

**Epidural Bupivacaine with or Without Corticosteroid for Lumbar Disc Prolapse: A Randomized Controlled Trial**Darshan N.<sup>1</sup>, N. Nagabhushan<sup>2</sup>, Umer Hamdan<sup>3</sup>, Vijay Kumar M. M.<sup>4</sup><sup>1,4</sup>Orthopaedic Spine Surgeon, Bowring and Lady Curzon Hospital, Bengaluru, Karnataka, India<sup>2,3</sup>Fellow in Spine Surgery, Bowring and Lady Curzon Hospital, Bengaluru, Karnataka, India

Received: 01-12-2025 / Revised: 15-01-2026 / Accepted: 21-02-2026

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Conflict of interest: Nil

**Abstract****Background:** Epidural interlaminar injections are widely used in the management of intervertebral disc prolapse; however, the additional benefit of corticosteroids over local anesthetics alone remains controversial.**Objectives:** To assess and compare the therapeutic efficacy of epidural interlaminar corticosteroid with bupivacaine versus epidural interlaminar bupivacaine alone in patients with intervertebral disc prolapse.**Methods:** In this randomized controlled study, 180 patients were allocated into two groups receiving either epidural interlaminar steroid with bupivacaine or bupivacaine alone. Pain intensity, functional disability, neurological recovery, and analgesic requirement were assessed over a 12-week follow-up period.**Results:** Both groups demonstrated significant improvement; however, the steroid-bupivacaine group showed significantly lower VAS and ODI scores, higher JOA scores, and reduced need for repeated analgesics at 12 weeks compared to the bupivacaine-only group.**Conclusion:** Epidural interlaminar injection of corticosteroid combined with bupivacaine provides significantly superior pain relief, functional improvement, and reduced need for repeated analgesic consumption compared to epidural interlaminar bupivacaine alone in patients with intervertebral disc prolapse.**Keywords:** Intervertebral disc prolapse; Epidural interlaminar injection; Corticosteroids; Bupivacaine.**DOI:** 10.25258/ijcpr.18.3.142

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**Introduction**

Intervertebral disc prolapse (IVDP) is one of the most common causes of chronic low back pain and radiculopathy, leading to significant functional disability and socioeconomic burden worldwide. Lumbar disc herniation results from degenerative or traumatic disruption of the annulus fibrosus with extrusion of nucleus pulposus material, producing both mechanical nerve root compression and a complex inflammatory response [1]. In addition to direct compression, inflammatory mediators such as phospholipase A2, prostaglandins, cytokines, and tumor necrosis factor- $\alpha$  play a pivotal role in the genesis and persistence of radicular pain, even in the absence of significant mechanical compromise [2].

Conservative management remains the first line of treatment for symptomatic IVDP and includes pharmacotherapy, physical therapy, and lifestyle modification. However, a substantial proportion of patients fail to achieve satisfactory pain relief with oral medications alone or experience unacceptable adverse effects with prolonged systemic drug use [3]. In such scenarios, epidural injections have

emerged as an important minimally invasive therapeutic modality, bridging the gap between conservative management and surgical intervention. Epidural injections deliver medications directly into the epidural space, targeting the site of pathology while minimizing systemic exposure. Local anesthetics such as bupivacaine provide immediate analgesia by blocking sodium channels and interrupting nociceptive transmission, whereas corticosteroids exert a prolonged anti-inflammatory effect by inhibiting inflammatory mediators, reducing nerve root edema, and stabilizing neural membranes [4]. The interlaminar epidural approach, in particular, allows relatively uniform spread of injectate within the epidural space and is widely practiced due to its technical simplicity and safety profile [5].

Despite widespread clinical use, the therapeutic superiority of adding corticosteroids to epidural local anesthetics remains a subject of ongoing debate. Several randomized controlled trials and systematic reviews have reported short- to intermediate-term pain relief and functional

improvement with epidural steroid injections in lumbar disc herniation, while others have questioned the magnitude and duration of benefit attributable specifically to steroids [6]. This controversy is further fueled by heterogeneity in study designs, patient populations, injection techniques, outcome measures, and follow-up durations.

High-quality evidence suggests that epidural injections with local anesthetic alone can provide meaningful pain relief, possibly through interruption of nociceptive pathways and modulation of dorsal horn sensitization [7]. Conversely, corticosteroids may offer additional benefit by attenuating the inflammatory cascade responsible for radicular symptoms, particularly in the acute and subacute phases of disc prolapse [8]. However, concerns regarding potential adverse effects of epidural corticosteroids—such as infection, dural puncture, endocrine suppression, and rare but serious neurological complications—underscore the need for judicious patient selection and evidence-based practice [9].

Given the high prevalence of IVDP, the increasing utilization of epidural injections, and the persistent uncertainty regarding the incremental benefit of corticosteroids when combined with local anesthetics, further randomized controlled studies are warranted. A clear understanding of the comparative efficacy of epidural bupivacaine with and without corticosteroids is essential for optimizing pain management strategies, minimizing unnecessary drug exposure, and improving patient outcomes [10].

In this context, the present randomized controlled study was undertaken to assess the therapeutic efficacy of epidural interlaminar corticosteroids when used in combination with bupivacaine, compared to bupivacaine alone, in patients with intervertebral disc prolapse.

### Material and Methods

This randomized controlled study was conducted at Bowring and Lady Curzon Hospital Bengaluru, Karnataka in patients diagnosed with intervertebral disc prolapse presenting with low back pain with or without radiculopathy. A total of 180 patients who fulfilled the inclusion criteria were enrolled after obtaining approval from the Institutional Ethics Committee. The diagnosis of intervertebral disc prolapse was confirmed based on clinical evaluation and radiological findings, primarily magnetic resonance imaging of the spine. Patients aged between 20 and 65 years with persistent symptoms despite conservative management were included in the study. Patients with previous spinal surgery, spinal instability, local or systemic infection, coagulopathy, known allergy to study

drugs, pregnancy, or severe neurological deficits requiring immediate surgery were excluded.

After explaining the nature, benefits, and potential risks of the procedure in detail, informed and written consent was obtained from all participants. The enrolled patients were randomly allocated into two equal groups of 90 patients each using a computer-generated randomization sequence. Group 1 consisted of patients who received epidural interlaminar corticosteroid combined with bupivacaine injection, while Group 2 consisted of patients who received epidural interlaminar bupivacaine alone.

All procedures were performed under strict aseptic precautions in the operating room with standard monitoring. Patients were placed in the prone position, and the affected spinal level was identified using anatomical landmarks. The epidural interlaminar space was accessed using a midline approach with a Tuohy needle, and correct needle placement was confirmed using the loss-of-resistance technique. In Group 1, patients received an epidural injection of corticosteroid combined with bupivacaine, whereas patients in Group 2 received epidural bupivacaine alone in equivalent volume. Following the injection, patients were monitored for immediate complications and observed in the recovery area before discharge.

Pain intensity and functional improvement were assessed using standardized outcome measures at baseline prior to the procedure and during follow-up visits at predetermined intervals. Patients were advised to continue routine activities as tolerated and avoid additional interventional pain procedures during the study period. Any adverse events or complications related to the procedure were documented and managed appropriately.

The collected data were entered into a master chart and subjected to statistical analysis using appropriate statistical software. Continuous variables were expressed as mean and standard deviation, while categorical variables were expressed as percentages. Comparative analysis between the two groups was performed to evaluate the therapeutic efficacy of epidural interlaminar corticosteroid with bupivacaine versus bupivacaine alone. A p-value of less than 0.05 was considered statistically significant.

### Results

Table 1 compares the baseline characteristics of the two treatment groups. The mean age in Group 1 (steroid with bupivacaine) was  $44.6 \pm 9.8$  years, while in Group 2 (bupivacaine alone) it was  $45.2 \pm 10.1$  years. Male patients constituted 56.7% in Group 1 and 54.4% in Group 2. The mean duration of symptoms was  $6.4 \pm 2.1$  months in Group 1 and  $6.6 \pm 2.3$  months in Group 2. Baseline VAS and

ODI scores were also comparable between the groups, with no statistically significant difference observed ( $p > 0.05$ ), indicating adequate baseline homogeneity.

Table 2 shows the comparison of Visual Analogue Scale (VAS) scores between the two groups at baseline and during follow-up. At baseline, mean VAS scores were comparable (Group 1:  $7.62 \pm 1.12$ ; Group 2:  $7.58 \pm 1.09$ ;  $p = 0.78$ ). At 4 weeks, the mean VAS score reduced to  $3.42 \pm 1.34$  in Group 1 compared to  $4.86 \pm 1.41$  in Group 2 ( $p < 0.001$ ). At 12 weeks, Group 1 showed significantly lower VAS scores ( $1.94 \pm 1.21$ ) compared to Group 2 ( $3.36 \pm 1.39$ ), demonstrating superior pain relief with the addition of corticosteroid ( $p < 0.001$ ).

Table 3 presents the comparison of Oswestry Disability Index (ODI) scores between the groups. Baseline ODI scores were similar in Group 1 ( $48.3 \pm 9.6$ ) and Group 2 ( $47.9 \pm 9.9$ ) with no significant difference ( $p = 0.81$ ). At 4 weeks, ODI scores decreased to  $24.8 \pm 10.2$  in Group 1 and  $33.6 \pm 11.1$  in Group 2 ( $p < 0.001$ ). At 12 weeks, Group 1

demonstrated significantly better functional improvement with a mean ODI score of  $15.9 \pm 8.7$  compared to  $27.8 \pm 9.4$  in Group 2 ( $p < 0.001$ ).

Table 4 compares the Japanese Orthopaedic Association (JOA) scores between the two groups. Baseline JOA scores were comparable (Group 1:  $12.4 \pm 2.6$ ; Group 2:  $12.6 \pm 2.4$ ;  $p = 0.63$ ). At 4 weeks, Group 1 showed greater improvement with a mean score of  $20.1 \pm 3.2$  compared to  $17.8 \pm 3.4$  in Group 2 ( $p < 0.001$ ). At 12 weeks, the mean JOA score further improved to  $24.6 \pm 3.1$  in Group 1, which was significantly higher than  $21.2 \pm 3.5$  observed in Group 2 ( $p < 0.001$ ).

Table 5 depicts the comparison of the need for repeated analgesic consumption between the two groups during the 12-week follow-up period. Only 18 patients (20.0%) in Group 1 required repeated analgesics, whereas 41 patients (45.6%) in Group 2 required additional analgesic support. This difference was statistically significant ( $p < 0.001$ ), indicating better sustained pain control in patients receiving epidural corticosteroids with bupivacaine.

**Table 1: Baseline Characteristics of Study Participants (n = 180)**

Parameter	Group 1 (Steroid + Bupivacaine) n=90	Group 2 (Bupivacaine only) n=90	p value
Mean age (years)	$44.6 \pm 9.8$	$45.2 \pm 10.1$	0.72
Male : Female	51 : 39	49 : 41	0.76
Mean duration of symptoms (months)	$6.4 \pm 2.1$	$6.6 \pm 2.3$	0.54
Baseline VAS score	$7.62 \pm 1.12$	$7.58 \pm 1.09$	0.78
Baseline ODI score	$48.3 \pm 9.6$	$47.9 \pm 9.9$	0.81

**Table 2: Comparison of VAS Scores between the Treatment Groups**

Time point	Group 1 (Mean $\pm$ SD)	Group 2 (Mean $\pm$ SD)	p value
Baseline	$7.62 \pm 1.12$	$7.58 \pm 1.09$	0.78
4 weeks	$3.42 \pm 1.34$	$4.86 \pm 1.41$	<0.001
12 weeks	$1.94 \pm 1.21$	$3.36 \pm 1.39$	<0.001

**Table 3: Comparison of ODI Scores between the Treatment Groups**

Time point	Group 1 (Mean $\pm$ SD)	Group 2 (Mean $\pm$ SD)	p value
Baseline	$48.3 \pm 9.6$	$47.9 \pm 9.9$	0.81
4 weeks	$24.8 \pm 10.2$	$33.6 \pm 11.1$	<0.001
12 weeks	$15.9 \pm 8.7$	$27.8 \pm 9.4$	<0.001

**Table 4: Comparison of JOA Scores between the Treatment Groups**

Time point	Group 1 (Mean $\pm$ SD)	Group 2 (Mean $\pm$ SD)	p value
Baseline	$12.4 \pm 2.6$	$12.6 \pm 2.4$	0.63
4 weeks	$20.1 \pm 3.2$	$17.8 \pm 3.4$	<0.001
12 weeks	$24.6 \pm 3.1$	$21.2 \pm 3.5$	<0.001

**Table 5: Comparison of Need for Repeated Analgesics between the Groups**

Analgesic requirement	Group 1 n (%)	Group 2 n (%)	p value
Required repeated analgesics	18 (20.0%)	41 (45.6%)	<0.001
Did not require repeated analgesics	72 (80.0%)	49 (54.4%)	

**Discussion:** The present randomized controlled study evaluated the therapeutic efficacy of epidural interlaminar corticosteroid combined with

bupivacaine compared with epidural interlaminar bupivacaine alone in patients with intervertebral disc prolapse. The findings demonstrate that

although both treatment modalities provided symptomatic relief, the addition of corticosteroid resulted in significantly superior pain reduction, functional improvement, and reduced need for repeated analgesic consumption over a 12-week follow-up period.

In the present study, baseline pain and disability scores were comparable between the two groups, confirming appropriate randomization and baseline homogeneity. At 12 weeks, the mean VAS score in the steroid-bupivacaine group reduced to  $1.94 \pm 1.21$  compared to  $3.36 \pm 1.39$  in the bupivacaine-only group, indicating significantly better pain control with corticosteroid supplementation. This finding supports the anti-inflammatory role of epidural corticosteroids in attenuating chemical radiculitis caused by disc herniation. Similar observations were reported by Okmen and Okmen, who demonstrated significantly greater pain relief in patients receiving interlaminar epidural steroid with bupivacaine compared to bupivacaine alone in multilevel lumbar disc prolapse [11].

Functional improvement assessed using the Oswestry Disability Index showed a marked reduction in disability scores in both groups; however, the improvement was significantly greater in the steroid group. At 12 weeks, the mean ODI score in the steroid-bupivacaine group was  $15.9 \pm 8.7$  compared to  $27.8 \pm 9.4$  in the bupivacaine-only group. This suggests that suppression of inflammatory mediators by corticosteroids contributes not only to pain relief but also to improved functional recovery. Manchikanti et al. similarly reported that epidural interlaminar injections with local anesthetic and steroid resulted in superior functional outcomes compared to anesthetic alone in patients with lumbar disc pathology [12].

The Japanese Orthopaedic Association scores further corroborated these findings, with significantly higher scores observed in the steroid-bupivacaine group at both 4-week and 12-week follow-ups. The mean JOA score at 12 weeks was  $24.6 \pm 3.1$  in the steroid group compared to  $21.2 \pm 3.5$  in the bupivacaine group, reflecting better neurological recovery and functional status. These results align with the findings of Cohen et al., who reported modest but clinically meaningful improvements in functional outcomes following epidural steroid injections for lumbar radicular pain [13].

Another important observation in the present study was the significantly reduced need for repeated analgesics in the steroid-bupivacaine group. Only 20.0% of patients in this group required additional analgesic support compared to 45.6% in the bupivacaine-only group. This highlights the longer-lasting therapeutic effect of corticosteroids in

controlling inflammation-mediated pain. Although some earlier trials have questioned the long-term benefit of epidural steroids, systematic reviews and controlled trials suggest that steroids offer superior short- to intermediate-term relief, which is clinically valuable in reducing dependence on systemic analgesics [14].

However, it is noteworthy that both groups showed significant improvement from baseline, indicating that epidural bupivacaine alone also provides substantial benefit. This supports the hypothesis that local anesthetics contribute to pain relief through mechanisms such as interruption of nociceptive transmission, suppression of ectopic discharges, and modulation of dorsal horn sensitization. Similar conclusions were drawn by Tafazal et al., who reported improvement in both steroid and non-steroid groups, although without additional long-term benefit from corticosteroids in certain patient subsets [15].

Overall, the present study reinforces the role of epidural interlaminar corticosteroids as an effective adjunct to local anesthetics in the management of intervertebral disc prolapse, particularly for achieving superior pain control, functional improvement, and reduced analgesic requirements during the early recovery phase.

## Conclusion

The present randomized controlled study concludes that epidural interlaminar injection of corticosteroid combined with bupivacaine provides significantly superior pain relief, functional improvement, and reduced need for repeated analgesic consumption compared to epidural interlaminar bupivacaine alone in patients with intervertebral disc prolapse.

While both treatment modalities are effective, the addition of corticosteroid offers enhanced short- to intermediate-term clinical benefits, supporting its use as a preferred minimally invasive therapeutic option before considering surgical intervention.

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