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ORIGINAL ARTICLE

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

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ABSTRACT

Introduction: *Prolapsed lumbar intervertebral disc (PLID) is a leading cause of low back pain and radiculopathy, significantly influencing patients' quality of life. ESIs reduce inflammation and nerve root irritation, offering short-term pain relief and improved mobility.* ***Methods & Materials:*** *This one-year retrospective study (January 2022–December 2023) at Gazi and Khulna Medical Colleges, Bangladesh, included 50 adults (20–60 years) with MRI-confirmed lumbar disc prolapse unresponsive to ≥4 weeks of conservative therapy. Patients received interlaminar or transforaminal epidural steroid injections. Pain (VAS), disability (ODI), complications, and satisfaction were evaluated at baseline, 1 week, 1 month, and 3 months.* ***Result:*** *The study included 50 patients with a mean age of 41.6 years; 56% were male, and 60% had sedentary occupations. The most common disc prolapse level was L4-L5 (56%), and protrusion was the predominant type (44%). Interlaminar ESI was most frequently used (60%) with methylprednisolone (64%), and 60% received a single injection. Significant reductions in pain and disability were observed, with VAS scores dropping from 7.6 to 2.8 and ODI scores from 58.2% to 24.3% at 3 months ($p<0.001$). Complications were minimal and mild, and 76% of participants reported excellent or good satisfaction following the intervention.* ***Conclusion:*** *Epidural steroid injections (ESIs) effectively manage prolapsed lumbar intervertebral disc (PLID) by providing significant pain relief and functional improvement. This study showed marked reductions in VAS and ODI scores, with minimal complications and high patient satisfaction, supporting ESIs as a safe, effective, and non-surgical treatment option for PLID.*

Keywords: *Epidural Steroid Injection (EPI), Pain Reduction, Functional Recovery and Prolapsed Lumbar Intervertebral Disc (PLID)*

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INTRODUCTION

Prolapsed lumbar intervertebral disc (PLID), commonly manifesting as lumbar radiculopathy ("sciatica"), is a leading cause of pain, disability, and health-care utilization worldwide. Low back pain (LBP), of which disc herniation is a frequent structural correlate, has been the top cause of years lived with disability for decades in the Global Burden of Disease (GBD) programme [1]. In 2017, point prevalence estimates suggested ~7.5% of the global population had LBP, equivalent to ~550–580 million people [1,2]. GBD 2019 further documented rising disability associated with LBP across regions, including South Asia, underscoring the scale of the problem and its economic impact through reduced productivity and work absence [3]. Within Bangladesh, nationally representative data identify LBP as the highest-ranked musculoskeletal disorder (18.6% prevalence in adults), highlighting substantial regional burden and the need for context-appropriate, cost-effective care pathways [4]. Epidural steroid injection (ESI) has been a mainstay non-surgical option for disc-related radiculopathy, intended to deliver corticosteroid and local anaesthetic near the inflamed nerve root to reduce neuroinflammation and facilitate functional recovery. Clinical guidelines in the United Kingdom (NICE NG59) recommend considering an epidural injection of local anaesthetic and steroid for adults with acute, severe sciatica, reflecting its role as a bridge between conservative

care and surgery in selected patients [5,6]. Nevertheless, the magnitude, durability, and predictors of benefit remain a topic of debate. Systematic reviews conducted between 2010 and 2022 generally agree that ESIs confer small to moderate short-term reductions in leg pain and disability compared with placebo, with diminishing effects beyond 3–6 months [7]. Similar conclusions were reported in an abridged Cochrane update and a plain-language Cochrane summary (2020), which judged the effects as modest and mainly short-term, with uncertainty about longer-term outcomes and safety due to the low quality of adverse-event data [8,9]. Randomized controlled trials (RCTs) provide complementary signals. A multicenter double-blind RCT comparing transforaminal ESI with gabapentin in lumbosacral radicular pain showed faster early relief with ESI, although differences narrowed over time [10]. Active-control trials and comparative analyses of caudal, interlaminar, and transforaminal approaches suggest broadly similar overall efficacy across routes, with some studies indicating potential advantages of steroids over anaesthetic alone for selected outcomes or time points [11]. Conversely, a BMJ RCT comparing caudal ESI with saline for chronic radiculopathy found no clinically significant long-term differences, highlighting heterogeneity due to chronicity, approach, and comparator [12]. Trials in lumbar spinal stenosis (distinct from PLID) have shown limited benefit, emphasizing the importance of diagnostic specificity when extrapolating evidence [13]. Clinically, even transient reductions in pain and disability can be valuable. Short-term relief enables earlier mobilization, increased rehabilitation engagement, and reduced analgesic requirements, and may even result in deferred or avoided surgery in some patients. Moreover, a substantial proportion of disc herniations undergo spontaneous resorption over months, so temporizing strategies that control pain while natural history unfolds may be rational [3]. However, key knowledge gaps persist. There is limited high-quality evidence on functional recovery trajectories (return to work, resumption of activity) beyond pain scores, especially in low- and middle-income countries (LMICs), such as Bangladesh. Fourth, predictors of response (e.g., symptom duration, sequestration vs protrusion, foraminal level, and precise injectate composition/dose) remain insufficiently defined for routine stratified care. Given the high global and regional PLID burden, the clinical salience of short-term improvement, and persistent uncertainty regarding functional recovery and context-specific outcomes, robust, locally generated evidence is warranted. This study aimed to assess the role of epidural steroid injections in pain reduction and functional recovery among patients with PLID in a tertiary care setting.

METHODS & MATERIALS

This retrospective observational study was conducted at the Department of Orthopaedics in Gazi Medical College and, Khulna Medical College, Khulna, Bangladesh, from January 2022 to December 2023. A total of 50 patients aged 20–60 years with clinically and MRI-confirmed lumbar disc prolapse were included. Patients with spinal infection, malignancy, fracture, coagulopathy, uncontrolled comorbidities, steroid hypersensitivity, or pregnancy were excluded. All patients underwent epidural steroid injections (interlaminar, or transforaminal) under aseptic precautions, using either Methylprednisolone acetate (40–80 mg) or Triamcinolone (40–80 mg) with lidocaine. Each patient received 1–2 injections apart based on symptoms. Pain was assessed using the Visual Analogue Scale (VAS) at baseline, 1 week, 1 month, and 3 months [17]. At the same time, functional disability was evaluated with the Oswestry Disability Index (ODI) at baseline, 1 month, and 3 months [18]. Patients were monitored for complications, and at 3 months, overall satisfaction and willingness to repeat the procedure were recorded.

Data were collected using a pre-designed data collection sheet. Data were entered into Microsoft Excel and analyzed using SPSS version 26.0. Numerical variables such as age, VAS, and ODI scores were expressed as mean ± standard deviation (SD). Categorical variables were expressed as frequencies and percentages. Changes in VAS and ODI scores over time were analyzed using repeated measures, such as ANOVA (for normally distributed data) or Friedman test (for non-parametric data). A p-value < 0.05 was considered statistically significant.

RESULT

The mean age of participants was 41.6 ± 9.3 years. Among them, 56% were male and 44% female. In terms of occupation, 60% had sedentary jobs, while 40% were engaged in manual labor. The mean BMI was 26.1 ± 2.8 kg/m^2. Regarding smoking status, 36% were smokers and 64% non-smokers. More than half of the patients (52%) had no comorbidities, while 24% had diabetes, 16% hypertension, and 8% other conditions. The duration of symptoms was less than 3 months in 24%, 3–6 months in 48%, and more than 6 months in 28% of cases. The side of pain was right in 40%, left in 36%, and bilateral in 24% of patients. [Table I]

Table – I: Demographic and Clinical Characteristics of the Study Participants (*n*=50)

Variable	Frequency (n)	Percentage (%)
	(Mean ± SD)	
Age (in years)	41.6 ± 9.3	
Sex		
Male	28	56.00
Female	22	44.00
Occupation		
Sedentary	30	60.00
Manual labor	20	40.00
BMI (kg/m^2)	26.1 ± 2.8	

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Smoking Status		
Smoker	18	36.00
Non-smoker	32	64.00
Comorbidities		
None	26	52.00
Diabetes	12	24.00
Hypertension	8	16.00
Others	4	8.00
Duration of Symptoms		
<3 months	12	24.00
3–6 months	24	48.00
>6 months	14	28.00
Side of Pain		
Left	18	36.00
Right	20	40.00
Bilateral	12	24.00

The most commonly affected disc level was L4–L5 (56%), followed by L5–S1 (36%), while 8% had involvement at other levels. Regarding the type of herniation, protrusion was most common (44%), followed by extrusion (36%), bulge (12%), and sequestration (8%). Associated spinal stenosis was present in 38% of patients, whereas 62% had no stenosis. [Table II]

Table – II: MRI and Diagnostic Findings of the Study Participants (*n*=50)

Category	Frequency (n)	Percentage (%)
Level of Disc Prolapse		
L4–L5	28	56.00
L5–S1	18	36.00
Other	4	8.00
Type of Disc Herniation		
Bulge	6	12.00
Protrusion	22	44.00
Extrusion	18	36.00
Sequestration	4	8.00
Associated Stenosis		
Yes	19	38.00
No	31	62.00

Among the participants, 60% received interlaminar and 40% received transforaminal epidural steroid injections. The most commonly used corticosteroid was methylprednisolone (64%), followed by dexamethasone (36%). A single injection was administered in 60% of patients, while 40% required two injections. [Table III]

Table – III: Details of Epidural Steroid Injection (ESI) among the Study Participants (*n*=50)

Category	Frequency (n)	Percentage (%)
Type of ESI		
Interlaminar	30	60.00
Transforaminal	20	40.00
Steroid Used		
Methylprednisolone	32	64.00
Dexamethasone	18	36.00
Number of Injections		
1	30	60.00
2	20	40.00

The mean VAS score significantly decreased following epidural steroid injection. The baseline mean VAS was 7.6 ± 1.2, which reduced to 4.1 ± 1.3 at 1 week ($p < 0.001$), 3.2 ± 1.1 at 1 month ($p < 0.001$), and 2.8 ± 1.0 at 3 months ($p < 0.001$). These findings indicate a sustained and statistically significant improvement in pain intensity over time after ESI. [Table IV]

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Table – IV: Comparison of Visual Analogue Scale (VAS) Scores before and After ESI

Time Point	Mean VAS Score ± SD	p-value (vs. Pre-ESI)
Before ESI	7.6 ± 1.2	-
1 week after ESI	4.1 ± 1.3	<0.001
1 month after ESI	3.2 ± 1.1	<0.001
3 months after ESI	2.8 ± 1.0	<0.001

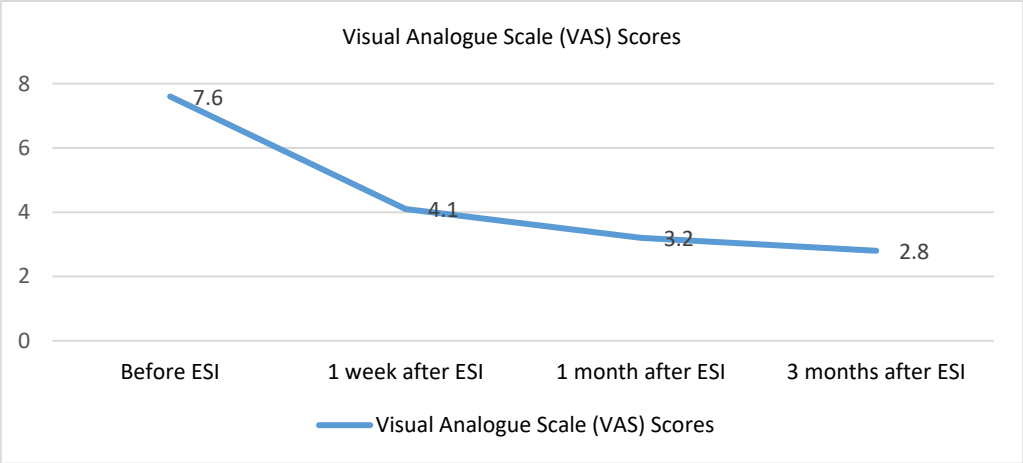

Figure – 1: Mean Comparison of Visual Analogue Scale (VAS) Scores before and After ESI

The mean Oswestry Disability Index (ODI) score showed a marked improvement following epidural steroid injection. The baseline mean ODI was 58.2 ± 10.4%, which significantly decreased to 32.6 ± 9.2% at 1 month ($p < 0.001$) and further to 24.3 ± 8.6% at 3 months ($p < 0.001$). This demonstrates a substantial and statistically significant reduction in functional disability over time after ESI. [Table V]

Table – V: Comparison of Oswestry Disability Index (ODI) Scores before and After ESI

Time Point	Mean ODI Score (%) ± SD	p-value (vs. Pre-ESI)
Before ESI	58.2 ± 10.4	–
1 month after ESI	32.6 ± 9.2	<0.001
3 months after ESI	24.3 ± 8.6	<0.001

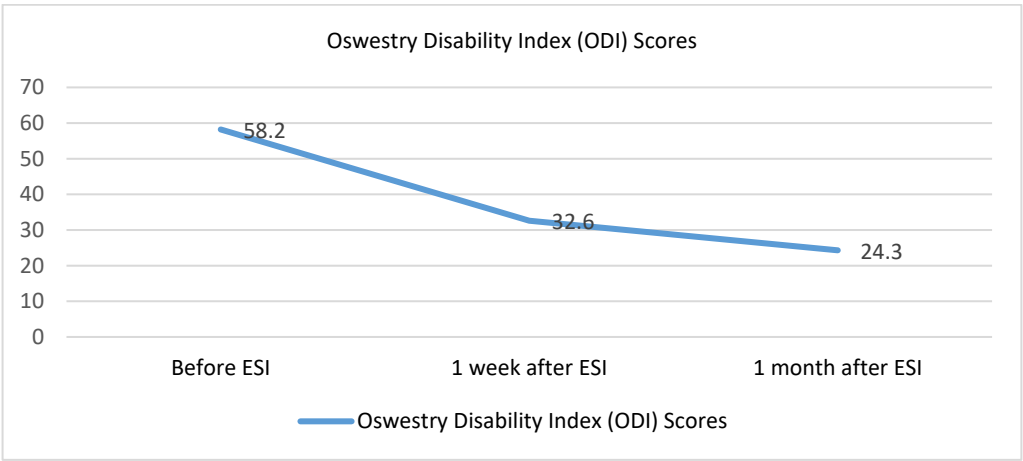

Figure – 2: Mean Comparison of Oswestry Disability Index (ODI) Scores before and After ESI

Postoperative complications were generally uncommon. Headache occurred in 6% of patients, infection and bleeding/hematoma each in 2%, and transient pain in 4%. No cases of neurological worsening were reported. [Table VI]

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Table – VI: Distribution of Complications Following Epidural Steroid Injection (*n*=50)

Complication Type	Frequency (n)	Percentage (%)
Headache	3	6.00
Infection	1	2.00
Neurological worsening	0	0.00
Bleeding/hematoma	1	2.00
Others (transient pain)	2	4.00

Most patients reported positive experiences, with 40% rating their satisfaction as excellent and 36% as good. Fair satisfaction was reported by 16%, while 8% rated their experience as poor. [Table VII]

Table – VII: Overall Satisfaction Level of the Study Participants Following ESI (*n*=50)

Overall Satisfaction	Frequency (n)	Percentage (%)
Excellent	20	40.00
Good	18	36.00
Fair	8	16.00
Poor	4	8.00

DISCUSSION

This study evaluated the role of epidural steroid injection (ESI) in the management of pain and functional impairment among patients with prolapsed lumbar intervertebral disc (PLID). The observed reduction in VAS and ODI scores in this study aligns with previous study findings, which indicate that ESIs provided significant pain relief in patients with lumbar disc herniation, particularly within the first three months of treatment [14]. Similarly, Manchikanti et al. (2014) demonstrated substantial improvements in pain and disability scores among patients receiving interlaminar and transforaminal ESIs, corroborating our results [15]. Consistent with our findings, a randomized controlled trial by Karppinen et al. (2016) demonstrated that ESI resulted in rapid short-term pain reduction and functional recovery in patients with lumbar disc herniation. However, the benefits tended to diminish beyond six months [16]. This transient nature of benefit was also noted in a systematic review, which concluded that ESIs were superior to placebo for short-term relief but did not significantly reduce long-term surgical rates [17]. The predominance of L4–L5 involvement in our study (56%) mirrors global epidemiological data. According to Weber et al. (2011), the L4–L5 level is the most common site of herniation due to high mobility and mechanical stress [18]. Similarly, a Bangladeshi cohort also found that the L4–L5 level was the most frequently affected [19]. Regarding the technique used, our findings show that the interlaminar approach was preferred (60%). This preference is consistent with worldwide clinical practice, as interlaminar injections are technically simpler and widely available compared to transforaminal injections. However, the transforaminal approach often provides superior pain relief due to targeted drug delivery to the affected nerve root [10]. Nevertheless, both techniques appear safe and effective when performed by experienced practitioners. Methylprednisolone was the most commonly used steroid (64%) in our study. Previous trials have found methylprednisolone to be highly effective, although dexamethasone and triamcinolone are also widely employed with comparable outcomes [21]. The choice of steroid may affect the duration of action; overall efficacy is primarily related to injection technique and patient selection [22]. In terms of safety, our study recorded mild complications, including headaches (6%) and transient pain (4%), with no severe adverse events. This finding aligns with those of Buenaventura et al. (2009), who reported low rates of significant complications, thereby reinforcing the safety of ESIs when administered appropriately [23]. However, rare but serious risks, such as infection, hematoma, or neurological injury, have been described in the literature, underscoring the importance of meticulous technique and patient selection [24]. Our results on functional recovery are comparable to those of Ghahreman et al. (2010), who reported marked improvement in ODI scores after ESIs for lumbar disc prolapse [25]. Similarly, significant short-term improvements in function, although the magnitude of the benefit decreased over time [26]. The durability of symptom relief, therefore, remains a debated issue. Still, surgical discectomy remains the gold standard for persistent or severe cases, as supported by the SPORT trial, which demonstrated superior long-term outcomes with surgery compared to non-operative management [27].

Limitations of the study:

The three-month follow-up, lack of a control group, and reliance on subjective measures (VAS, ODI) limit assessment of long-term effectiveness and the true impact of epidural steroid injection.

CONCLUSION AND RECOMMENDATION

Epidural steroid injections (ESIs) play a significant role in the conservative management of prolapsed lumbar intervertebral disc (PLID), offering substantial pain relief and functional recovery. This study demonstrated a marked reduction in VAS and ODI scores over 3 months, with minimal complications and high patient satisfaction. The interlaminar approach with methylprednisolone was most commonly used, showing consistent effectiveness across varied clinical profiles. Given their safety, efficacy, and patient acceptability, ESIs remain a valuable non-surgical option for PLID management. Further

long-term, randomized studies are warranted to optimize treatment protocols and assess sustained outcomes.

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