcome data from tertiary-care centres in South India — which serve a population characterised by physically demanding occupations, delayed healthcare-seeking, and limited rehabilitation infrastructure — remain limited. The present study was therefore designed to prospectively evaluate the functional outcomes of laminectomy and discectomy in patients with lumbar disc herniation at a tertiary referral centre, using serial JOA scoring, and to identify patient-level variables that may influence surgical outcome.

Aims and Objectives

The study was undertaken with the following objectives:

- To assess the functional outcomes of laminectomy and discectomy using the JOA Low Backache Score.
- To evaluate postoperative improvement in neurological deficits (sensory and motor).
- To analyse the association between surgical outcome and patient variables — age, sex, symptom duration, and disc level.
- To document the complication profile of laminectomy and discectomy at a tertiary-care centre.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective observational study conducted in the Department of Orthopaedics, Government General Hospital, Kurnool, Andhra Pradesh, India, from June 2023 to June 2025. Institutional Ethics Committee clearance was obtained prior to commencement, and written informed consent was obtained from all patients. Follow-up ranged from 4 to 24 months.

Sample Size

Thirty consecutive patients (n = 30) fulfilling the inclusion criteria who underwent laminectomy and discectomy during the study period were enrolled.

Inclusion Criteria

- Age 25–70 years, both sexes.
- Low back pain with or without radiculopathy, weakness, or paraesthesia.
- Radiologically confirmed lumbar disc herniation on MRI.
- Failure of adequate conservative management (≥ 6 weeks).

Exclusion Criteria

- Age < 25 or > 70 years.
- Spinal fractures, spondylolisthesis, or prior lumbar surgery.
- Associated long-bone fractures or significant psychiatric comorbidity.

Surgical Technique

All patients underwent standard open laminectomy and discectomy under general anaesthesia in the prone position on bolsters, allowing the abdomen to hang freely to minimise epidural venous pressure and blood loss. The operative level was confirmed fluoroscopically using a C-arm image intensifier. A midline posterior incision was followed by subperiosteal paraspinal muscle dissection. Laminectomy was performed using an angulated Kerrison rongeur. After careful excision of the ligamentum flavum, the dura was retracted medially, the nerve root was identified, and herniated disc material was

removed with pituitary rongeur forceps until adequate neural decompression was achieved. The wound was closed in anatomical layers.

Outcome Assessment — JOA Score

Outcomes were assessed using the Japanese Orthopaedic Association (JOA) Low Backache Score, a validated 15-point scale: (a) subjective symptoms — low back pain (0–3), leg pain/tingling (0–3), and walking ability (0–3), totalling 9 points; and (b) clinical signs — straight-leg raising (0–2), sensory deficit (0–2), and motor deficit (0–2), totalling 6 points. Scores were recorded preoperatively and postoperatively. The recovery rate was calculated using Hirabayashi's formula:[7]

Recovery Rate (%) = [(Post-operative JOA – Pre-operative JOA) / (15 – Pre-operative JOA)] × 100

Outcomes were graded as Excellent (> 90%), Good (75–89%), Fair (50–74%), and Poor (< 49%).

Statistical Analysis

Data were analysed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables are expressed as mean ± standard deviation, and categorical variables as frequency (n) and percentage (%). The paired t-test was used to compare pre- and post-operative JOA scores, and the chi-square test was used to assess categorical associations. A p-value < 0.05 was considered statistically significant.

RESULTS

Thirty patients underwent laminectomy and discectomy during the study period (June 2023–June 2025), with follow-up of 4–24 months. The results are presented in Tables 1–8.

Table 1. Age distribution (n = 30)

Age group (years)	n	%	Cumulative %
≤30	4	13.3	13.3
31–40	7	23.3	36.7
41–50	8	26.7	63.3
51–60	7	23.3	86.7
≥61	4	13.3	100.0
Total	**30**	**100.0**	—

Mean ± SD: 44.80 ± 11.91 years; range 25–65 years.

The largest proportion of patients (26.7%) were in the 41–50-year age group, and the mean age was 44.80 ± 11.91 years.

Table 2. Sex distribution (n = 30)

Sex	n	%	M:F ratio
Male	20	66.7	2 : 1
Female	10	33.3	—
Total	**30**	**100.0**	—

A male predominance was observed, with a male-to-female ratio of 2 : 1.

Table 3. Occupation distribution (n = 30)

Category	n	%
Physically demanding (heavy labour, lifting, bending)	19	63.3
Sedentary / light work	11	36.7
Total	**30**	**100.0**

The majority of patients (63.3%) were engaged in physically demanding occupations.

Table 4. Duration of symptoms (n = 30)

Duration	n	%	Cumulative %
≤6 months	15	50.0	50.0
7–12 months	10	33.3	83.3
≥13 months	5	16.7	100.0
Total	**30**	**100.0**	—

Mean ± SD: 8.10 ± 4.45 months; range 3–24 months.
Half of the patients (50%) presented within 6 months of symptom onset; the mean symptom duration was 8.10 ± 4.45 months.

Table 5. Level of disc prolapse (n = 30)

Level	n	%
L3–L4	2	6.7
L4–L5	24	80.0
L5–S1	4	13.3
Total	**30**	**100.0**

L4–L5 was the predominant level of herniation (80%).

Table 6. Pre- and post-operative JOA scores (n = 30)

JOA score	Pre-operative, n (%)	Post-operative, n (%)
0–5	12 (40.0)	0 (0.0)
6–10	18 (60.0)	1 (3.3)
11–15	0 (0.0)	29 (96.7)
Mean ± SD	**6.30 ± 1.91**	**12.57 ± 1.78**
Total	**30 (100)**	**30 (100)**

Paired t-test: $p < 0.001$.

The mean JOA score improved from 6.30 ± 1.91 preoperatively to 12.57 ± 1.78 postoperatively ($p < 0.001$). Postoperatively, 96.7% of patients achieved a JOA score of 11–15.

Table 7. Postoperative complications (n = 30)

Complication	n	%
Superficial wound infection	2	6.7
Dural tear (intraoperative)	1	3.3
Discitis (delayed)	1	3.3
None	26	86.7
Total	**30**	**100.0**

Complications occurred in 13.3% of patients (n = 4); all were managed successfully, with no permanent neurological sequelae.

Table 8. Surgical outcome (n = 30)

Outcome	Recovery rate	n	%
Excellent	> 90%	0	0.0
Good	75–89%	25	83.3
Fair	50–74%	4	13.3
Poor	< 49%	1	3.3
Total	—	**30**	**100.0**

The success rate (Good plus Excellent) was 83.3%. The single poor outcome occurred in a 25-year-old man with a 13-month symptom duration.

Neurological Improvement
Of the 23 patients with a preoperative sensory deficit, 21 (91.3%) improved. Of the 19 patients with a motor deficit, 18 (94.7%) recovered.

Correlation of Outcome with Patient Variables
No significant association was found between surgical outcome and sex ($p = 0.703$), age ($p = 0.488$), or symptom duration ($p = 0.361$).

DISCUSSION

The present study evaluated the functional outcomes of laminectomy and discectomy in 30 patients using the JOA score, achieving a good-outcome rate of 83.3% with a significant improvement in the mean JOA score from 6.30 ± 1.91 to 12.57 ± 1.78 ($p < 0.001$). These findings are consistent with major Indian and international surgical series.

The mean age of 44.80 ± 11.91 years, with a peak in the fourth and fifth decades, and the male predominance (66.7%) are consistent with the demographic profile reported in the large operative series of Spangfort and of Pappas et al., and in Davis's long-term analysis of 984 surgically treated discs, in which lumbar disc herniation similarly peaked in middle-aged men.[8,9,10]

The predominance of physically demanding occupations (63.3%) accords with the classic epidemiological observations of Kelsey and White, who reported the highest hospitalisation rates for LDH among manual labourers, and of Hult, who demonstrated a strong relationship between heavy physical work and disc degeneration.[11,12]
L4–L5 was the predominant level of herniation (80%), in keeping with its recognised status as the most frequently affected lumbar segment; Davis reported near-equal involvement of the L4–L5 and L5–S1 levels (approximately 47% each) in a predominantly Western cohort.[10]

The good-outcome rate of 83.3% compares favourably with the results of Davis (89% good outcome) and Pappas et al. (a good outcome in approximately three-quarters of patients), with Weber's landmark controlled trial that established the superiority of surgical over conservative treatment, and with Spengler's limited-discectomy series. It is also concordant with contemporary discectomy cohorts, including the Indian series of Wankhade et al. (84% good outcomes), Gupta et al. (an excellent outcome in 80%), and Mahesha (an excellent or good outcome in 96%), as well as El Shazly et al., who reported a mean JOA recovery rate of 87.2%.[10,9,13,14,15,16,17,18]

The overall complication rate of 13.3% (superficial wound infection 6.7%, dural tear 3.3%, and discitis 3.3%) lies within the published range; Pappas et al. reported an overall complication rate of approximately 11%, and Davis a rate of 4%. All complications in the present series were managed successfully, with no permanent sequelae.[9,10]

The absence of a significant association between outcome and sex ($p = 0.703$), age ($p = 0.488$), or symptom duration ($p = 0.361$) contrasts with series that have identified prognostic factors. Hurme and Alaranta found that operation within two months of symptom onset yielded the best results and that psychosocial factors influenced outcome more strongly than physical findings, while Wankhade et al. observed better outcomes in younger patients and in those with a shorter symptom duration. The lack of such associations in the present cohort likely reflects its modest sample size and relatively short mean symptom duration.[19,15]

Neurological recovery was high, with sensory improvement in 91.3% and motor recovery in 94.7% of affected patients. This supports the principle that timely surgical decompression, before irreversible axonal injury supervenes, optimises neurological recovery, as reflected in the favourable functional outcomes of comparable discectomy cohorts.[16,17]
The strengths of this study include its prospective design, standardised JOA scoring, MRI confirmation of the diagnosis, and complete follow-up. Its limitations include the modest sample size ($n = 30$), which limits subgroup statistical power, and the absence of a conservative-treatment control arm. Larger cohorts incorporating patient-reported outcome measures such as the Oswestry Disability Index and the SF-36 are warranted.

CONCLUSION

Laminectomy and discectomy is a safe, effective, and reproducible procedure for lumbar disc herniation. In this prospective study of 30 patients, it produced a significant improvement in the JOA score (from 6.30 ± 1.91 to 12.57 ± 1.78; $p < 0.001$), a good-outcome rate of 83.3%, and excellent neurological recovery (sensory 91.3%, motor 94.7%). The complication rate of 13.3% was acceptable, with no permanent sequelae, and no significant demographic predictor of outcome was identified. The JOA Low Backache Score is a reliable, validated outcome tool recommended for comparative lumbar spine research in the Indian context. Standard laminectomy and discectomy remains the gold standard for the surgical management of lumbar disc prolapse in resource-appropriate tertiary-care settings in India.

Declarations
Ethical approval: This study was conducted after obtaining Institutional Ethics Committee clearance from Government General Hospital, Kurnool, Andhra Pradesh. Written informed consent was obtained from all participants.
Funding: No financial support or sponsorship was received.
Conflict of interest: The author declares no conflict of interest.
Data availability: De-identified data are available from the corresponding author on reasonable request.
Author contributions: ST conceptualised the study, collected the data, performed the surgical procedures and statistical analysis, and drafted the manuscript. The author read and approved the final manuscript.

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