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Effectiveness of epidural steroid injections in managing lumbar radicular pain: A prospective study

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ABSTRACT

Background: Lumbar radicular pain, often caused by intervertebral disc herniation or lumbar spinal stenosis, significantly affects quality of life due to nerve root inflammation and compression. Conservative treatments, including epidural steroid injections (ESIs), are commonly used to reduce inflammation, relieve pain, and improve function before considering surgery. **Aims and Objectives:** To evaluate the clinical effectiveness of ESIs in reducing symptoms of lumbar radicular pain, with a primary focus on functional outcomes over a 1-year follow-up period. To assess the degree of pain relief and functional improvements in patients with lumbar radiculopathy and to compare these outcomes with previous studies. **Materials and Methods:** A cohort of 50 patients aged 20–60 years (mean age: 41.1 years) with lumbar radiculopathy due to intervertebral disc herniation or lumbar canal narrowing was studied. Baseline assessments included routine blood work, lumbar spine X-rays (anteroposterior and lateral views), and comprehensive magnetic resonance imaging scans. Pre-anesthetic clearance was performed before ESI procedures. Data collection was standardized using a structured proforma for patient histories and lumbar spine examinations. Follow-up assessments utilized various evaluation tools over 1 year. Statistical analyses were conducted to evaluate patient outcomes and compare them with historical data. **Results:** During the 1-year follow-up, 86% of patients reported significant improvement and satisfaction with ESI outcomes. However, 14% of patients required surgical intervention due to persistent symptoms. **Conclusion:** ESIs are an effective initial treatment option for patients with lumbar radiculopathy resulting from intervertebral disc herniation or lumbar canal narrowing. The study demonstrates meaningful functional improvements and pain relief in the majority of patients, supporting ESIs as a valuable non-surgical intervention in clinical practice.

Key words: Epidural steroid; Radicular pain; Disc prolapse

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INTRODUCTION

Low back pain is a highly prevalent health condition, affecting up to 80% of individuals at some point in their lives.[1] It is widely recognized that low back pain contributes significantly to health-care costs, with these expenses rising faster than overall health-care expenditures.[2] This condition is particularly disabling for young adults and remains one of the leading causes of physical activity limitations, resulting in substantial losses in workdays.[3]

Steroids are believed to reduce inflammation resulting from chemical, immunologic, and mechanical factors. While the exact mechanism of action remains unclear,

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evidence suggests that corticosteroids provide pain relief by inhibiting proinflammatory mediators and inducing a temporary local anesthetic effect.[4]

In patients with sciatica unresponsive to non-steroidal anti-inflammatory drugs, steroids may be administered locally, often in combination with a local anesthetic, directly into the epidural space to provide more prolonged relief. For patients who do not achieve adequate pain control with conservative treatments within 3 months and are not candidates for surgery, epidural steroid injections (ESIs) offer a viable alternative. ESIs have been used to manage sciatica since their introduction around 60 years ago, though numerous studies have yielded mixed results regarding their effectiveness.[5]

Aims and objectives

This study aims to clinically assess the effectiveness of ESIs in alleviating pain and determining the time required for patients to resume normal work activities.

MATERIALS AND METHODS

A total number of 50 patients having complaints of back pain with radiculopathy either unilateral or bilateral side admitted to the Department of Orthopaedics in Chettinad Hospital for the period of January 2023 January 2025 were included in the study. Proposal id: IHEC-1/3023/24.

Inclusion criteria

18–60 years of age, back pain >3 months with radiculopathy after confirming by imaging studies (magnetic resonance imaging [MRI] along with X-rays) MRI findings indicating a disc herniation with <50% narrowing of the canal, presenting as back pain and radiculopathy were included in the study.

Exclusion criteria

Back pain <3 months, MRI indicating a disc herniation with >50% narrowing of the canal, presence of neurological deficits, previous spine surgeries or injections, conditions like multi-level spinal degeneration, compression fractures of the vertebra which are unstable, spondylolisthesis, cauda equina syndrome, and arachnoiditis were excluded from the study.[6]

Operative procedure

Patient evaluations utilized multiple assessment tools, including the Patient Satisfaction Scale, revised Oswestry Disability Index (ODI), Roland Morris Low Back Pain Disability Questionnaire (RMDQ), and Visual Numeric Pain Scale. Assessments were conducted at baseline, followed by intervals at 1 week, 1 month, 3 months, 6 months, and 12 months following the procedure. Upon study completion, the data were subjected to statistical analysis and compared with results from similar studies in the literature. The patient was positioned in a sitting position with pillow support over the abdomen to support his/her arms and bend forward on the table (Figure 1). The patient's back was cleaned and painted with betadine 3 times, and part of the injection site was dropped under aseptic precaution (Figure 2).

The anatomical level of the interspinous space was determined using the iliac crest as a landmark, corresponding to the L3-L4 intervertebral space. The target levels were then identified as one segment above and below the affected level. After pinpointing the affected level, 5–10 mL of local anesthetic was administered, with a waiting period of approximately 20 s to allow the anesthetic to take effect. An 18-gauge Tuohy epidural needle was inserted into the epidural space using an interlaminar approach. Once the epidural space was accessed, a pre-mixed solution of 2 mL of 80 mg methylprednisolone acetate and 2 mL of 0.25% bupivacaine was diluted with 6 mL of normal saline and injected into the lumbar epidural space. Following the procedure, patients were instructed to lie supine if they experienced bilateral symptoms or to assume a right or left lateral position based on the side of their symptoms for a duration of 10 min. During this time, they were monitored for any potential complications.[7]

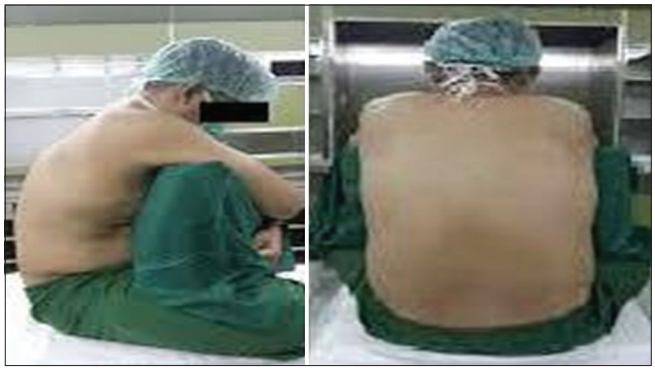

Figure 1: Patient position

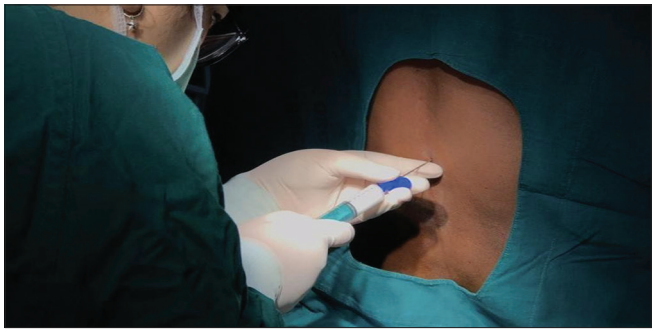

Figure 2: Dropped for epidural steroid injection

RESULTS

In our study of 50 cases, most patients were between their 20s and 60s. Specifically, 13 patients (26%) were aged 20–30 years, 11 patients (22%) were 31–40 years, 13 patients (26%) were 41–50 years, 9 patients (18%) were 51–60 years, and 4 patients (8%) were in the 61–70 years age group.

Our study included patients with intervertebral disc prolapse (IVDP) and Lumbar canal stenosis at a single-level pathology. Out of 50 patients, 43 (86%) had IVDP, and 7 (14%) patients had Lumbar canal stenosis (Table 1).

In our study, 62% of patients were having severe to bed-bound disability. According to ODI, the pre-injection mean disability ODI score was 57.4 (Table 2). The improvement of the mean ODI scores immediately post-injection with respect to the initial preprocedure value was noted. The difference between the initial values and the 12th-month values mean reduction was 25.20, the t value was 11.56, and the P<0.0001 shows statically significant.[7,8]

The patient satisfaction score during the whole study period was a significant improvement in score from the mean value at pre-injection was 0.14, and after 12 months of follow-up the mean value was 2.08. In our study, the pre-injection minimum score was 0, the maximum score was 1, and the mean value was 0.14, 1 week after injection, the minimum score was 0, the maximum score was 4, and the mean value was 2.68, slightly decreased to 2.38 by the end of 1 month with further declinement to 2.18 by 6th month and by the end of the year it was 2.08. The difference between the initial value and 12 months value for satisfaction score was the mean reduction was −1.94, and the t value was −11.747 and P<0.001, which is statistically significant (Table 3).

DISCUSSION

The management of low back aches is a challenge not mere to the orthopaedic surgeons but also for anesthesiologists in pain clinics and neurosurgeons because of its higher incidence, chronicity, and hampered social and professional life of patients. ESIs are given because abnormal concentrations of nociceptive and inflammatory mediators around inflamed nerves lead to chemical neuroradiculitis, and corticosteroids block prostaglandin synthesis and inhibit nociceptive C-fiber conduction.[9] Steroids classically work by the elimination of the rate-limiting step by the enzyme prostaglandin A2 to release arachidonic acid from cell membranes.[9,10]

Table 1: Etiology of patients

Etiology	Number of patients	Percentage
Intervertebral disc prolapse	43	86
Lumbar stenosis	7	14
Total	50	100

In our study of 50 cases, most of the patient's age group ranged from 2nd to 6th decade of life. There were 13 (26%) patients in the group of 20–30 years, 11 (22%) patients in the age group of 31–40 years, 13 (26%) patients in the group of 41–50 years, 9 (18%) patients in the group of 51–60 years, 4 (8%) patients in the age group of 61–70 years respectively. The mean age of the patients was 41.1 years, which indicates that people at this age are highly active in daily life and exposed to various stress, loss of bone strength, muscle, and tone elasticity decrease. Hence, there is 92 (92%) of the working population in this study group, i.e., the 20–60 years age group (Table 4). Our study was comparable with many other studies; the majority of patients were in the working-age population. In the present study, there was a male preponderance of 39 (78%) cases in our patients, and the majority of them were in the 3rd–5th decade of life. 11 (22%) cases were female patients, with a ratio of 3.5:1, which is quite different from the literature, as it says that low back pain can affect sooner (60) almost everyone in life.[89] Baral et al.'s study found that male patients experienced a significant prevalence of low back pain, which may be related to jobs involving heavy lifting, pushing, or tugging, as well as long drives.

In the present study, 41 (82%) patients were having symptoms for <1 year, among which 20 (40%) for <1 year, among which 20 (40%) for in the present study most of the patients 18 (36%) out of 50 were having bilateral radiating pain whereas 15 (30%) out of 50 patients were had right and 17 (34%) had left-sided radicular pain.

In our present study, MRI level of disc pathology out of 50 patients, level of disc abnormality was most common level at L4-L5 in 30 (60%) patients, next common level is L5-S1 in 15 (30%) and at L3-S4 in 5 (10%) patients.

In our study, we included patients with IVDP and Lumbar canal stenosis at a single-level pathology. Out of 50 patients, 43 (86%) had IVDP, and 7 (14%) patients had Lumbar canal stenosis. Compared with other studies, he concluded that 72.4% of patients with MRI findings of protrusion or extrusion of the disc with nerve root compression had neurological involvement.

In the present study, according to Michigan State University classification, grading was done for all 43 patients with IVDP depending on the MRI of their lumbar spine;

Table 2: Oswestry disability index analysis

ODI	Minimum score	Maximum score	Mean score	Standard deviation	P-value
Pre-injection	76	40	57.4	8.42	<0.001
1 Week after injection	68	30	46.36	9.09	<0.001
1st Month after injection	68	28	49.2	8.91	<0.001
3rd Month after injection	64	14	31.4	11.02	<0.001
6th Month after injection	62	12	30.6	13.47	<0.001
12th Month after injection	52	8	32.2	12.90	<0.001

ODI: Oswestry disability index

Table 3: Patient satisfaction score analysis

Patient satisfaction score	Minimum score	Maximum score	Mean score	Standard deviation	P-value
Pre-injection	0	1	0.14	0.35	0.068
1st Week after injection	0	4	2.68	1.23	<0.001
1st Month after injection	0	4	2.38	1.15	<0.001
3rd Month after injection	0	4	2.26	1.19	<0.001
6th Month after injection	0	4	2.18	1.17	<0.001
12th Month after injection	0	4	2.08	1.15	<0.001

Table 4: Age distribution

Age (years)	Number patients	Percentage
21–30	13	26
31–40	11	22
41–50	13	26
51–60	9	18
61–70	4	8
Total	50	100

we observed there were 9 (20.93%) patients with 1A, 1 (2.32%) patient with 1B, 24 (55.81%) patients with 2A, 5 (11.62%) patients with 2AB, 3 (6.97%) patients with 2B, and 1 (2.32%) patient with 3A. Among these, 2A was the most common type. Virtually all the patients had similar functional outcome scores at the end of 6 months. However, we observed that three patients from the 2AB type and one patient from the 3A type underwent surgery as their symptoms and signs did not resolve with ESI.

All the patients were evaluated with RMDQ. Our study shows a significant reduction in mean score from pre- and after-injection. The pre-injection RMDQ score was a maximum of 20 and a minimum of 12, and the mean value was 16.46. All the patients were evaluated at 1 week after injection, 1st month, 3rd month, 6th month, and 12th month. The mean overall RMDQ score at 1 week after injection was 11.58, with a reduction of mean value of 4.88, which signified 80% of symptoms improved after injection. The mean was 11.14 by 3rd month, by 6th month 10.58, and by the end of the study period was 9.28. A reduction of 5 scores or more after the procedure is considered significant. The difference between the initial value and 12 months value for the RMDQ score mean reduction was 7.18; the t value was 10.878, and the P<0.001, which is statistically significant.

All the patients were evaluated with satisfaction scores during the whole study period. There was a significant improvement in score from the mean value at pre-injection, which was 0.14, and after 12 months of follow-up, the mean value was 2.08. In our study, the pre-injection minimum score was 0, the maximum score was 1, and the mean value was 0.14, 1 week after injection, the minimum score was 0, the maximum score was 4, and the mean value was 2.68, slightly decreased to 2.38 by the end of 1 month with further declinement to 2.18 by 6th month and by the end of the year; it was 2.08. The difference between the initial value and the 12 months value for satisfaction score was that the mean reduction was −1.94, and the t value was −11.747 significant.

For all the patients who were evaluated with finger-floor distance analysis during the whole study, The pre-procedure finger-to-floor distance mean was 63.12 cm, and it was reduced to 37.92 cm by the end of 1st month, by the 6th month 39.60 cm, and the end of the study period, the mean value was 41.74 cm. The difference between the initial values and the 12th-month values mean reduction was 21.38 cm, which was statistically significant (P<0.0001), t=10.289. This indicates that epidural steroid application also leads to functional improvement in patients.

All the patients were assessed for disability under ODI scoring showed that a maximum number of patients were severely disabled for their day-to-day activities, i.e., 62% of patients had severe to bed-bound disability. According to ODI, the pre-injection mean disability ODI score was 57.4. On disability assessment in the population, 31 (62%) out of 50 patients were severely disabled to bed-bound before applying injection. The improvement of the mean ODI scores immediately post-injection with respect to the initial

pre-procedure value was noted. The difference between the initial values and the 12th-month values mean reduction was 25.20, the t value was 11.56, and the P<0.0001 shows statically significant.

Limitations of the study

1) The sample size is quite limited.
2) The follow-up period lasted for just one year.
3) Patients were discharged, so we were unable to track their adherence to the lumbar stabilization program.
4) There was no control group in the study.

All outcome which was measured showed reduction of score after 6 months after injection it could be due

1) Effect of steroid detoriates over a time period.
2) Existing pathology progression.
3) Non-compliance to proceed with stabilization of the lumbar vertebra.

CONCLUSION

Successful outcomes were defined by meeting the following benchmarks: (1) an improvement in patient satisfaction scores to 2 (good), 3 (very good), or 4 (excellent), with a minimum increase of 2 points; (2) a reduction of at least 5 points on the RMDQ; (3) a pain reduction of over 50% (as indicated by visual numeric scale ratings of 1, 2, and 3) maintained for a minimum of 3 months post-treatment; and (4) achieving a revised ODI score below 50%. This enhances functional status and reduces pain severity, enabling the patient to engage in lifestyle changes, physical therapy, and a quicker return to regular activities, ultimately conserving workforce hours. This approach may serve as a definitive treatment for some patients or as a temporary measure allowing for a delay in surgery for others. Nevertheless, the study has limitations due to its 1-year duration, and some patients may subsequently require surgery. This opens up opportunities for further research to be conducted as a long-term follow-up study.

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Authors' Contributions:
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