Original Research Article

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Role of Epidural Steroid Injection in Pain Reduction and Functional Recovery in Prolapsed Lumbar Intervertebral Disc (PLID)

Md Sanaulla Khandakar[1,*], Md Raihanul Hoque[2], Viquarunnesa Sanam[3], Suraia Rashid[4], Tapos Kumar Roy[5], Mohammad Osman Goni[6], Sujan Tripura[7]

[1]Department of Orthopaedic Surgery, Brahmanbaria Medical College, Brahmanbaria, Bangladesh.
[2]Department of Spine Surgery, National Institute of Traumatology and Orthopaedic Rehabilitation, Dhaka, Bangladesh.
[3]Department of Radiology, Armed Forces Medical Institute, Dhaka, Bangladesh.
[4]Bangladesh Medical University, Dhaka, Bangladesh.
[5]Department of Musculoskeletal Tumor & Orthopaedic Oncology, Rangpur Medical College, Rangpur, Bangladesh.
[6]Department of Orthopedic Surgery, Enam Medical College and Hospital, Dhaka, Bangladesh.
[7]Upazila Health Complex Chakaria, Cox's Bazar, Bangladesh.

***Address for correspondence:** Dr. Md Sanaulla Khandakar, Department of Orthopaedic Surgery, Brahmanbaria Medical College, Brahmanbaria, Bangladesh. **E-mail:** sananitor15@gmail.com

Abstract

Introduction: Prolapsed lumbar intervertebral disc (PLID) is a common disorder of the spinal cord with pain presenting as the most common presenting symptom and has been established as one of the leading causes of low back pain and radiculopathy. Despite conservative management remains the initial treatment modality, some patients continue to suffer symptoms that necessitate further intervention. Epidural steroid injection (ESI) has now been used as a minimally invasive treatment modality with the intent to reduce inflammation around nerve roots and to improve clinical results. The purpose of this study was to investigate the role of epidural steroid injection in relieving pain and function during prolapsed lumbar intervertebral disc (PLID).

Methods & Materials: This prospective observational study was done in the Department of Orthopedics, Brahmanbaria Medical College Hospital, Brahmanbaria, Bangladesh. From January 2025 to December 2025, to assess the effect of epidural steroid injection (ESI) as the relief of pain and can improve functional recovery for distribution of PLID. Patients admitted with diagnosis of PLID (total 58) by a purposive sampling. The data were analyzed by Statistical Package for Social Sciences (SPSS) 26.0 Version.

Result: Among the 58 patients, the majority belonged to the 41–50 years age group (34.5%) with male predominance (58.6%), and L4–L5 was the most commonly affected disc level (48.3%). Following epidural steroid injection, substantial improvement was observed in both pain and functional status, with mean VAS scores decreasing from 7.8 ± 1.1 before treatment to 2.9 ± 1.2 at 3 months, and mean ODI scores improving from 62.5 ± 8.4% to 29.6 ± 6.8%. Overall, 72.4% of patients achieved good to excellent clinical outcomes, while 89.7% improved without requiring surgical intervention.

Conclusion: The research demonstrates that epidural steroid injection (ESI) is effective in managing prolapsed lumbar intervertebral disc (PLID) by significantly alleviating pain and enhancing functional recovery. Initially, the mean VAS score was 7.8 ± 1.1, which progressively decreased to 2.9 ± 1.2 after three months. Similarly, the mean ODI improved from 62.5 ± 8.4% to 29.6 ± 6.8%, reflecting a notable enhancement in daily functional

activities. Most patients (72.4%) achieved good to excellent clinical outcomes, and 89.7% did not require surgical intervention during follow-up.

Keywords: Steroid injection, PLID, functional recovery, pain reduction

Introduction

Prolapsed lumbar intervertebral disc (PLID) is one of the most common causes of low back pain and radiculopathy of the leg across the globe and accounts for a significant burden of disability, disability-adjusted life years, reduced productivity, and decreased quality of life. It results from herniation of the nucleus pulposus through the fibrous annulus, resulting in compression of the exiting nerve root and inflammatory changes within the spinal nerve. It affects predominantly the economically active age group and has a profound socioeconomic impact.[1,2] The pathophysiology of PLID is not just mechanical compression, but there is also a very important inflammatory component mediated by cytokines, mainly tumor necrosis factor (TNF) and interleukins, which are mainly responsible for irritation of the nerve root and neuropathic pain.[3] It is for this reason that the treatment is directed for decompression as well as minimisation of inflammation and pain. Conservative management is the initial line of treatment, and this involves physical therapy, oral analgesics, and lifestyle modification.[4] In these circumstances, epidural steroid injection (ESI) has developed as a valuable minimally invasive treatment option. Epidural steroid injections are corticosteroid drugs injected directly into the epidural space to act directly upon the nerves at the site of inflammation. The action is reduction in inflammatory mediators, reduction of the nerve root oedema, reduction in pain transmission with ESIs administered by interlaminar, transforaminal or caudal routes.[5,6] Several studies have demonstrated that ESIs provide significant short- to intermediate-term pain relief in patients with lumbar disc herniation, particularly in reducing radicular leg pain measured by visual analogue scale (VAS) scores.[7] Functional enhancement, evaluated through instruments like the Oswestry Disability Index (ODI), has been documented, though the extent and persistence of improvement can differ among individuals.[8] Despite these advantages, the long-term effectiveness of ESIs is still a topic of discussion, with certain research indicating that although short-term pain relief is notable, the consistency of functional outcomes may diminish over time.[9] Recent systematic reviews and meta-analyses endorse ESIs as a viable non-surgical treatment option that can alleviate pain, enhance mobility, and potentially postpone or eliminate the need for surgical procedures in certain patients.[10] Considering the escalating incidence of PLID and the expanding utilization of less invasive treatment options, there is a need to more critically appraise the efficacy of epidural steroid injections through actual clinical practices. The primary goal of this study is to explore the efficacy of ESI for pain alleviation and improving the quality of life in prolapsed Lumbar intervertebral disc patients.

Methods & Materials

This prospective, observational study was carried out in the Department of Orthopedics, Brahmanbaria Medical College Hospital, Brahmanbaria, Bangladesh from January 2025 to December 2025 to assess the efficacy of epidural steroid injection for pain relief & functional restoration in patients having prolapsed Lumbar intervertebral disc (PLID). 58 patients were selected purposively, presenting with PLID. Patients aged 18 years or more, with clinically suspected and MRI proven lumbar intervertebral disc prolapse and complain of back pain with radicular irritation, who had not responded to conservative management over a period of 4, 6 weeks. Patients with spinal tumors, patients with spinal infection, having a past history of lumbar spine surgical intervention, with neurological deficit that needed immediate surgical intervention, bleeding and coagulation disorders, pregnant patients or patients having contraindication for corticosteroid therapy were excluded. Dimorphic etmlagLPrescribed data collection

form was used to gather the Demiro administrative (age sex occupation, duration of complained of symptom, level of disc level involvement.) Demographic and clinical data was recorded. All the patients were injected with epidural steroid injection following the same standard aseptic precautions and protocol. Baseline pain intensity prior to injection was assessed using the VAS, while functional disability was evaluated with the Oswestry Disability Index (ODI). Measurements of pain severity and functional status were repeated at 1 week, 1 month, and 3 months after the injection to assess the intervention's impact. Clinical outcomes were categorized as excellent, good, fair, or poor, depending on the percentage of symptomatic improvement. Data entry, verification, and analysis were conducted using the Statistical Package for Social Sciences (SPSS) version 26.0. Continuous data were presented as mean ± SD, and categorical data were expressed as percentages and numbers. The Chi-square test was used to compare variables, with statistical significance set at a *P*-value of <0.05. Prior to the study's initiation, approval was secured from the Institutional Review Board (IRB) of the respective institution. Informed and written consent was obtained from all participants.

Results

Among 58 patients, the most common age group was 41–50 years, comprising 20 patients (34.5%), followed by 31–40 years with 18 patients (31.0%), while both 20–30 years and >50 years groups had 10 patients each (17.2%). Males were more affected than females, with 34 males (58.6%) and 24 females (41.4%). Regarding occupation, 30 patients (51.7%) had sedentary work while 28 patients (48.3%) were manual laborers [Table 1].

The most commonly affected disc level was L4–L5 in 28 patients (48.3%), followed by L5–S1 in 20 patients (34.5%), while L3–L4 involvement was seen in 10 patients (17.2%). This indicates a higher predilection for lower lumbar segments, particularly L4–L5 [Table 2].

The average initial VAS score was 7.8 ± 1.1, reflecting intense pain prior to treatment. Following the epidural steroid injection, pain levels significantly dropped to 4.9 ± 1.2 after one week, decreased further to 3.6 ± 1.3 after one month, and eventually reached 2.9 ± 1.2 at the three-month mark [Table 3].

The mean baseline ODI was 62.5 ± 8.4%, indicating severe functional disability before treatment. Following epidural steroid injection, ODI decreased to 41.2 ± 7.9% at 1 month and further improved to 29.6 ± 6.8% at 3 months [Table 4].

Table 1: Baseline demographic characteristics of the study population (n = 58)

Variables	*n*	%
Age 20–30 years	10	17.2
Age 31–40 years	18	31.0
Age 41–50 years	20	34.5
Age >50 years	10	17.2
Male	34	58.6
Female	24	41.4
Sedentary occupation	30	51.7
Manual labor	28	48.3

Table 2: Distribution of affected lumbar disc level (n = 58)

Level	*n*	%
L3–L4	10	17.2
L4–L5	28	48.3
L5–S1	20	34.5

Table 3: VAS score before and after epidural steroid injection (n = 58)

Time point	Mean VAS ± SD
Pre-injection	7.8 ± 1.1
1 week	4.9 ± 1.2
1 month	3.6 ± 1.3
3 months	2.9 ± 1.2

At 3 months, 20 patients (34.5%) achieved excellent improvement with ≥75% symptom relief, while 22 patients (37.9%) had good improvement with 50–74% relief. Fair improvement was seen in 12 patients (20.7%), and only 4 patients (6.9%) showed poor response, indicating that 72.4% of patients experienced good to excellent outcomes following epidural steroid injection [Table 5].

Out of 58 patients, 52 patients (89.7%) improved sufficiently after epidural steroid injection and did not require surgery during follow-up, while only 6 patients (10.3%) eventually required surgical intervention [Table 6].

Discussion

In the present study, the highest proportion of patients belonged to the 41–50 years age group, accounting for 34.5% of cases, followed by 31–40 years, comprising 31.0% of patients. The mean age was approximately in the mid-forties, and males constituted 58.6% of the study population. These findings are comparable to the study conducted by Soliman et al., where the mean age of patients with lumbar disc herniation treated with epidural steroid injection was 44.7 ± 8.2 years, and males represented 60% of cases.[11] Ripon et al. also reported male predominance, with 66.7% male patients among individuals receiving epidural steroid injections for lumbar radiculopathy.[12] The predominance of middle-aged adults and males in both the current and previous studies may be related to occupational stress, degenerative spinal changes, and greater exposure to physical strain. In this study, the most commonly affected disc level was L4–L5 in 48.3% of patients, followed by L5–S1 in 34.5% and L3–L4 in 17.2%. Similar findings were observed by Ripon et al., who reported L4–L5 involvement in 53.3% of patients and L5–S1 involvement in 36.7% of patients with lumbar disc prolapse.[12] Soliman et al. likewise found that L4–L5 was the most frequently involved level in 50% of cases, followed by L5–S1 in 35%.[11] Pain reduction following epidural steroid injection was significant in the present study. The mean Visual Analogue Scale (VAS) score decreased from 7.8 ± 1.1 before injection to 4.9 ± 1.2 at 1 week, 3.6 ± 1.3 at 1 month, and 2.9 ± 1.2 at 3 months. Soliman et al. reported a reduction in mean VAS score from 8.1 ± 0.9 before injection to 3.4 ± 1.1 after 3 months of follow-up.[11] Similarly, Kennedy et al. demonstrated that mean pain scores improved from 7.4 ± 1.2 pre-treatment to 3.1 ± 1.4 at 3 months after transforaminal epidural steroid injection.[13] Sajeev et al. also observed a decrease in VAS score from 7.2 ± 0.8 before treatment to 3.0 ± 1.0 after 12 weeks.[14] Functional recovery assessed by the Oswestry Disability Index (ODI) also improved substantially in this study. The mean ODI decreased from 62.5 ± 8.4% before treatment to 41.2 ± 7.9% at 1 month and 29.6 ± 6.8% at 3 months. Soliman et al. found that the mean ODI score improved from 61.3 ± 9.5% pre-treatment to 30.5 ± 7.2% at 3 months after epidural steroid injection.[11] Kennedy et al. similarly reported significant improvement in

Table 4: Oswestry Disability Index (ODI) before and after ESI (n = 58)

Time point	Mean ODI (%) ± SD
Pre-injection	62.5 ± 8.4
1 month	41.2 ± 7.9
3 months	29.6 ± 6.8

Table 5: Degree of clinical improvement at 3 months (n = 58)

Outcome	n	%
Excellent (≥75% improvement)	20	34.5
Good (50–74%)	22	37.9
Fair (25–49%)	12	20.7
Poor (<25%)	4	6.9

Table 6: Need for surgical intervention during follow-up (n = 58)

Outcome	n	%
No surgery required	52	89.7
Required surgery	6	10.3

disability scores, with ODI decreasing from 58.6 ± 10.2% before treatment to 32.8 ± 8.7% after follow-up.[13] Cervera-Irimia and Tomé-Bermejo also documented improvement in ODI from 65% before treatment to 33% after caudal epidural steroid injection.[15] Regarding overall clinical outcome, 34.5% of patients in the present study achieved excellent improvement, 37.9% had good improvement, 20.7% showed fair improvement, and only 6.9% demonstrated poor response. Comparable results were reported by Ripon et al., where 36.7% of patients experienced excellent relief, and 40% showed good improvement after epidural steroid injection.[12] Soliman et al. also found successful clinical improvement in approximately 70% of patients receiving epidural steroid injection.[11] In the current study, 89.7% of patients improved without requiring surgery, whereas only 10.3% eventually required operative intervention. Buttermann reported that approximately 71% of patients treated with epidural steroid injection avoided surgery during follow-up.[16] Similarly, Kennedy et al. observed that most patients experienced sufficient symptomatic relief after injection and did not proceed to surgical treatment.[13] The higher non-surgical success rate in the present study may be related to appropriate patient selection and early intervention.

Limitations of the Study

The study was conducted in a single hospital with a limited sample size; therefore, the results may not be representative of the entire community.

Conclusion

The results of this research indicate that epidural steroid injection (ESI) is highly effective in managing prolapsed lumbar intervertebral disc (PLID) by significantly alleviating pain and enhancing functional recovery. The average VAS score decreased steadily from 7.8 ± 1.1 prior to treatment to 2.9 ± 1.2 after three months. Additionally, the mean ODI improved from 62.5 ± 8.4% to 29.6 ± 6.8%, reflecting notable progress in daily functional activities. A majority of patients (72.4%) experienced good to excellent clinical outcomes, and 89.7% did not need surgical intervention during the follow-up period.

Recommendation

The findings of this study indicate that ESI serves as an effective non-surgical treatment option for patients with PLID, as demonstrated by our findings. In our direct comparative analysis, ESI relieved persistent pain and dysfunction that did not respond to conservative treatment. Identifying and selecting suitable patients for ESI early on may yield better outcomes than prolonging conservative therapy. Conducting consistent multicenter studies over an extended period is likely to solidify ESI's role in the definitive management of PLID.

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