International Journal of Orthopaedics Sciences

**E-ISSN:** 2395-1958
**P-ISSN:** 2706-6630
IJOS 2025; 11(2): 13-17

www.orthopaper.com
Received: 12-01-2025
Accepted: 18-02-2025

**Dr. Bijay Kumar Shrestha**
Consultant, Department of Orthopaedic, Kathmandu University, Kathmandu, Nepal

**Dr. Bimal Kumar Pandey**
Associate Professor Department of Orthopaedic, Kathmandu University, Kathmandu, Nepal

**Dr. Rabindra Lal Pradhan**
Professor Department of Orthopaedic, Kathmandu University, Kathmandu, Nepal

**Dr. Prakash Sitoula**
Professor Department of Orthopaedic, Kathmandu University, Kathmandu, Nepal

**Dr. Krishna Raj Khanal**
Assistant Professor Department of Orthopaedic, Kathmandu University, Kathmandu, Nepal

**Corresponding Author:**
**Dr. Bijay Kumar Shrestha**
Consultant, Department of Orthopaedic, Kathmandu University, Kathmandu, Nepal

# Efficacy of ultrasound-guided caudal epidural steroid injection in prolapsed intervertebral disc and canal stenosis in lower lumbar region

**Bijay Kumar Shrestha, Bimal Kumar Pandey, Rabindra Lal Pradhan, Prakash Sitoula and Krishna Raj Khanal**

**DOI:** https://www.doi.org/10.22271/ortho.2025.v11.i2a.3739

**Abstract**
**Introduction:** Lower back pain is mainly accounted by neurological back pain and disc herniation, which results in physical limitations. This study aimed to evaluate efficacy of Caudal epidural steroid injection (CESI) under ultrasound guidance in patients with lumbar disc herniation (LDH) and lumbar canal stenosis.
**Methodology:** This prospective observational interventional study was conducted at Kathmandu Medical College Teaching Hospital. All patients 20 years and above diagnosed with low back pain with radiculopathy and/or neurological claudication were included in the study. Each patient was injected with a mixture of 2ml (80 mg) of Depomedrol, 2ml of 2% lignocaine, and 6ml of normal saline under ultrasound guidance. Patients were observed for 30 minutes after injection and then discharged. Severity of pain and disability were assessed using visual analog scale (VAS), Numeric Pin Rating Scale (NRS) and Oswestry Disability Index (ODI) before the injection; and at 3 and 12 weeks post injection.
**Results:** Out of 56 patients, 3 patients were lost to follow up and remaining 53 (29 males and 24 females) who completed their follow-up were included. Mean age was 45.9±16.1 years. L4-L5 and L5-S1 levels were involved in 25 (47.2%) and 9 (17%) respectively. 19 (17%) patients had involvement of both levels. 62.3% (n=33) had LDH and 37.7% (n=20) had spinal canal stenosis. Mean pre-injection ODI and at 3 weeks and 12weeks follow-up were 50.5±14.2, 30.30±12.52 and 29.64±12.12 respectively. Mean VAS pre-injection and at follow-up of 3 weeks and 12 weeks were 2.9±0.7, 1.30±0.54 and 1.25±0.51 respectively ($p$-value <0.05).
**Conclusion:** Ultrasound-guided CESI was found to be a quick, safe and effective technique for short-term pain control in patients with lower lumbar disc herniation and spinal canal stenosis in the present study.

**Keywords:** Ultrasound guided caudal epidural steroid, Oswestry disability index, prolapsed intervertebral disc, visual analog score

## Introduction
Low back pain with or without sciatica resulting from prolapsed lumbar intervertebral disc is a common problem for physical limitations and absence from daily work globally. Approximately Eighty percent of the general population are affected at some point in their lifetime, among which 15% of causes of neurological back pain is secondary to lumbar disc herniation [1-3]. The annual prevalence of lumbar sciatica varies from 9.9% to 25% in the general population [4].
Generally in young adults, the common cause for back pain with radiculopathy is prolapsed intervertebral disc or disc degeneration whereas the elderly population have multifactorial etiology such as disc prolapse, thickened flavum, facet joints hypertrophy, spinal instability [5]. Disc herniation is broadly defined as a localized or focal displacement of disc material beyond the intervertebral disc space [6]. With the advancement in imaging techniques, lumbar disc herniation is increasingly recognized in symptomatic and asymptomatic individuals [7]. Similarly with aging, degenerative changes progress resulting into central canal stenosis in eldery and central canal is further narrowed by posterior impingement from facet joint osteophytes and the hypertrophied ligamentum flavum.

40% of spinal stenosis result from hypertrophy of the soft tissues. vertebral foramin stenosis occurs most commonly in the lower lumbar region with common involvement of fifth lumbar nerve root compression [8].

In a tertiary care center in Kathmandu Nepal, among total 48.5% of patients undergoing MRI had low back pain with radiculopathy [9]. According to the European guidelines, low back pain with sciatica is better treated with spinal steroid injections and surgeries in which other conservative methods are not useful [10].

Since 1885 from when Corning advent epidural analgesia, many drugs have been prescribed in the management of back pain [11]. Lievre *et al*. injected hydrocortisone injection into the epidural space via first sacral foramina and reported benefit in his 20 patients [12]. different techniques for epidural steroid injection are interlaminar, caudal and transforaminal routes. In different studies the efficacy of epidural steroid injection via different routes contribute pain management strategies for patients suffering from back pain with radiculopathy [1, 13, 14]. With the accurate placement of the needle epidural steroid injection (ESI) is secure and has minimal risk of coincidental dural puncture [15]. Fluoroscopy-guided injection is the gold standard for giving epidural steroid, ultrasound-guided can also be one modality of delivering the steroid in epidural space. Ultrasound (US) is excellent in localizing and identifying sacral hiatus and guiding the needle trajectory into the caudal epidural space with comparable treatment outcomes as with Fluoroscopy-guided CESI [12, 13].

Factor such as severity of disc herniation, patient demographics and associated comorbidities can influence the treatment outcome. There is no preferred route of epidural steroid injection for management of radicular low back pain. This study is done to assess the effectiveness of US guided caudal epidural steroid injection in patients with low backache with lower lumbar prolapsed intervertebral disc.

## Methodology

This prospective observational interventional study was conducted at Kathmandu Medical College Teaching Hospital, Sinamangal, Kathmandu from February 2022 to July 2023 in Department of Orthopaedics. All patients 20 years and above diagnosed with low back pain with radiculopathy and/or neurological claudication were included in the study. The X-ray, MRI of lumbosacral spine and blood investigations (PT/INR, Random blood sugar and serology) were done in every case included in the study. The inclusion criteria encompassed patients with single or multilevel disc herniation presented with signs and symptoms of nerve root irritation and failure of conservative treatments (bed rest, physiotherapy, traction). Patients with sequestrated discs, motor deficits (motor power < 4/5), cauda equina syndrome, segmental instability, allergy to local anesthetic or corticosteroids, psychogenic disorders, tumors, deformities, spinal infections, and patients who had lumbar surgery in the past were excluded from the study.

All patients were subjected to detailed clinical history assessment and physical examination. All selected patients were informed about the potential benefits and risks associated with the procedure and treatment. The informed written consents were taken from the patients before inclusion in the study. Thus, 56 patients were enrolled for the study. Each patient was injected with a mixture of 2ml (80 mg) of Depomedrol, 2ml of 2% lignocaine, and 6ml of normal saline under ultrasound guidance. Patients were observed for 30 minutes after injection and then discharged. Severity of pain was assessed using visual analog scale (VAS) and Numeric Pain Rating Scale (NRS) whereas disability was evaluated with Oswestry Disability Index (ODI) Nepali version before the injection; and at 3 and 12 weeks post injection.

### Procedure

The procedure was performed in the procedure room using the ultrasound instrument with a linear probe of 6 to 12 MHz. The patient was placed in prone position and the set of required equipment were arranged on a table covered with a sterile drape (figure I). The sacrococcygeal area was painted with 10% povidone-iodine solution and ultrasound transducer wrapped with sterail glove placed transversely at the midline over the sacral region to obtain the transverse view of the sacral hiatus. In this view, two hyperechoic sacral cornua, seen as inverted 'U' shaped and band-like hyperechoic structures, superficial one is the sacrococcygeal ligament (SCL) and the deep one is the dorsal surface of sacral bone. The hypoechoic region in between represent the sacral hiatus. At this level, to obtain the longitudinal view of the sacral hiatus the ultrasound transducer is 90º rotated (figure II). Local anaesthesia (2-3ml 2% lignocaine) is injected into skin and subcutaneous tissue. The spinal needle within the plane technique was inserted in 45º with a probe which can be visualized in real-time, piercing the SCL, entering sacral hiatus (A spinal needle of 22-gauge and 3.5-inch was used) there is a feeling of loss of resistance while penetrating sacrococcygeal ligament and then the needle was more advanced into the sacral canal under real-time US guidance (figure III). The mixture of the solution as mentioned earllier was injected once the position was confirmed and patient was discharged after 30 mins of observation

The patient was reassessed on follow-up in 3 weeks, 12 weeks. The disability outcome were evaluated with the help of ODI and improvement in pain intensity was mesured with the help of VAS and NRS.

All the required data was collected, entered in Microsoft Excel and analyzed in Statistical Package for the Social Sciences (SPSS) version 23. Data were presented in terms of mean and standard deviation, frequency and percentages. Descriptive (mean, standard deviation) and inferential statistics (paired t test) were used. The p value < 0.05 was considered to be statistically significant.

**Fig 1:** Requirements for Caudal Epidural Steroid Injection, Spinal needle no. 22G, 5 cc syringe, 10 cc syringe, 20 cc syringe

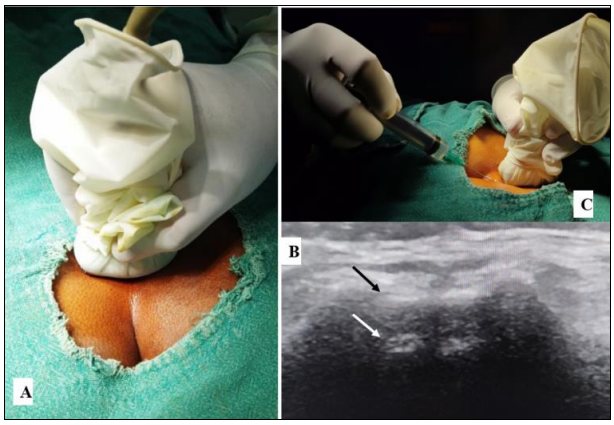


**Fig 2:** A: US probe position, B: US image of the sacrococcygeal ligament (SCL) and dorsal surface of sacral bone(arrow), C: Local infiltration of 2% lignocaine

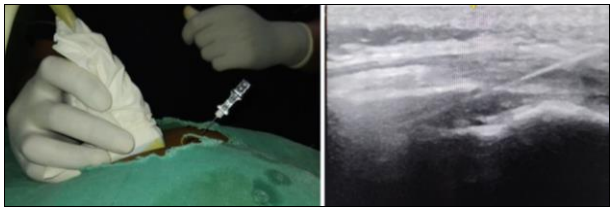

**Fig 3:** Spinal needle placed into epidural space

## Results

Out of 56 patients, three patients were lost in follow up and only 53 completed their follow up. The mean age of the patient was 45.89±16.04 years and age ranged from 21 years to 80 years. Most of the patients 19/53 (35.8%) belonged to the age group of 36-50 years (Table 1). There were 29 males (54.7%) and 24 females (45.3%) (Table 2). Among the total cases in study, 47.2%(n=25) had L4-L5 and 35.8% (n=9) had L5-S1 level involvement and 17% patients had involvement of both levels (Table 3**).** Similarly, 62.3% (n=33) had PIVD and 37.7% (n=20) had spinal canal stenosis. Pre infiltration mean ODI was 50.53±14.15 ranged from 18-82%, 58.5%(n=31) cases had severe disability, 18.9% (n=10) had crippled, 8.9% (n=10) had moderate disability whereas only one case was bed bound and one had mild disability (Table 5). Similarly, pre infiltration mean VAS was 7.60 ± 1.32 and 75.5% (n=40) had severe pain, 24.5% (n=13) had moderate pain, (Table 6). In post infiltration period, mean ODI was 30.30±12.52 and 29.64±12.12 in three weeks and twelve weeks follow up respectively with p value < 0.05 which was statistically significant. There was also decrease in pain score with mean VAS of 2.83±1.79 and 2.51±1.65 in three weeks and twelve weeks follow up respectively with p value < 0.05 which was also statistically significant (Table 7).

**Table 1:** Age distribution of patients (n=53)

| Age in years | Number of patients(n=53) | Percentage (%) |
|---|---|---|
| 20-35 | 16 | 30.2 |
| 36-50 | 19 | 35.8 |
| 51-65 | 10 | 18.9 |
| 66-80 | 8 | 15.1 |
| Total | 53 | 100 |

**Table 2:** Gender distribution of patients(n=53)

| Gender | Number of patients (n=53) | Percentage (%) |
|---|---|---|
| Male | 29 | 54.7 |
| Female | 24 | 45.3 |
| Total | 53 | 100 |

**Table 3:** Level of disc in lumbar spine (n=53)

| Disc level | Number of patients(n=53) | Percentage (%) |
|---|---|---|
| L4-L5 | 25 | 47.2 |
| L5-S1 | 9 | 17 |
| Both | 19 | 35.8 |
| Total | 53 | 100 |

**Table 4:** Duration of symptoms (n=53)

| Duration of symptoms | Number of patients(n=53) | Percentage (%) |
|---|---|---|
| 3-9 months | 5 | 9.4 |
| 9-12 months | 11 | 20.8 |
| > 12 months | 37 | 69.8 |
| Total | 53 | 100 |

**Table 5:** Pre infiltration Oswestry Disability Index (n=53)

| Grade | Number of patients(n=53) | Percentage (%) |
|---|---|---|
| 0-20%: Minimal disability | 1 | 1.9 |
| 21%-40%: Moderate disability | 10 | 8.9 |
| 41%-60%:Severe disability | 31 | 58.5 |
| 61%-80%: Crippled | 10 | 18.9 |
| 81%-100%: Bed-bound | 1 | 1.9 |
| Total | 53 | 100 |

**Table 6:** Pre infiltration VAS score(n=53)

| VAS score | Number of patients(n=53) | Percentage (%) |
|---|---|---|
| Mild | 0 | 0 |
| Moderate | 13 | 24.5 |
| Severe | 40 | 75.5 |
| Total | 53 | 100 |

**Table 7:** Mean ODI and VAS of Pre and Post CESI and P value (n=53)

| Participants | Pre infiltration | Post infiltration (3rd week) | p value |
|---|---|---|---|
| ODI | 50.53±14.15 | 30.30±12.52 | 0.001 |
| | | Post infiltration (12th week) | |
| | | 29.64±12.12 | 0.001 |
| | Pre infiltration | Post infiltration (3rd week) | |
| VAS | 7.60 ± 1.32 | 2.83±1.79 | 0.001 |
| | | Post infiltration (12th week) | |
| | | 2.51±1.65 | 0.001 |

## Discussion

Low back pain with sciatica caused by prolapsed lumbar intervertebral disc and canal stenosis is a significant medical and socioeconomic problem. Occupations requiring heavy weight-lifting by laborers and farming were deemed a major risk for disc prolapse. Several conservative approaches like activity modification, lumbar tractions, physiotherapy techniques, spinal manipulations have been used for LBP but has inconsistent results [16]. Epidural steroid injection is used to treat pain caused by irritation and inflammation of spinal nerve roots for many years and significant improvement in pain scores has been reported [17].

Although fluoroscopy guided procedure was considered as gold standard [18], radiation exposure to surgeon and patient is a concern. In this study, ultrasound guided caudal epidural steroid injection was selected due to its efficacy, safety and cost effectiveness. The mixture of 80 mg Depomedrol (methyl prednisolone), two ml of 2% lignocaine and calculated volume of distilled normal saline was injected. In adults, normally one to two mL of local anesthetic agent is typically used per segment to be blocked. For example, to achieve a T4 sensory level from an L4- L5 injection, about 12-24 mL volume is require [19]. The local anaesthetic agent relieves

pain immediately and steroid with its potent anti-inflammatory properties reduces edema and helps to achieve long term pain relief. Literatures are available that have compared and correlated the efficacy and outcome of epidural steroid injection via different route in management of LBP with radiculopathy. Similarly, comparative study of Ultrasound guided and fluoroscopy guided CESI are also avilable. Hazra and his team had comparative study in total of 50 cases focusing on the time needed for correct placement of needle and clinical effectiveness in patients with chronic LBP with radiculopathy. They concluded that USG guided injection were the safe and efficient alternative for achieving faster needle placement in caudal epidural space [20].

The mean age of the patient was 45.89±16.04 years and age ranged from 21 years to 80 years. It occurs most commonly in fourth to fifth decades of life and more common in men than women (3:1 ratio) [3]. Kirkaldy-Willis and Farfan divided degenerative process into three distinct phases: dysfunction (15-45years), instability (35-70years) and stabilization (> 60 years) which is seen in individuals of different age group [21]. There were 29 males (54.7%) and 24 females (45.3%) in this study. Rayegani *et al*. [22] had similar gender distribution like that of the present study with 60% of patients being male. The slightly higher male frequency in this study could be male predominant society or males being more active in outdoor activities. However, in some other studies [23, 24], females were more in number which could be related to growing gender equalities and equal involvement in activities. Most of the patients had chronic LBP with radiculopathy.

The most common site of lumbar disc herniation is at lower lumbar vertebral level at L4-L5 and L5-S1 [3]. Similarly, in this study 47.2%(n=25) had L4-L5 and 35.8% (n=9) had L5-S1 level involvement and both level involvement was 17%. Shrestha and team [14], had similar result regarding disc herniation, 68.57% of patients had disc herniation at L4-L5 level and 20% had at L5-S1 level. Only 5.71% have both level involved [14]. Similarly, recent study by Budrovac *et al*. [25] reported that most of the participants had L5/S1 nerve root involvement with disc herniation at L4-L5 and L5-S1 level.

Among the total cases 62.3% (n=33) had PIVD and 37.7% (n=20) had spinal canal stenosis. In this study there was significant improvement in ODI and VAS in post infiltration period at 3 week and 12 week follow up. Similarly, Sudhir Singh *et al*. considered a decrease in post-injection VAS by two scales, or 50% pain relief within three weeks of epidural steroid, or 40% reduction of Oswestry Disability Index (ODI) as significant [26].

## Conclusion

USG guided Caudal epidural steroid injection is a simple, cost effective treatment for chronic low back pain with radicular pain due to lower Lumbar PIVD and canal stenosis. This study found to be effective for short-term pain control in patients with lower lumbar disc herniations and spinal canal stenosis. It is a new and quick technique free from radiation hazard, and can be practiced on an OPD basis. It deserves a wider use and scientific assessment

**Conflict of Interest:** Not available.

**Financial Support:** Not available.

## Reference

1. Pandey RA. Efficacy of Epidural Steroid Injection in Management of Lumbar Prolapsed Intervertebral Disc: A Comparison of Caudal, Transforaminal and Interlaminar Routes. J Clin Diagn [Internet]. 2016 [cited http://jcdr.net/article_fulltext.asp?issn=0973 2021 Jul 21]; Available 709x&year=2016&volume=10&issue=7&page=RC05&issn=0973-709x&id=8127.
2. Rivera CE. Lumbar Epidural Steroid Injections. Phys Med Rehabil Clin N Am. 2018;29:73-92.
3. Dunn R, Kruger N. The back In: Bloom A, Warwick D System of Orthopaedics and Trauma. 10th ed. Boca Raton: CRC press; 2018:489-530.
4. Van Boxem K, Cheng J, Patijn J, Van Kleef M, Lataster A, Mekhail N, *et al*. 11. Lumbosacral Radicular Pain: Lumbosacral Radicular Pain. Pain Practice. 2010;10:339-358.
5. Behera DrS, Mohanty S. Clinical outcome of caudal epidural steroid injection in lumbosacral radiculopathy. Int J Orthop Sci. 2021;7:13-17.
6. Fardon DF, Williams AL, Dohring EJ, Murtagh FR, Rothman SL, Sze GK, *et al*. Lumbar disc nomenclature: version 2.0: Recommendations of the combined task forces of the North American Spine Society, the American Society of Spine Radiology and the American Society of Neuroradiology. TSJ. 2014 Nov 1;14(11):2525-2545.
7. Saal Ja, Saal Js. Nonoperative treatment of herniated lumbar intervertebral disc with radiculopathy: an outcome study. Spine. 1989 Apr 1;14(4):431-437.
8. Christopher BM, Andrew S, Steven GR. Lumbar Disc Herniation In: Herkowitz HN, Garfin SR, Eismont FJ, Bell GR, Balderston RA. Rothman-Simeone The Spine, 6th edition. Philadalphia: Elsevier. Elsevier Health Sciences; 2011, 887-909.
9. Ma A. MRI Pattern of Lumbosacral Degeneration in Tribhuvan University Teaching Hospital, Nepal. Journal of Institute of Medicine. 2015;6.
10. European Commission (EC), Cost Action B13 Management Committee. European Guidelines for the Management of Chronic Low Back Pain. 2004 http://www.backpaineurope.org Assessed January 30, 2019.
11. Corning JL. Spinal anaesthesia and local medication of the spinal cord. New York Medical Journal. 1885;31:483-485.
12. Lievre JA, Bloch-Michel H, Pean G. L'hydrocortisone en injection locale. Rev Rhum. 1953;20:310-311.
13. Manchikanti L, Singh V, Pampati V, Falco FJ, Hirsch JA. Comparison of the efficacy of caudal, interlaminar, and transforaminal epidural injections in managing lumbar disc herniation: is one method superior to the other? The Korean journal of pain. 2015 Jan;28(1):11.
14. Shrestha P, Subba L, Agrawal P, Lohani S. Outcome of transforaminal epidural steroid injection for lumbar radiculopathy: initial three-year experience at Upendra Devkota Memorial-National Institute of Neurological and Allied Sciences, Nepal. Chin Neurosurg Jl. 2020;6:6.
15. Pountos I, Panteli M, Walters G, Bush D, Giannoudis PV. Safety of Epidural Corticosteroid Injections. Drugs R D. 2016;16:19-34.
16. Singh AV, Saxena NK, Lal TS. Chronic low back ache and its management by means of caudal epidural steroid injections: A prospective study. International Journal of Orthopaedics. 2021;7(4):153-156.
17. Azar FM, Canale ST, Beaty JH. Degenerative disorders of the thoracic and lumbar spine, Lumbar disc disease.

Campbell's Operative Orthopaedics. 14th ed. 2020 Dec 23. 1741-1751.
18. Kao SC, Lin CS. Caudal Epidural Block: An Updated Review of Anatomy and Techniques. BioMed Research International. 2017;2017:1-5.
19. Butterworth JF, Mackey DC, Wasnick JD. Spinal, epidural and caudal blocks. Morgan and Mikhail's Clinical Anaesthesiology. 6th ed. New York: McGraw-Hill;2018:959-996.
20. Hazra AK, Bhattacharya D, Mukherjee S, Ghosh S, Mitra M, Mandal M, *et al*. Ultrasound versus fluoroscopy-guided caudal epidural steroid injection for the treatment of chronic low back pain with radiculopathy: a randomised, controlled clinical trial. Indian journal of anaesthesia. 2016;60(6):388.
21. Kirkaldy-Willis WH, Farfan HF. Instability of the lumbar spine. Clinical Orthopaedics and Related Research (1976-2007). 1982 May 1;165:110-123.
22. Rayegani SM, Soltani V, Cheraghi M, Omid Zohor MR, Babaei-Ghazani A, Raeissadat SA, *et al*. Efficacy of ultrasound guided caudal epidural steroid injection with or without ozone in patients with lumbosacral canal stenosis; a randomized clinical controlled trial. BMC Musculoskeletal Disorders. 2023 Apr 29;24(1):339.
23. Manchikanti L, Cash KA, Pampati V, Falco FJ. Transforaminal epidural injections in chronic lumbar disc herniation: a randomized, double-blind, active-control trial. Pain Physician. 2014;17(4):E489-501.
24. Alfeky AN, Ramadan MO, Mohamed A. Short term results of single shot epidural steroid administration in patients with lumbar canal stenosis. International Journal of Orthopaedics. 2023;9(1):366-370.
25. Budrovac D, Radoš I, Hnatešen D, Haršanji-Drenjančević I, Tot OK, Katić F, *et al*. Effectiveness of Epidural Steroid Injection Depending on Discoradicular Contact: A Prospective Randomized Trial. International Journal of Environmental Research and Public Health. 2023 Feb 19;20(4):3672.
26. Singh S, Kumar S, Chahal G, Verma R. Selective nerve root blocks vs. caudal epidural injection for single level prolapsed lumbar intervertebral disc-A prospective randomized study. Journal of clinical orthopaedics and trauma. 2017 Apr 1;8(2):142-147.

**How to Cite This Article**
Shrestha BK, Pandey BK, Pradhan RL, Sitoula P, Khanal KR. Efficacy of ultrasound-guided caudal epidural steroid injection in prolapsed intervertebral disc and canal stenosis in lower lumbar region. International Journal of Orthopaedics Sciences. 2025;11(2):13-17.