Journal of Chemical Health Risks

www.jchr.org

JCHR (2026) 16(3), 79-84 | ISSN:2251-6727

Functional Outcome of Caudal Epidural Block in MRI-Proven Lumbar Canal Stenosis and Prolapsed Intervertebral Disc: A Prospective Observational Study

Dr. Abhishek Chouhan[1], Dr. Sameer Gambhir[2], Dr. Vishwas Agarwal[3], Dr. Vishal Bansal[4], Dr. Rahul Baghel[5], Dr. Mohit Dashore[6]

[1]Post Graduate Resident, Department of Orthopaedics, Peoples College of Medical Science and Research Centre, Bhopal, Madhya Pradesh, India

[2]Assistant Professor, Department of Orthopaedics, Peoples College of Medical Science and Research Centre, Bhopal, Madhya Pradesh, India

[3]Senior Resident, Department of Orthopaedics, Shrimant Rajmata Vijayaraje Scindia Medical College and Hospital, Shivpuri, Madhya Pradesh, India (Correspondence Author)

[4]Professor, Department of Orthopaedics, Peoples College of Medical Science and Research Centre, Bhopal, Madhya Pradesh, India

[5]Senior Resident, Department of Orthopaedics, Peoples College of Medical Science and Research Centre, Bhopal, Madhya Pradesh

[6]Post Graduate Resident, Department of Orthopaedics, Peoples College of Medical Science and Research Centre, Bhopal, Madhya Pradesh

Correspondence Author: Dr. Vishwas Agarwal

(Received: 16 March 2026 Revised: 14 April 2026 Accepted: 01 May 2026)

KEYWORDS

Epidural Block, Lumbar Canal Stenosis, Intervertebral Disc, Lower Back Pain

ABSTRACT:

This prospective observational study evaluates the clinical efficacy of caudal epidural steroid injections (CESI) in patients with lumbar canal stenosis (LCS) and prolapsed intervertebral disc (PIVD). Assessing 50 patients over a 12-month period, the study measured pain intensity via the Visual Analog Scale (VAS) and functional disability via the Oswestry Disability Index (ODI) and Straight Leg Raising (SLR) test. Results demonstrated a statistically significant ($p < 0.001$) and sustained improvement in pain and mobility from 24 hours post-intervention through the final follow-up. The findings support CESI as a reliable, minimally invasive non-surgical alternative, particularly for multilevel pathology.

Introduction

Low back pain (LBP) is one of the most prevalent musculoskeletal disorders affecting the adult population worldwide and is a leading cause of disability, work absenteeism, and healthcare utilization. It is estimated that nearly 60–80% of individuals experience low back pain at some point in their lifetime, with a substantial proportion developing chronic or recurrent symptoms.[1] Lumbar canal stenosis (LCS) and prolapsed intervertebral disc (PIVD) represent two of the most frequently encountered conditions responsible for lower back pain. These pathologies often result in pain, numbness or weakness of lower extremities that is exacerbated while walking or standing, and are relieved during sitting or spinal flexion.[2] An increase in incidence and diagnosis of LCS and PIVD is attributed to sedentary lifestyle, occupational strain, and advances in imaging modalities. LCS is a predominantly degenerative pathological narrowing of spinal canal, lateral recess or the neural foramina in the lumbar region, resulting in compression of the cauda equina or the nerve roots [3]. Degenerative lumbar canal stenosis arises from a combination of intervertebral disc degeneration, facet joint hypertrophy, thickening of

Journal of Chemical Health Risks
www.jchr.org
JCHR (2026) 16(3), 79-84 | ISSN:2251-6727

ligamentumflavum, osteophyte formation, and vertebral end-plate changes.[4] PIVD (Prolapsed Intervertebral Disc) manifests as various neurological deficits-including sensory impairment, motor weakness , and attenuated reflexes which depend on the level and severity of nerve root impingement. Distinguishing it from Lumbar Canal Stenosis, PIVD afflicts an IVD frequently afflicts a younger, economically active demographic, thereby precipitating substantial socioeconomic repercussions.[5] While a significant proportion of disc herniations undergo spontaneous resolution, a subset of patients experience chronic, persistent symptomatology. In these instances, conservative pain management protocols are typically prioritized as a precursor to surgical intervention. Magnetic Resonance Imaging (MRI) remains the gold-standard diagnostic modality for the evaluation of lumbar spine pathologies. Its provides superior soft-tissue contrast, allowing for the meticulous visualization of intervertebral discs, spinal canal morphology, nerve roots, and ligamentous structures.[6] Furthermore, MRI-confirmed diagnosis is imperative not only for establishing the aetiology of symptoms but also for informing therapeutic strategies and excluding "red-flag" pathologies, such as neoplastic processes, infections, or acute fractures. Management of lumbar canal stenosis and prolapsed intervertebral disc encompasses a spectrum ranging from conservative therapy to surgical intervention. not all patients are suitable surgical candidates due to comorbidities, advanced age, or patient preference. These limitations have led to increased interest in minimally invasive interventional pain management techniques. Conservative treatment includes patient education, activity modification, physiotherapy, non-steroidal anti-inflammatory drugs (NSAIDs), muscle relaxants, and neuropathic pain medications.[7] Epidural steroid injections (ESIs) are among the most commonly employed interventional procedures for managing lumbar radicular pain. The therapeutic benefit of ESIs is attributed to the anti-inflammatory effects of corticosteroids, which reduce nerve root edema, inhibit inflammatory mediators, and suppress ectopic neural discharge.[8] Local anaesthetics administered along with steroids provide immediate pain relief and may interrupt pain pathways. Epidural injections can be administered via interlaminar, transforaminal, or caudal routes. Each approach has specific indications, advantages, and potential risks. While transforaminal injections offer targeted delivery near the affected nerve root, they are technically demanding and associated with rare but serious complications such as vascular injury and spinal cord infarction.[9] Several studies have demonstrated the efficacy of caudal epidural steroid injections in reducing pain and improving function in patients with lumbar radiculopathy due to disc herniation and spinal stenosis.[10,11] However, outcomes vary depending on patient selection, severity of disease, injectate composition, and assessment parameters. Furthermore, lumbar canal stenosis and PIVD differ in pathophysiology, clinical presentation, and natural history. Comparing functional outcomes following caudal epidural block in these two conditions may help identify patient subgroups that benefit most from the intervention. Therefore, the present study aims to evaluate the functional outcome of caudal epidural block in patients with MRI-proven lumbar canal stenosis and prolapsed intervertebral disc, using validated functional assessment tools. By correlating clinical improvement with radiological diagnosis, this study seeks to establish the role of caudal epidural block as an effective non-surgical treatment modality in improving function and quality of life in patients with these common lumbar spine disorders.

Materials and Methodology

Data during the period from February 2024 to October 2025 was collected from out patients in the department of orthopedics, People's hospital, Bhopal. An ethical committee clearance was obtained before commencement of the study. Patients were selected based on inclusion and exclusion criteria and a informed consent was obtained from each participant. Patients between the age of 18-80 years, with low back pain with or without radiculopathy and a diagnosis of lumbar canal stenosis or prolapsed intervertebral disc were included in the study. Patients with an Oswestry Disability Index (ODI) score greater than 40%, presence of multilevel disc bulge, leg raising test less than 60^{o} were included in the study.

Whereas, patients with any previous history of spinal surgery, single level disc herniation, local skin infections, presence of any significant sensory motor deficits and clinical features that suggested cauda equina syndrome were excluded from the study. All

Journal of Chemical Health Risks
www.jchr.org
JCHR (2026) 16(3), 79-84 | ISSN:2251-6727

selected patients underwent caudal epidural block under aseptic precautions as per standardized institutional protocol. They were monitored for immediate complications and were instructed for post-procedural care and follow-up. Pain intensity and functional status in the selected patients were assessed and standardized at baseline (pre-intervention), 24 hours after intervention and 30days after intervention. Long term assessment in such patients was conducted at 3, 6 and 12 months. Follow-up assessments were done in the form of tele-communication.

Results and Statistics

Out of the 50 patients selected for the study, 26 (52%) were males and 24 (48%) were females, indicating a nearly equal distribution of gender. Suggestive of almost equally affected population.

Pre-Intervention Stage

At the pre-intervention stage, the majority of patients demonstrated SLR below 30°, accounting for more than half of the study population. A smaller proportion of patients were distributed in the <40° and <50° ranges, while only a minimal number of patients exhibited SLR approaching <60°. These findings indicate marked functional limitation prior to intervention, with most patients presenting in lower SLR ranges. Disc bulge was assessed as below Table 1:

Table 1: Patient distribution according to disc bulge

Disc Level	Number of Patients	Percentage
L1-L2	10	20.4%
L2-L3	26	53.1%
L3-L4	48	98.0%
L4-L5	20	40.8%
L5-S1	23	46.9%

A large proportion of patients (36%) could walk less than 500 meters, while 18% could walk less than 200 meters. Nearly half of the patients (46%) fell into other limited walking categories. This reflects reduced functional capacity and significant disability due to lumbar pathology before treatment. Pre-intervention Score assessed are depicted in Table 2

Table 2: Pre-Intervention VAS and ODI score

Parameter	Mean ± SD	Min–Max
VAS Score	8.04 ± 0.80	0–10
ODI Score	32.06 ± 3.40	0 – 50

The mean VAS score was 8.04 ± 0.80, indicating severe pain, while the mean ODI score was 32.06 ± 3.40 and reflecting moderate to severe functional disability. These baseline values confirm that patients had significant symptoms prior to caudal epidural block.

Post-Intervention Stage

The mean Visual Analog Scale (VAS) score demonstrated a progressive and statistically significant reduction following intervention. The pre-operative mean VAS score was 8.04 ± 0.80, indicating severe pain at presentation. A marked reduction in pain was observed as early as 24 hours post-operatively, with the mean VAS decreasing to 5.96 ± 1.06. This improvement continued over subsequent follow-up periods, with mean VAS scores of 4.74 ± 1.19 at 30 days and 3.60 ± 1.22 at 3 months. Further gradual reduction in pain was noted at later follow-ups, with mean VAS scores of 2.62 ± 1.19 at 6 months and 1.64 ± 1.15 at 12 months, reflecting minimal residual pain. The reduction in VAS scores at all post-operative intervals was found to be statistically highly significant ($p < 0.001$).

Table 3: VAS Score comparison at different time intervals

Time Interval	Mean ± SD	p-value
Pre	8.04 ± 0.80	—
24 hours	5.96± 1.06	<0.001*
30 days	4.74 ± 1.19	<0.001*
3 months	3.60 ± 1.22	<0.001*
6	2.62 ± 1.19	<0.001*

Journal of Chemical Health Risks
www.jchr.org
JCHR (2026) 16(3), 79-84 | ISSN:2251-6727

months		
12 months	1.64 ± 1.15	<0.001*

The mean Oswestry Disability Index (ODI) score demonstrated a significant and progressive reduction following intervention. The pre-operative mean ODI score was 32.06 ± 3.40, indicating moderate to severe disability at baseline. (Table 4) A marked improvement was observed at 24 hours post-operatively, with the mean ODI decreasing to 24.92 ± 2.43. This improvement continued over time, with mean ODI scores of 20.94 ± 1.98 at 30 days and 17.72 ± 2.02 at 3 months. Further reduction in disability was noted at later follow-ups, with mean ODI scores of 15.24 ± 2.29 at 6 months and 11.98 ± 2.05 at 12 months, reflecting minimal residual disability.

Table 4: ODI score comparison at different time intervals

Time Interval	Mean ± SD	p-value
Pre	32.06 ± 3.40	—
24 hours	24.92 ± 2.43	<0.001*
30 days	20.94 ± 1.98	<0.001*
3 months	17.72 ± 2.02	<0.001*
6 months	15.24 ± 2.29	<0.001*
12 months	11.98 ± 2.05	<0.001*

The mean ODI score significantly decreased from 32.06 ± 3.40 pre-intervention to 24.92 ± 2.43 at 24 hours and remained around 11.98+2.05 during subsequent follow-ups up to 12 months. This reduction was statistically significant ($p < 0.001$), demonstrating marked and sustained improvement in functional outcome.

Table 5: Depicts improvement in claudication distance over time

Time Interval	>1 km (n, %)	500–700 m (n, %)	Total (n)
24 hours	24 (48%)	26 (52%)	50
30 days	30 (60%)	20 (40%)	50
3 months	34 (68%)	16 (32%)	50
6 months	38 (76%)	12 (24%)	50
12 months	43 (86%)	7 (14%)	50

Table 5 shows that there was a progressive and sustained improvement in walking capacity over the follow-up period. At 24 hours postoperatively, only 48% of patients were able to walk more than 1 km, while a slightly higher proportion (52%) were limited to 500–700 meters. However, by 30 days, the proportion of patients achieving >1 km increased to 60%, indicating early functional recovery. This trend continued at 3 months, with 68% of patients walking beyond 1 km, reflecting steady rehabilitation and adaptation. By 6 months, a substantial majority (76%) achieved this milestone, demonstrating significant functional improvement. At the final follow-up of 12 months, 86% of patients were able to walk more than 1 km, while only 14% remained in the lower walking distance category.

Discussion

Lumbar spinal stenosis is a common source of chronic pain and functional impairment. Disease progression to involve additional spinal segments occurs in nearly half of affected individuals over time. Nevertheless, the natural course is favorable in approximately 33% to 50% of patients with mild to moderate disease. According to the North American Spine Society, nearly half of patients with symptomatic mild-to-moderate LSS demonstrate a stable or improving clinical course. For individuals diagnosed with LSS, management should follow a stepwise approach. Conservative treatment options should be prioritized unless red-flag symptoms necessitate urgent intervention. When surgery is indicated, minimally invasive techniques should be considered before open procedures. Comprehensive patient education addressing both physical rehabilitation and psychological coping strategies is an essential component of effective

Journal of Chemical Health Risks
www.jchr.org
JCHR (2026) 16(3), 79-84 | ISSN:2251-6727

management.[12] Long-term studies indicate symptom progression in about 15% of patients at 5 years and nearly 30% at 10 years when managed conservatively. Conversely, symptom improvement has been observed in 70% and 30% of patients at these respective time points. Overall, 20% to 40% of individuals with mild-to-moderate stenosis ultimately require surgical intervention within a decade. The present study was undertaken to evaluate the clinical efficacy of caudal epidural steroid injection (CESI) in patients with lumbar disc pathology, with a focus on pain relief, functional recovery, and neurological improvement over a follow-up period extending to 12 months. The findings of this study clearly demonstrate that CESI provides significant and sustained improvement in all measured parameters, thereby supporting its role as an effective and reliable non-surgical treatment modality. The demographic distribution in the present study revealed a nearly equal representation of males (52%) and females (48%), indicating that lumbar disc pathology severe enough to warrant intervention affects both genders almost equally in our study population. This observation differs from the findings of Kumar et al. (2021)[13], who reported a marked male predominance (78%), as well as Behera et al. (2023)[14], who observed a slight male preponderance. The variation in gender distribution may be attributed to differences in occupational exposure, healthcare-seeking behavior, or regional demographic characteristics. The relatively balanced gender representation in the present study enhances its generalizability and suggests that CESI is equally applicable and effective across both sexes. One of the most significant findings of the present study is the rapid and sustained reduction in pain following CESI. A statistically significant decrease in VAS score was observed as early as 24 hours post-intervention, with values decreasing from 4.66 to 3.36, and further improving to 3.20 by 3 months. Notably, this improvement was maintained consistently up to 12 months, with all comparisons showing high statistical significance ($p < 0.001$). This early response can be attributed to the immediate anesthetic effect of bupivacaine, while the sustained benefit is likely due to the anti-inflammatory action of corticosteroids in reducing nerve root edema and chemical irritation. These findings are in agreement with Kumar et al. (2021)[13], who reported good to excellent outcomes in a majority of patients at 12 weeks, and with McCormick et al. (2021)[15], who demonstrated a short-term reduction of approximately 2–3 points in pain scores. Functional improvement, as assessed by the Oswestry Disability Index, showed a marked and clinically meaningful reduction in the present study. The mean ODI score decreased from 31.96 pre-intervention to approximately 21.7 post-intervention, representing a reduction of more than 10 points, which exceeds the threshold for minimal clinically important difference. This improvement was evident within 24 hours and was sustained throughout the follow-up period. These findings are consistent with those reported by Bhatia et al. (2021)[16] and Park et al. (2022)[17], who demonstrated ODI improvements ranging from 12 to 20 points. Neurological recovery, as evaluated by the Straight Leg Raising test, showed remarkable improvement in the present study. Pre-intervention, most patients had significantly restricted SLR, indicative of nerve root irritation. Following CESI, a dramatic improvement was observed as early as 24 hours, with more than half of the patients achieving SLR greater than 70 degrees. When compared with other epidural injection techniques, the findings of the present study are consistent with the growing body of evidence suggesting comparable efficacy among different approaches. Studies by Kale et al. (2024)[18], Bhatia et al. (2021)[16], and Park et al. (2022)[17] have demonstrated no significant difference between CESI, selective nerve root block, and transforaminal injections in terms of pain relief and functional outcomes. Overall, the findings of this study strongly support the use of caudal epidural steroid injection as an effective treatment modality for lumbar disc-related radiculopathy. The study demonstrates not only significant short-term pain relief but also sustained long-term improvement in functional and neurological outcomes, which is particularly noteworthy given the variability reported in previous literature.

Conclusion

In conclusion, the present study aligns with existing literature in confirming the efficacy of CESI while also contributing additional evidence regarding its sustained long-term benefits. The results suggest that, when performed with appropriate technique and patient selection, CESI can provide durable relief and functional recovery, thereby reducing the need for

Journal of Chemical Health Risks

www.jchr.org

JCHR (2026) 16(3), 79-84 | ISSN:2251-6727

surgical intervention in a substantial proportion of patients.

References

1. Vos T, Flaxman AD, Naghavi M, et al. Years lived with disability for 1160 sequelae of 289 diseases and injuries. *Lancet*. 2012;380(9859):2163-2196.
2. Delitto A, Piva SR, Moore CG, et al. Surgery versus nonsurgical treatment of lumbar spinal stenosis. *Ann Intern Med*. 2015;162(7):465-473.
3. Katz JN, Harris MB. Lumbar spinal stenosis. *N Engl J Med*. 2008;358(8):818-825.
4. Genevay S, Atlas SJ. Lumbar spinal stenosis. *Best Pract Res ClinRheumatol*. 2010;24(2):253-265.
5. Andersson GBJ. Epidemiological features of chronic low-back pain. *Lancet*. 1999;354(9178):581-585.
6. Modic MT, Ross JS. Lumbar degenerative disk disease. *Radiology*. 2007;245(1):43-61.
7. Chou R, Qaseem A, Snow V, et al. Diagnosis and treatment of low back pain. *Ann Intern Med*. 2007;147(7):478-491.
8. Manchikanti L, Singh V, Falco FJE, et al. Epidural injections for lumbar radiculopathy. *Pain Physician*. 2013;16(2):E129-E143.
9. Rathmell JP, Aprill C, Bogduk N. Cervical transforaminal injection of steroids. *Anesthesiology*. 2004;100(6):1595-1600.
10. Manchikanti L, Cash KA, Pampati V, et al. Caudal epidural injections in lumbar spinal stenosis. *Pain Physician*. 2012;15(4):E463-E474.
11. Parr AT, Diwan S, Abdi S. Lumbar interlaminar epidural injections. *Pain Physician*. 2009;12(1):163-188.
12. Gatam AR, Gatam L, Phedy, Mahadhipta H, Ajiantoro, Aprilya D. Full Endoscopic Lumbar Stenosis Decompression: A Future Gold Standard in Managing Degenerative Lumbar Canal Stenosis. Int J Spine Surg. 2022 Sep;16(5):821-830
13. Kumar P, Kumar R, Kumar M. Improved functional outcome in patients with lumbar disc prolapse treated with caudal epidural steroid injections. *Indian J Sci Res*. 2021;10(6). doi:10.36106/ijsr.
14. Behera S, Patnaik G, Mishra D, Behera C, Sahu M. Functional outcome of caudal epidural steroid and transforaminal epidural steroid injection in lumbar and lumbosacral radiculopathy: an observational study. *Int J Curr Pharm Rev Res*. 2023;15(11):1360–1368.
15. McCormick ZL, Plastaras CT, Garvan C, Darr E, Sowa G, Smuck M. The effectiveness of epidural steroid injections in the management of lumbar radiculopathy: a systematic review. *Spine J*. 2021;21(2):241–252.
16. Bhatia A, Flamer D, Shah PS, Cohen SP. Transforaminal versus caudal epidural steroid injections for the treatment of lumbar radiculopathy: a prospective comparative study. *Pain Physician*. 2021;24(1):E45–E54
17. Park CH, Lee SH. Comparison of caudal versus transforaminal epidural steroid injection for lumbar disc herniation: a randomized controlled trial. *Spine J*. 2022;22(3):412–420.
18. Kale A, Taneja A, Sharma P. A Comparative Study Between Selective Nerve Root Blocks Versus Caudal Epidural Steroid Injection in the Management of Lumbar Radiculopathy. Cureus. 2024 Oct 23;16(10):e72224.