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Original Research Paper

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THE IMPACT OF LUMBAR EPIDURAL STEROID INJECTION ON NEUROPATHIC PAIN: A PROSPECTIVE OBSERVATIONAL STUDY.

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ABSTRACT **Objective:** To study whether neuropathic or nociceptive pain was better improved after an epidural steroid injection. **Study Design:** Prospective study. **Place and Duration of Study:** Department of Orthopaedics, VYDEHI INSTITUTE OF MEDICAL SCIENCES AND RESEARCH CENTRE, BANGALORE, from Jan 2023 to Mar 2024. **Background:** Low back pain (LBP) can result from conditions such as disc herniation, spinal stenosis, or facet syndrome. It may manifest as either nociceptive pain or neuropathic pain (NP), with neuropathic pain being a significant factor in chronic LBP. While lumbar epidural steroid injections (ESI) are recognized as an effective treatment for LBP, their effects on nociceptive and neuropathic pain have not been separately evaluated. This study aimed to determine whether ESI provides greater improvement in neuropathic or nociceptive pain. **Methods:** This prospective study classified patients based on their pre-procedure painDETECT questionnaire (PD-Q) scores. A PD-Q score of ≤12 indicated nociceptive pain, while a score of ≥19 indicated neuropathic pain (NP). Patients received either a transforaminal (TF) or interlaminar (IL) epidural steroid injection (ESI). The PD-Q was completed by each patient both before the ESI (baseline) and four weeks afterward. Outcomes were evaluated one month after the ESI using the numerical rating scale (NRS), the short-form McGill Pain Questionnaire (MPQ), and the revised Oswestry Back Disability Index (ODI). **Results:** A total of 114 patients participated in the study, with 54 classified into the nociceptive pain group (PD-Q score ≤12) and 60 into the neuropathic pain group (PD-Q score ≥19). One month post-treatment, both groups demonstrated significant reductions in their mean NRS scores. However, despite these improvements, there were no significant differences in MPQ or ODI scores between the nociceptive and neuropathic pain groups. Following the procedure (TF-ESI or IL-ESI), PD-Q scores in the nociceptive group (n = 54) remained unchanged. In the neuropathic group (n = 41), 13 patients shifted to a PD-Q score <12, and 15 patients had PD-Q scores between 13 and 18. **Conclusion:** ESI proved effective for short-term relief of both nociceptive and neuropathic pain, suggesting its potential to address the neuropathic pain component in patients with low back pain.

KEYWORDS : neuropathic pain; epidural; steroid, lower back pain, lumbar disc

INTRODUCTION

Chronic low back pain (LBP) is often linked to conditions such as lumbar disc herniation, spinal stenosis, and degenerative spondylolisthesis. Pain caused by nerve root compression is typically the result of a strong inflammatory reaction, making epidural corticosteroid injections a suitable treatment option [1–4]. Epidural steroid injections (ESI) are widely used to manage neuropathic pain (NP) [5,6].

Nociceptive and neuropathic pain have distinct underlying mechanisms. Neuropathic pain arises from neural compression or damage, whereas nociceptive pain is triggered by painful stimuli [7]. For patients with failed back surgery syndrome and prominent radicular symptoms, ESI is a viable option when less invasive treatments have failed, but the patient is not ready for more invasive procedures like spinal cord stimulation [8]. Corticosteroids, such as 80 mg of methylprednisolone, have been found effective in reducing overall pain, and both interlaminar (IL) and transforaminal (TF) ESI have demonstrated efficacy in alleviating the neuropathic component of chronic lumbar radicular pain [6]. Moreover, an 80 mg triamcinolone TFESI has shown significant improvement in pain, neuropathic symptoms, and sleep quality, although it does not affect overall quality of life [5].

Despite these findings, no study has specifically investigated the proportion of pain relief attributable to treating the neuropathic component. This study focuses on determining which pain component—neuropathic or nociceptive—benefits more from epidural steroid injections.

Methods

The protocol for this prospective observational study was approved by the Ethics Review Committee.

Inclusion Criteria For The Study Included:

- Age between 18 and 80 years.
- Lumbar radicular pain or low back pain unresponsive to conventional treatments (pharmacotherapy and physical

therapy) in the last four weeks.
- Confirmation of lumbar radicular pain pathology through magnetic resonance imaging (MRI).
- No significant motor deficits or bowel/urinary incontinence.

Exclusion Criteria Were:
- Age under 18 or over 80 years.
- Low back pain without radicular symptoms.
- Diabetes.
- Progressive neurological disorders.
- A history of allergic reactions to local anesthetics, opioids, contrast agents, or steroids.
- A history of opioid abuse or current long-term opioid use.

The interlaminar epidural steroid injection (IL-ESI) was performed using a 20-gauge Touhy needle, with a mixture of 5 mg dexamethasone and 5 mL of 0.5% lidocaine. The transforaminal epidural steroid injection (TF-ESI) was done using a 22-gauge needle, with a solution of 5 mg dexamethasone in 3 mL of 0.5% lidocaine. During the observation period, patients did not receive any anticonvulsants or antidepressants, but for two weeks following the procedures, all subjects were given NSAIDs and muscle relaxants. Patients experiencing breakthrough pain were administered 50 mg tramadol as rescue medication.

Each patient completed the painDETECT questionnaire (PD-Q) before the ESI (baseline) and again four weeks after the procedure. A PD-Q score of ≤12 indicated nociceptive pain, while a score of ≥19 indicated neuropathic pain (NP).

Outcomes were evaluated using the numerical rating scale (NRS), the short-form McGill Pain Questionnaire (MPQ), and the revised Oswestry Back Disability Index (ODI), measured before treatment and one month after the procedure.

All data were analyzed using IBM SPSS Statistics for Windows, Version 23.0 (IBM; Armonk, NY) The statistical analyses were performed using basic methods of descriptive statistics. The Student's t-test or Mann Whitney U test was used for comparing mean values. P-values ≤ 0.05 were considered statistically significant. The sample size of 114 was specified in advance to provide 90% power to detect a difference.

RESULTS

The study included 114 patients. According to their pre-procedure PD-Q scores, 54 patients had a score of ≤12 (indicating nociceptive pain), and 60 patients had a score of ≥19 (indicating neuropathic pain) (Table 1).

Before treatment, there were no significant differences in the mean NRS, MPQ, or ODI scores between the two groups (Table 2). However, one month after treatment, both groups showed a significant reduction in their mean NRS scores (P = 0.000) (Table 2). Despite these improvements and the difference in NRS scores, the changes in MPQ and ODI scores after treatment were not significantly different between the nociceptive and neuropathic pain groups (Table 2).

After the procedure (TF-ESI or IL-ESI), patients in the nociceptive pain group (PD-Q score ≤12, n = 54) showed no change in their PD-Q scores. In the neuropathic pain group (pre-treatment PD-Q score ≥19, n = 41), 13 patients' scores decreased to <12, and 15 patients had scores ranging from 13–18 (Table 3).

Table 1. Patient's Characteristics.

N = 114	Nociceptive (n = 54) group	Neuropathic (n = 60) group
PD-Q	≤ 12	19 ≤
Gender (M : F)	35 : 19	27 : 33
Age (yrs)	51.1 ± 14.2	53.4 ± 13.5
Diagnosis DDD	12	10
HIVD	26	30
Stenosis	14	14
Spondylolisthesis	2	6
Level L3–4	6	5
L4–5	40	45
L5–S1	8	10

Note: PD-Q: painDETECT questionnaire, DDD: degenerative disc disease, HIVD: herniated intervertebral disc.

Table 2. Values of the Numeric Rating Scale (NRS), McGill Pain Questionnaire (MPQ), and Oswestry Disability Index (ODI) before and one month after epidural steroid injection treatment in patients with low back pain.

	Baseline	1 month	P value
Nociceptive (n = 54)			
NRS	7.5 ± 0.5	3.9 ± 2.6	0.000
McGill			
Sensory	16.7 ± 6.0	16.8 ± 6.2	0.383
Affective	5.0 ± 2.3	4.8 ± 2.1	0.159
ODI	57.7 ± 4.9	58.4 ± 5.7	0.152
Neuropathic (n = 60)			
NRS	7.5 ± 0.8	4.2 ± 1.8	0.000
McGill			
Sensory	14.8 ± 5.6	14.7 ± 5.6	0.339
Affective	5.2 ± 1.7	4.9 ± 1.4	0.306
ODI	54.0 ± 5.0	55.0 ± 3.8	0.152

Table 3. Change in the patient's painDETECT questionnaire (PDQ) score following epidural steroid injection (ESI).

	Pre-ESI PDQ		Post-ESI PDQ		
	PDQ £ 12	19 £ PDQ	PDQ £ 12	12 < PDQ < 19	19 £ PDQ
Nociceptive pain (n = 54)	54	0	54	0	0
Neuropathic pain (n = 60)	0	60	13	15	32

DISCUSSION

In this study, there was no significant difference in pain relief between nociceptive and neuropathic pain following epidural steroid injection (ESI), and no significant difference was found in the effectiveness of triamcinolone versus dexamethasone in alleviating neuropathic pain. These results align with previous studies [5,6], where ESI (80 mg of triamcinolone combined with 3 mL of 0.5% bupivacaine and a 3-month follow-up) significantly improved pain levels, neuropathic pain, and quality of sleep, but had no impact on the overall quality of life [5].

Neuropathic pain arises from damage to the peripheral or central nervous system. It can result from mechanical compression of nerve roots (mechanical neuropathic root pain), lesions on nociceptive fibers within a degenerated disc (local neuropathic pain), or the effects of inflammatory mediators like chemokines and cytokines, which can be triggered by degenerative disc changes, even without direct mechanical stress causing inflammatory neuropathic root pain [6]. Epidural steroids work by reducing inflammation [9–11], thereby helping to alleviate pain.

Triamcinolone (a particulate steroid) and dexamethasone (a non-particulate steroid) are commonly used for epidural steroid injections (ESI), though there is ongoing debate about which is superior. Patients who received transforaminal ESI with triamcinolone reported more frequent pain relief (greater than 50%) at short-term follow-up compared to those who received betamethasone [12,13]. However, a study on patients with cervical radiculopathy found that both triamcinolone (40

mg) and dexamethasone (15 mg) provided similar benefits based on patients' self-reported pain scores [14]. In our study, the neuropathic pain component was considered in both nociceptive and intermediate forms in the neuropathic group. We hypothesized that either a local anesthetic or steroid could effectively treat neuropathic pain.

Triamcinolone and dexamethasone differ in their duration of action and anti-inflammatory potency. Dexamethasone acts quickly, has a longer duration of action, and possesses stronger anti-inflammatory properties than triamcinolone [15]. Additionally, dexamethasone particles are smaller (<5 μm), with lower density and a reduced tendency to aggregate compared to triamcinolone particles, which can form aggregates larger than red blood cells [16].

We anticipated that patients in the nociceptive pain group would experience more pain relief than those in the neuropathic pain group. However, our results showed no significant difference in pain reduction. Despite the varied causes of neuropathic pain compared to nociceptive pain, some medications are effective for only one type of pain (either nociceptive or neuropathic).

There has been controversy regarding the safety of ESI [17], with reports of brain or spinal cord infarctions following the procedure [17,18]. Although the risk of complications from lumbar ESI is lower than that for cervical or thoracic ESI, serious issues such as neural infarctions can still occur [17]. Accidental intra-arterial injection of a particulate steroid (e.g., into the radicular artery) can cause embolism, leading to infarction [19–23].

One limitation of the study was that patient outcomes were solely assessed through self-reported pain scores and the follow-up period was relatively short.

In conclusion, ESI was effective for both nociceptive and neuropathic pain, suggesting that ESI could be considered for treating the neuropathic pain component in patients with chronic low back pain.

Limitations

1. The study has been done in a single centre.
2. The study was carried out in a tertiary care hospital, so hospital bias cannot be ruled out.

Conflict of Interest

All authors declare no conflicts of interest.

REFERENCES

1. Olmarker K, Byröd G, Cornefjord M, et al. (1994) Effects of methylprednisolone on nucleus pulposus-induced nerve root injury. Spine 19: 1803–1808. https://doi.org/10.1097/00007632- 199408150-00003
2. Koc Z, Ozcakir S, Sivrioglu K, et al. (2009) Effectiveness of physical therapy and epidural steroid injections in lumbar spinal stenosis. Spine 34: 985–989. https://doi.org/10.1097/BRS.0b013e31819c0a6b
3. Delport EG, Cucuzzella AR, Marley JK, et al. (2004) Treatment of lumbar spinal stenosis with epidural steroid injections: a retrospective outcome study. Arch Phys Med Rehabil 85: 479–484.https://doi.org/10.1016/S0003-9993(03)00472-6
4. Manchikanti L, Cash KA, McManus CD, et al. (2010) A preliminary report of a randomized double-blind, active controlled trial of fluoroscopic thoracic interlaminar epidural injections in managing chronic thoracic pain. Pain Physician 13: E357–E369. https://doi.org/10.36076/ppj.2010/13/E357
5. Sari S, Aydin ON, Güleser G, et al. (2015) Effect of transforaminal anterior epidural steroid injection on neuropathic pain, quality of sleep and life. Agri 27: 83–88. https://doi.org/10.5505/agri.2015.91489
6. Rados I, Zdravcevic KS, Hrgovic Z (2013) painDETECT questionnaire and lumbar epidural steroid injection for chronic radiculopathy. Eur Neurol 69: 27–32. https://doi.org/10.1159/000338265
7. Nicholson B (2006) Differential diagnosis: nociceptive and neuropathic pain. Am J Manag Care 12: S256–S262.
8. Dworkin RH, O'Connor AB, Kent J, et al. (2013) Interventional management of neuropathic pain: NeuPSIG recommendations. Pain 154: 2249–2261. https://doi.org/10.1016/j.pain.2013.06.004
9. Carette S, Leclaire R, Marcoux S, et al. (1997) Epidural corticosteroid injections for sciatica due to herniated nucleus pulposus. N Engl J Med 336: 1634–1640. https://doi.org/10.1056/NEJM199706053362303
10. Cappio M (1957) Sacral epidural administration of hydrocortisone in therapy of lumbar sciatica; study of 80 cases. Reumatismo 9: 60–70.
11. Abdi S, Datta S, Lucas LF (2005) Role of epidural steroids in the management of chronic spinal pain: a systematic review of effectiveness and complications. Pain Physician 8: 127–143. https://doi.org/10.36076/ppj.2006/9/127
12. McCormick Z, Kennedy DJ, Garvan C, et al. (2015) Comparison of pain score reduction using triamcinolone vs. betamethasone in transforaminal epidural steroid injections for lumbosacral radicular pain. Am J Phys Med Rehabil 94: 1058–1064. https://doi.org/10.1097/PHM.0000000000000296
13. Park CH, Lee SH, Kim BI (2010) Comparison of the effectiveness of lumbar transforaminal epidural injection with particulate and nonparticulate corticosteroids in lumbar radiating pain. Pain Med 11: 1654–1658. https://doi.org/10.1111/j.1526-4637.2010.00941.x
14. Shakir A, Ma V, Mehta B (2013) Comparison of pain score reduction using triamcinolone vs. dexamethasone in cervical transforaminal epidural steroid injections. Am J Phys Med Rehabil 92: 768–775. https://doi.org/10.1097/PHM.0b013e318282c9f2
15. Langhoff E, Madsen S (1983) Rapid metabolism of cyclosporin and prednisone in kidney transplant patient receiving tuberculostatic treatment. Lancet 2: 1031. https://doi.org/10.1016/S0140-6736(83)91019-X
16. Derby R, Lee SH, Date ES, et al. (2008) Size and aggregation of corticosteroids used for epidural injections. Pain Med 9: 227–234. https://doi.org/10.1111/j.1526-4637.2007.00341.x
17. Manchikanti L, Candido KD, Singh V, et al. (2014) Epidural steroid warning controversy still dogging FDA. Pain Physician 17: E451–E474. https://doi.org/10.36076/ppj.2014/17/E451
18. Scanlon GC, Moeller-Bertram T, Romanowsky SM, et al. (2007) Cervical transforaminal epidural steroid injections: more dangerous than we think? Spine 32: 1249–1256. https://doi.org/10.1097/BRS.0b013e318053ec50
19. Tiso RL, Cutler T, Catania JA, et al. (2004) Adverse central nervous system sequelae after selective transforaminal block: the role of corticosteroids. Spine J 4: 468–474. https://doi.org/10.1016/j.spinee.2003.10.007
20. Muro K, O'Shaughnessy B, Ganju A (2007) Infarction of the cervical spinal cord following multilevel transforaminal epidural steroid injection: case report and review of the literature. J Spinal Cord Med 30: 385–388. https://doi.org/10.1080/10790268.2007.11753957
21. Houten JK, Errico TJ (2002) Paraplegia after lumbosacral nerve root block: report of three cases. Spine J 2: 70–75. https://doi.org/10.1016/S1529-9430(01)00159-0
22. Baker R, Dreyfuss P, Mercer S, et al. (2003) Cervical transforaminal injection of corticosteroids into a radicular artery: a possible mechanism for spinal cord injury. Pain 103: 211–215. https://doi.org/10.1016/S0304-3959(02)00343-3
23. Rathmell JP, Aprill C, and Bogduk N, et al. (2004) Cervical transforaminal injection of steroids.
24. Anesthesiology 100: 1595–1600. https://doi.org/10.1097/00000542-200406000-00035