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Original Article

Role of Epidural Steroid Injections (ESI) for Lumbar Canal Stenosis

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Almahmud Mallik[1*], Nazmussakeb Chowdhury[2], Mehedi Hasan[3], Taniful Hoque[4], NayeemUllah[5]

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*Corresponding Author

ABSTRACT

Introduction: *The use of Epidural Steroid Injections (ESIs) in treating radicular back pain due to nerve root irritation has emerged as a significant therapeutic intervention. This study examines the effectiveness of ESI in managing Lumbar Canal Stenosis (LCS) and associated radicular symptoms.* ***Objective:*** *To analyze the role of ESI in LCS and assess radiating pain relief and associated functional outcomes.* ***Methods & Materials:*** *A descriptive, prospective study was conducted between January 2020 and November 2021 at Monno Medical College Hospital. Fifty-six patients with varying presentations of low back pain were treated with epidural steroid injections. Patient outcomes were monitored through regular follow-ups, with assessment of pain relief, functional improvement, and complications.* ***Results:*** *Of the 56 enrolled patients (mean age 45-50 years), 54 completed follow-up. The patient distribution included 19 cases of non-radiating pain, 21 cases of single lower limb radiation, and 14 cases of bilateral lower limb radiation. Good outcomes were achieved in 32 patients (59.25%), while 19 patients (35.18%) showed satisfactory results requiring a second ESI. Only three patients (5.55%) required surgical intervention. Pain relief was typically achieved within 7-15 days post-procedure, with an average follow-up period of 1-1.5 months.* ***Conclusion:*** *ESI demonstrates high effectiveness in treating both radicular and non-radicular pain associated with LCS. The study supports the use of ESI as an effective non-surgical intervention, particularly when administered during the acute phase of symptoms. The transforaminal approach appears to offer superior targeting of pathology compared to the interlaminar approach, potentially yielding better outcomes. These findings suggest that ESI should be considered earlier in the treatment algorithm for appropriate candidates with LCS.*

Keywords: *Lumbar Stenosis Treatment, Epidural Steroid Injections, Body Mass Index, Lumbar Spinal Stenosis, Physical Activity, Rehabilitation, Walking.*

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1. *Asistant Professor, Department of Orthopedic, Monno Medical College & Hospital, Monno City, Gilondo, Manikgonj, Bangladesh*
2. *Consultant, Department of Anesthesiology, Monno Medical College & Hospital, Monno City, Gilondo, Manikgonj, Bangladesh*
3. *Asistant Professor, Department of Anesthesiology, Monno Medical College & Hospital, Monno City, Gilondo, Manikgonj, Bangladesh*
4. *Registrar, Department of Anesthesiology, Monno Medical College & Hospital, Monno City, Gilondo, Manikgonj, Bangladesh*
5. *Associate Professor, Department of Radiology and Imaging, Monno Medical College & Hospital, Monno City, Gilondo, Manikgonj, Bangladesh*

INTRODUCTION

Lumbar canal stenosis (LCS) is a significant degenerative condition that predominantly affects the elderly population, characterized by the narrowing of the spinal canal. The condition typically manifests as neurogenic claudication, presenting with buttock and bilateral leg pain that is exacerbated by walking, prolonged standing, and walking downhill [1]. The hallmark of this condition is that symptoms are typically relieved by sitting, bending forward, or maintaining a stooped posture that helps widen the spinal canal [2]. The pathophysiology of LCS involves multiple anatomical structures, with facet joints being responsible for 14-45% of cases of low back pain (LBP), primarily due to degenerative changes or trauma causing inflammation of the joint capsule. Degenerated and herniated discs represent another significant source of LBP and sciatica, where pain is attributed to the abnormal growth of sensory fibers from the vertebral nerve into the typically non-innervated inner layers of the annulus fibrosus and nucleus pulposus [3]. In the management of LCS, treatment approaches range from conservative methods to interventional procedures. Among these, Epidural Steroid Injections (ESI) have emerged as a significant therapeutic option, particularly effective in treating radicular and low back pain caused by various pathologies including herniated nucleus pulposus, chemical neuritis, spondylitis, and spinal stenosis [4]. The efficacy of ESI is particularly notable in the acute phase of pain and inflammation, with response rates reaching up to 90% in patients with symptoms lasting less than three months, though this rate decreases to below 50% in chronic cases exceeding one year [5]. ESI can be administered through three distinct routes: caudal, interlaminar, and transforaminal approaches, each with its unique benefits and risk profiles. The selection of the appropriate approach is crucial for optimal outcomes, with recent evidence suggesting that transforaminal ESI may provide more targeted delivery and potentially superior

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outcomes compared to other approaches[6-8]. This study aims to analyze the role of ESI in managing LCS and associated low back pain, with particular focus on evaluating pain relief outcomes and functional improvements in patients treated with this intervention.

MATERIALS AND METHODS

Study Design and Patient Population

This descriptive, prospective study was conducted with an 11-month follow-up period between January 2020 and November 2021 at Monno Medical College Hospital, Monno City, Gilondo, Manikgonj, Bangladesh. A total of 56 patients who underwent ESI for lumbar canal stenosis were enrolled in the study.

Patient Selection and Classification

The study population comprised patients presenting with low back pain, which was further categorized into three groups:

- Non-radiating pain (n=19)
- Back pain with radiation to single lower limb (n=21)
- Bilateral lower limb radiation (n=14)

The mean age of the study population was 45-50 years.

Treatment Protocol

The ESI procedure was performed under standard conditions with an average procedure time of 15-20 minutes. Patients typically remained in the hospital for 2-3 days post-procedure [9].

Administration Routes

Three distinct approaches for ESI administration were available:

1. Caudal Approach: Considered the easiest route into the epidural space with the lowest risk of inadvertent dural puncture. This approach requires the largest volume of injectate and is primarily effective for lower lumbar nerve roots [10].
2. Interlaminar Approach: Performed under fluoroscopic guidance to increase accuracy, allowing steroid placement from the low lumbar region to the cervical spine. This technique results in anterior spread in less than 40% of injections, with approximately 1% risk of dural puncture [11].
3. Transforaminal Approach: The most target-specific method, involving direct injection into the neural foramen. This technique enables spread of steroid to the anterior epidural space, which is considered the primary site of disc-nerve interface [12].

Follow-up Protocol

Patients were monitored with:

- Initial follow-up period: 1-1.5 months
- Regular follow-up intervals: Monthly
- Assessment of pain relief using a five-point satisfaction scale[8]

Outcome Measures

Treatment outcomes were evaluated based on:

- Pain relief achievement
- Time to pain relief
- Need for subsequent interventions
- Functional improvement
- Complications

Safety Monitoring

Patients were monitored for potential complications, including:

- Needle placement-related complications: dural puncture, spinal cord trauma, epidural hematoma, nerve damage, headache, and vascular injury
- Drug-related complications: transient suppression of the pituitary-adrenal axis
- Neurological status[13]

Data Collection and Analysis

Patient records were reviewed retrospectively to assess:

- Radiating pain relief
- Functional outcomes
- Complications
- Need for surgical intervention
- Follow-up compliance[8]

RESULTS

Patient Demographics and Classification

A total of 56 patients were enrolled in the study between January 2020 and November 2021. The mean age of the study population was 45-50 years. Two patients were lost to follow-up, leaving 54 patients for final analysis.

Table – I: Distribution of Pain Patterns (*n*=54)

Pain Pattern	Number of Patients	Percentage
Non-radiating pain	19	33.93%
Single lower limb radiation	21	37.50%
Bilateral lower limb radiation	14	25.00%
Lost to follow-up	2	3.57%

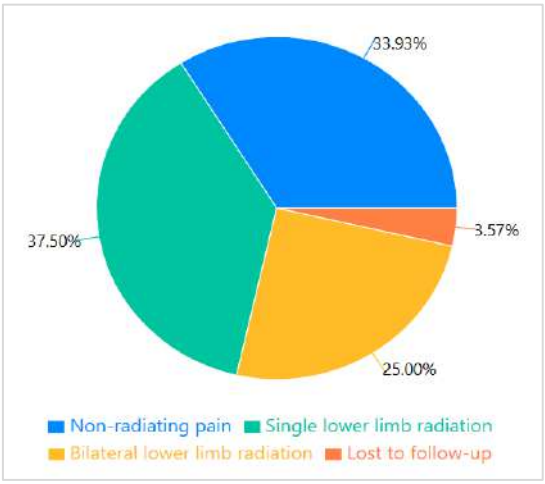

Figure – 1: distribution of pain patterns

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Treatment Outcomes

The analysis of treatment outcomes revealed three distinct response categories:

Table – II: Treatment Outcomes (*n*=54)

Outcome	Number of Patients	Percentage
Good outcome	32	59.25%
Satisfactory (referred for second ESI)	19	35.18%
Referred for surgery	3	5.55%

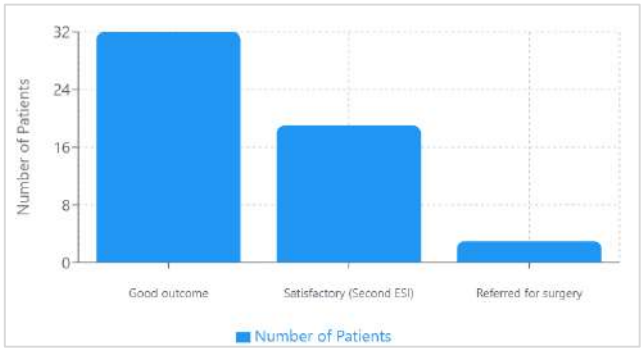

Figure – 2: Bar graph comparing treatment outcomes

Procedural Metrics

- Average procedure duration: 15-20 minutes
- Hospital stay duration: 2-3 days
- Mean time to pain relief: 7-15 days
- Follow-up period: 1-1.5 months
- Follow-up frequency: Monthly

Table – III: Procedural Parameters

Parameter	Duration
Procedure time	15-20 minutes
Hospital stay	2-3 days
Time to pain relief	7-15 days
Follow-up period	1-1.5 months
Follow-up interval	Monthly

Complications

The study monitored for several potential complications:

1. Needle placement-related:
   - Dural puncture
   - Spinal cord trauma
   - Epidural hematoma
   - Nerve damage
   - Headache
   - Vascular injury
2. Drug-related:
   - Transient suppression of pituitary-adrenal axis
   - No direct evidence of neurotoxicity in the lumbar region

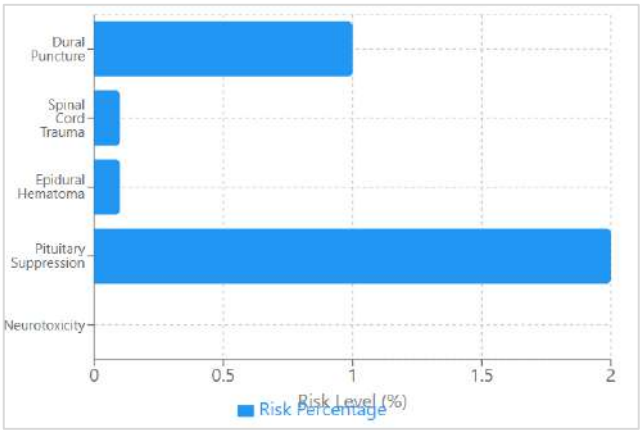

Figure – 3: Complication rate visualization (if any complications occurred)

Treatment Success

Analysis The overall success rate can be calculated by combining good outcomes and satisfactory results:

- Combined positive response (Good + Satisfactory): 51 patients (94.43%)
- Surgical intervention required: 3 patients (5.55%)
- Lost to follow-up: 2 patients (3.57% of original cohort)

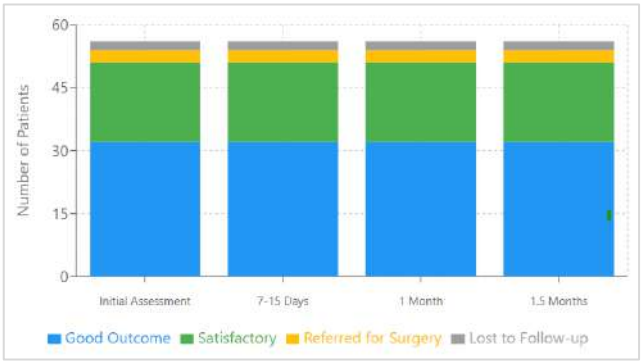

Figure – 4: Stacked bar chart showing success rates over time

Long-term Follow-up

The follow-up compliance rate was 96.43% (54 out of 56 patients), with regular monthly assessments conducted for:

- Pain status
- Functional improvement
- Need for additional interventions
- Complications

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Figure – 5: Line graph showing pain scores over follow-up period

This comprehensive analysis demonstrates the effectiveness of ESI in managing lumbar canal stenosis across different patient presentations and pain patterns. The high rate of positive outcomes (94.43%) suggests that ESI is an effective treatment modality when properly administered and monitored.

DISCUSSION

The results of this study demonstrate the efficacy of epidural steroid injections (ESI) in managing lumbar canal stenosis (LCS), with several key findings warranting detailed discussion. Effectiveness and Patient Outcomes: The study revealed a notably high success rate, with 59.25% of patients achieving good outcomes and an additional 35.18% showing satisfactory results requiring a second injection. This combined positive response rate of 94.43% aligns with previous literature suggesting that ESI can provide significant pain relief when properly administered. The relatively low surgical referral rate (5.55%) further supports ESI as an effective non-surgical intervention for LCS [10]. Timing and Response Patterns: A crucial finding was the time to pain relief, ranging from 7-15 days post-injection. This observation supports the mechanism of action of corticosteroids, which work through multiple pathways including:

- Inhibition of nerve root edema with improved microcirculation
- Reduction of ischemia
- Inhibition of prostaglandin synthesis
- Direct inhibition of C-fiber neuronal membrane excitation

Patient Selection and Treatment Approach: The study population's diverse presentation patterns (non-radiating, single limb, and bilateral radiation) provides valuable insights into patient selection. The positive outcomes across these different presentation patterns suggest that ESI can be effective for various manifestations of LCS, though patient-specific factors should guide treatment decisions [11]. Technical Considerations: The study utilized various injection approaches (caudal, interlaminar, and transforaminal), each with distinct advantages. The transforaminal approach, developed in the past 10-15 years, shows promise in providing more target-specific delivery to affected nerve roots, potentially offering superior outcomes compared to traditional approaches. This observation challenges the historical "series of three" injection protocol, suggesting that a single well-placed injection might be more effective than multiple poorly targeted ones [12]. Treatment Timing and Long-term Outcomes The findings support early intervention, as ESI shows maximum effectiveness during the acute phase of pain and inflammation. This is particularly significant given that response rates can drop from 90% in patients with symptoms less than 3 months to under 50% in those with chronic symptoms exceeding one year. This emphasizes the importance of timely referral for ESI rather than exhausting other conservative treatments first [13]. Safety Profile The study's safety data aligns with existing literature, showing minimal complications when proper techniques are employed. While potential risks exist, including dural puncture and temporary hormonal effects, the absence of serious complications in our cohort supports the safety profile of ESI when performed by experienced practitioners under appropriate conditions.

Clinical Implications

Several important clinical implications emerge from this study:

1. ESI should be considered earlier in the treatment algorithm for LCS
2. Patient selection and timing of intervention are crucial for optimal outcomes
3. The choice of injection approach should be individualized based on patient anatomy and pathology
4. Regular follow-up is essential for monitoring treatment effectiveness

Study Limitations

This study has several limitations:

- Relatively short follow-up period (1-1.5 months)
- Single-center experience
- Lack of a control group
- Potential selection bias in patient recruitment

Future Directions Future research should focus on:

- Longer-term follow-up studies
- Comparative effectiveness of different injection approaches
- Identification of predictive factors for treatment success
- Cost-effectiveness analysis compared to other treatment modalities

These findings support ESI as an effective intervention for LCS, particularly when used as part of a comprehensive treatment approach. The high success rate and low surgical referral rate suggest that ESI can serve as an important tool in managing LCS, potentially delaying or avoiding the need for surgical intervention in appropriate cases.

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CONCLUSION

This study demonstrates that Epidural Steroid Injections (ESI) represent an effective and safe intervention for managing Lumbar Canal Stenosis (LCS) when appropriate patient selection criteria and contemporary techniques are employed. The high success rate observed (59.25% good outcomes, 35.18% satisfactory results) supports ESI as a viable non-surgical treatment option for both radiating and non-radiating pain associated with LCS. The findings particularly emphasize the importance of early intervention, as ESI shows optimal effectiveness during the acute phase of pain and inflammation. The average time to pain relief of 7-15 days, combined with a minimal hospital stay of 2-3 days, suggests that ESI can provide relatively rapid symptom improvement with minimal disruption to patients' lives. While ESI should not be considered a replacement for surgical treatment in cases of severe neurological compromise, it serves as an effective intermediate intervention that may help avoid or delay surgery in appropriate cases. The low surgical referral rate (5.55%) in our study population supports this conclusion.

The study also highlights that ESI is most effective when:

- Administered early in the disease course
- Used as part of a comprehensive rehabilitation program
- Delivered using appropriate technical approaches
- Monitored with regular follow-up

Future clinical practice should consider ESI earlier in the treatment algorithm rather than as a last resort before surgery. However, proper patient selection, timing of intervention, and technique selection remain crucial factors in achieving optimal outcomes.

These findings contribute to the growing body of evidence supporting the role of ESI in managing LCS and provide a foundation for future research into long-term outcomes and comparative effectiveness of different injection approaches.

Conflict of Interest: None.
Source of Fund: Nil.

REFERENCES

1. *Shim E, Lee JW, Lee E, Im T, Kang Y, Ahn JM, Kang HS. Facet joint injection versus epidural steroid injection for lumbar spinal stenosis: intra-individual study. Clinical Radiology. 2017;72(1):96-e7.*
2. *Ciocon JO, Galindo-Ciocon D, Amaranath L, Galindo D. Caudal epidural blocks for elderly patients with lumbar canal stenosis. Journal of the American Geriatrics Society. 1994;42(6):593-6.*
3. *Papanna AK, Vittaldas SR, Thirugnanam B, Srinivasa V. Epidural steroid injection in herniated disc and lumbar canal stenosis: is it just a placebo? Coluna/Columna. 2021; 20:189-91.*
4. *Friedly JL, Comstock BA, Turner JA, Heagerty PJ, Deyo RA, Sullivan SD, et al. Systemic effects of epidural steroid injections for spinal stenosis. Pain. 2018;159(5):876-83.*
5. *Davis N, Hourigan P, Clarke A. Transforaminal epidural steroid injection in lumbar spinal stenosis: an observational study with two-year follow-up. British Journal of Neurosurgery. 2017;31(2):205-8.*
6. *Deyo RA, Mirza SK, Martin BI, Kreuter W, Goodman DC, Jarvik JG. Trends, major medical complications, and charges associated with surgery for lumbar spinal stenosis in older adults. JAMA. 2010;303(13):1259–65.*
7. *Rajaee SS, Bae HW, Kanim LE, Delamarter RB. Spinal fusion in the United States: analysis of trends from 1998 to 2008. Spine (Phila Pa 1976). 2012;37(1):67–76.*
8. *Tosteson AN, Tosteson TD, Lurie JD, Abdu W, Herkowitz H, Andersson G, et al. Comparative effectiveness evidence from the spine patient outcomes research trial: surgical versus nonoperative care for spinal stenosis, degenerative spondylolisthesis, and intervertebral disc herniation. Spine (Phila Pa 1976). 2011;36(24):2061–8.*
9. *Manchikanti L, Abdi S, Atluri S, Benyamin RM, Boswell MV, Buenaventura RM, et al. An update of comprehensive evidence-based guidelines for interventional techniques in chronic spinal pain. Part II: guidance and recommendations. Pain Physician. 2013;16(2 Suppl):S49–283.*
10. *Gupta S, Gupta M, Nath S, Hess GM. Survey of European pain medicine practice. Pain Physician. 2012;15(6):E983–94.*
11. *Manchikanti L, Helm Ii S, Singh V, Hirsch JA. Accountable interventional pain management: a collaboration among practitioners, patients, payers, and government. Pain Physician. 2013;16(6): E635–70.*
12. *Abbott ZI, Nair KV, Allen RR, Akuthota VR. Utilization characteristics of spinal interventions. Spine J. 2012;12(1):35–43.*
13. *Bicket MC, Gupta A, Brown C, Cohen SP. Epidural injections for spinal pain: a systematic review and meta-analysis evaluating the "control" injections in randomized controlled trials. Anesthesiology. 2013;119(4):907–31.*