



Original Article

The Influence of Epidural Steroids on Postoperative Pain and Hospital Stay in Patients Having a Single-Level Lumbar Discectomy

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ABSTRACT

Background/Objective: Poorly managed postoperative pain after lumbar disc surgery is linked to a slower recovery, a longer hospital stay, and a higher usage of analgesics. Intraoperative epidural steroids have been used to reduce post-operative discomfort after lumbar discectomy. In this study, we looked at how intraoperative epidural steroids affected postoperative pain and stay duration in patients with unilateral single-level lumbar discectomy.

Material & Methods: A randomized control trial was conducted at Ayub Teaching Hospital Abbottabad. Group A (n = 30) was given intraoperative epidural methylprednisolone, while group B (n = 30) was given normal saline only. The outcome was measured between the two groups in terms of postoperative pain (visual analog scale), time of mobilization, length of hospital stay, and duration to return to work.

Results: At discharge, the VAS score in group A was 0.40 compared to 2.4 in group B (p = 0.000). At 2 weeks follow-up, the mean VAS score was 1.10 in group A in contrast to 1.4 in group B (p = 0.001). Patients who received local epidural methylprednisolone were mobilized after an average of 1 day, stayed for an average of 1.16 days, and returned to work following 18.2 days, whereas patients in the control group were mobilized after an average of 1.2 days, stayed for an average of 1.86 days and returned to work following 25.9 days. An incidental Dural tear occurs in 2 cases.

Conclusion: Intra-operative epidural steroid is beneficial in reducing post-operative pain, hospital stay, and time to return to work. It allows early mobilization with enhanced recovery and few complications.

Keywords: Lumbar Discectomy, Epidural steroids, Post-Operative Pain, Visual Analog Scale (VAS).

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INTRODUCTION

Almost 80% of the population will have low back pain at least once in their lives.¹ Low Back Pain costs the United States of America more than \$100 billion each year due to its high incidence and a major contribution to disability.^{1,2} The most prevalent cause of low back pain in the vast differential diagnosis is intervertebral degeneration, which can cause degenerative disc issues, as well as lumbar disc herniations, can occur.² In the hospital outpatient department, the most common presentations following disc herniation are low back discomfort and radicular pain.³ Lumbar disc herniation can cause agonizing pain and misery in the patient.² Magnetic resonance imaging (MRI) is the gold standard for imaging to confirm suspected herniated lumbar discs, with a diagnostic accuracy rate of 97 percent.^{4,5} Although 90% of patients recover with conservative management, the remaining 10% require surgical intervention.⁶ Laminectomy and discectomy are the commonest surgeries to treat symptomatic lumbar disc herniation.⁷ Lumbar discectomy is the surgical treatment of choice for acute disc herniation without spondylolisthesis.⁸ Lumbar discectomy for herniated nucleus pulposus is one of the most common procedures performed on the spine.⁹⁻¹⁰ Despite significant advances in clinical and basic knowledge of pain transmission and regulation, most postoperative aches remain unsatisfactorily addressed.¹¹ Postoperative discomfort delays mobility and everyday activities, prolongs hospitalization and alters the patient's view of early postoperative recovery.¹⁰ Acute postoperative pain that is poorly managed is related to greater morbidity, functional impairment, delayed recovery time, longer opiate usage, higher healthcare expenses, and the development of chronic pain.¹² Postoperative analgesics are used by some surgeons, whereas others use other therapies such as intraoperative local anesthetics and/or corticosteroids. The effectiveness of epidural methylprednisolone for postoperative pain

control and hospital stay reduction is being questioned. In lumbar disc surgery, we evaluated the impact of intraoperative epidural methylprednisolone administration to that on normal saline (placebo) for postoperative pain management and its influence on the length of hospitalization of an individual patient post-procedure.

MATERIAL AND METHODS

Study Design & Setting

This randomized control trial (RCT) was done in the Department of Neurosurgery, Ayub Teaching Hospital Abbottabad from June to December 2020. Approval was taken from the hospital ethical committee.

Inclusion Criteria

Sixty Patients of either gender with an age range from 20 – 60 years, with unilateral single-level prolapsed lumbar intervertebral disc, who were planned for unilateral single-level lumbar laminotomy and discectomy were included in the study.

Exclusion Criteria

Those with recurrent lumbar disc herniation, multiple-level stenosis, spondylolisthesis, and cauda equine syndrome were excluded from the study.

Patient Groups

Patients were randomly divided into two groups (A&B) by blocked randomization, each consisting of 30 patients. The data were collected with the informed consent of the patients.

Surgical/Clinical Management

All patients underwent a single-level unilateral lumbar laminotomy and discectomy in a prone

position under general anesthesia. After removal of a herniated disc, group A was given intraoperative epidural methylprednisolone 80 mg, instilled over exposed nerve root or dura, while group B was given with normal saline only. Preoperative and postoperative pain in the back and/or leg at 6 and 12 hours, at the time of hospital discharge, and the first follow-up visit after 12 – 14 days were assessed using the Visual Analogue Scales (VAS). Additionally, the duration of hospital stay and the time taken to return to normal work were also recorded.

Data Collection & Analysis

The data was analyzed using SPSS version 25. The data was entered on a clinically designed proforma. A Chi-square test was used to compare the mean VAS at 6, 12 hours, at discharge, and follow-up between groups: epidural steroids (group A) and normal saline (group B). A Chi-square test was also applied to compare the time of mobilization, length of hospital stay, and time to return to work between groups A and B.

RESULTS

Age Distribution

The overall mean age of these patients was 42.4 ± 11 years. The average age of patients in group A (Epidural steroids group) was 43.5 years, while the average age of patients in group B (control group) was 43.3 years.

Gender Distribution

The male-to-female ratio was 1:1. In the epidural steroid group, there were 14 male and 16, female patients, while in the normal saline (placebo) group there were 16 male and 14 female patients (Table 1).

Disc Herniation

L4 - L5 was the most common site of disc herniation (n = 36, 60%), followed by L5 – S1 (n = 18, 36%). An equal number of patients were included in each discectomy level i.e., L4 – L5, L5 – S1, L3 – L5, and L3 – L4 (Table 1).

Pre and Post-Operative VAS Scores

Pain in the back and/ or leg, pre-operatively, postoperatively at 6 and 12 hours, at discharge from the hospital, and the first follow-up visit was assessed using the visual analog scale (Table 2) in patients undergoing microdiscectomy with methylprednisolone and control (Normal saline). The pre-operatively difference in the visual analog scale between the two groups was not statistically significant (9.3 ± 0.59 VS 9.3 ± 0.55) (p = 0.65).

Post-operatively at 6 hours, group A (Steroids group) had an average VAS score of 2.3 (±2.3) compared to 4.7 (±2.5) in group B (control group) (p = 0.000). The average VAS score after 12 hours of surgery in group A was 1.13 (±1.22) compared to 3.5 (±2.4) in group B (p = 0.001). At discharge, the VAS score in group A was 0.40 (±0.77)

Table 1: Background information of patients undergoing lumbar discectomy (n = 60).

Variables	Overall	Group of Patients		p-value
		Epidural Steroids	Normal Saline	
Mean Age (years)	42.4 ± 11	43.5 ± 11	41.3 ± 11	0.43
Male n (%)	30 (50%)	14 (46.7%)	16 (53.3%)	0.60
Female n (%)	30 (50%)	16 (53.3%)	14 (46.7%)	
Discectomy level n (%)				0.95
L4 – L5	36 (60%)	18 (50%)	18(50%)	
L5 – S1	18 (30%)	9 (50%)	9(50%)	
L3 – L5	3 (5%)	2 (66.6%)	1(33.3%)	
L3 – L4	2 (3.3%)	1 (50%)	1(50%)	

Table 2: Pre and Post-Operative VAS Scores.

Pre/Post VAS	Overall	Group of Patients		P-value
		Epidural Steroids (A)	Normal Saline (B)	
Mean Preoperative Pain VAS Score	9.3 ± 0.5	9.3 ± 0.59	9.3 ± 0.55	0.65
Mean Postoperative Pain VAS Score at 6 Hours	3.5 ± 2.67	2.3 ± 2.3	4.7 ± 2.5	0.000*
Mean Postoperative Pain VAS Score at 12 Hours	2.3 ± 2.25	1.13 ± 1.22	3.5 ± 2.4	0.001*
Postoperative Pain VAS Score at Discharge From Hospital	1.4 ± 1.59	0.40 ± 0.77	2.4 ± 1.58	0.000*
Postoperative Pain VAS Score at First Follow-Up	0.75 ± 1.38	0.10 ± 0.30	1.4 ± 1.71	0.001*

*Significant

compared to 2.4 (±1.58) in group B (p = 0.000). At the first follow-up after 12 – 14 days of surgery, the VAS score was 1.10 (±0.30) in group A in contrast to 1.4 (±1.71) in group B (p = 0.001) (Table 2).

Time of Mobilization, Hospital Stay, and Taken to Return to Work

A statistically significant difference was observed upon comparing the time of mobilization, length of hospital stay, and duration taken to return to work. Patients who received local epidural methylprednisolone were mobilized after an average of 1 (±0.00) day, stayed for an average of 1.16 (±0.37) days, and returned to work following 18.2 (±2.5) days whereas patients in the control group were mobilized after an average of 1.2 (±0.48) days, stayed for an average of 1.86 (±0.81) days and returned to work following 25.9 (±6.4) days (Table 3).

An incidental dural tear occurs in 2 cases (1.2%). One patient in the control group developed postoperative superficial surgical site infection. The postoperative cerebrospinal fluid leak was not observed in any patient among the two groups.

DISCUSSION

The Intervertebral disc separates each vertebra,

Table 3: Time of mobilization, length of hospital stay, and duration taken to return to work (days) for both groups.

Duration (Days)	Overall	Epidural Steroids (A)	Normal Saline (B)	P-value
Time of mobilization	1.1 ± 0.35	1 ± 0.00	1.2 ± 0.48	0.000*
Length of hospital stay	1.5 ± 0.72	1.16 ± 0.37	1.86 ± 0.81	0.000*
Duration took to return to work	22 ± 6.2	18.2 ± 2.5	25.9 ± 6.4	0.000*

*Significant

acts as a shock absorber, makes the spine flexible, and allows movements such as bending and twisting. The gel-like central part of the disc herniates once the stronger outer layer ruptures. The herniated part of the disc can compress the spinal cord and/or nerve root resulting in myelopathy and/or radiculopathy. The nerve root pain and dysfunction are not solely due to mechanical compression by the herniated disc. The inflammatory materials within herniated nucleus pulposus cause inflammation of the nerve root.¹⁴ The inflamed nerve root is sensitized and begins to transmit pain signals even with gentle pressure.¹⁵ An immunologic mechanism has also been proposed in addition to the various inflammatory mechanisms involved in pain generation. The avascular central part of the disc which has no contact with systemic circulation acts as a foreign body and has been proposed to have its own antigenic properties, once herniated.¹⁶

Herniation of the intervertebral disc in the lumbar spine is believed to be one of the main

causes of low back ache and sciatica.¹⁷ It is the most common cause of radiating nerve root pain but accounts for only 5% of all lower back pain problems.¹⁸ Lumbar microdiscectomy is the procedure to remove the herniated portion of the disc. It is the most common procedure performed in the United States for lumbar-related problems.¹⁹ Discectomy relieves radicular symptoms as well as back pain by removing the mechanical compression on the nerve root. However, some patients may experience mild to moderate back and/or leg pain due to an inflammatory process that may persist for a few days. Post-operative pain is disabling for patients and can delay mobilization, prolong the duration of hospital stay, and can increase the duration to return to normal daily life activities and work. In the past epidural steroids have been used as an adjunct to lumbar discectomy. Intraoperative epidural steroids following lumbar discectomy can reduce post-operative pain by reducing the early post-operative inflammatory reaction as well as late scar formation.²⁰

Aljabi et al, in their study of 150 patients, divided into two equal groups concluded that intraoperative use of epidural steroids reduces post-operative pain and length of hospital stay in patients undergoing single-level lumbar discectomy. Mean hospital stay in his study was 1.3 ± 0.9 days in the corticosteroids group compared to 3.2 ± 1.2 in the control group while the mean visual VAS score for postoperative pain at discharge and 1-week follow-up was 4.2 ± 1.1 versus 4.9 ± 0.8 ($P = 0.036$), 3.8 ± 0.5 versus 4.3 ± 0.2 (0.041), respectively.¹³ Cai et al. in their study hypothesized that intra-operative epidural steroids following lumbar discectomy are associated with lower pain scores and hospital stay as well as decreased postoperative analgesic requirements with no significant postoperative complications.²¹

In these randomized controlled trials, the author found that intraoperative use of epidural steroids following unilateral single-level lumbar

discectomy significantly reduces post-operative pain. The improvement in back and/or leg pain assessed by a visual analog scale post-operatively at 6 hours, at 12 hours, at discharge from the hospital, and at the first follow-up visit was much better with the use of intra-operative epidural methylprednisolone instilled over the exposed nerve root or Dura. The length of hospital stay was significantly shorter in the epidural steroid group than in the normal saline group. Time intervals from surgery to mobilization as well as the duration is taken to return to work were also assessed in this study. Patients who received local epidural methylprednisolone were mobilized after an average of 1 day and returned to work after 18.2 days whereas, patients in the saline group were mobilized after an average of 1.2 days and returned to work after 25.9 days of surgery. The difference in time of mobilization and duration taken to return to work between the two groups was statistically significant. It was concluded that the duration of hospital stay, time of mobilization, and time taken to return to work are related to the presence and severity of postoperative pain. Absence or mild postoperative pain is associated with enhanced recovery, early mobilization, shorter length of hospital stay, and decreased time interval to return to work following lumbar disc surgery. Though discectomy relieves mechanical compression caused by herniated nucleus pulposus, a perioperative epidural steroid is necessary to decrease nerve root inflammation. Epidural methylprednisolone may counteract the effect of inflammatory material released by herniated disc contents.

Lowell and associates in his study reported that intraoperative use of epidural steroids after lumbar discectomy may predispose to infection.²² They relate the infection to the local immunosuppressant effect of steroids. Oluwaseun et al, from their meta-analysis, demonstrated an increased infection rate with the use of intra-operative epidural steroids but the result of their study was not statistically

significant.¹¹ A recent study by Ishfaq et al, reported an increased infection rate in patients with the use of intra-operative epidural steroids than in the control group, with a ratio of 2:1.²³ In our study of 60 patients, only one patient in the saline group develops superficial surgical site infection. We assume that low-dose epidural steroids cannot predispose to superficial or deep wound infection if proper aseptic measures were taken.

Unintended Dural tear is a common complication and can occur in up to 14% of all lumbar spine surgeries.²⁴ It is possibly the most frequent complication with a rate of 3.5% for a primary discectomy and 13.2% for revision discectomy.²⁵ The rate varies with surgical procedures with a reported incidence of 1 – 17%.²⁵ Incidental Dural tears may or may not be associated with a postoperative cerebrospinal fluid leak. In our study, we observed two cases of incidental durotomies in the control group with no post-operative CSF leak, even though the Dural rent was left open. We believe that, if the Dural tears were not repaired, then tight closure of para-spinal muscles and fascia can prevent postoperative CSF leak.

CONCLUSION

Intra-operative epidural methyl-prednisolone following lumbar discectomy is beneficial in reducing post-operative pain, length of hospital stay, and time is taken to return to work and permits early mobilization of patients after surgery with enhanced recovery and little or no complications.

REFERENCES

1. Qaseem A, McLean RM, Forciea MA. Noninvasive Treatments for Acute, Subacute, and Chronic Low Back Pain: A Clinical Practice Guideline From the American College of Physicians *Ann Intern Med.* 2017; 166: 514-530.
2. Choi KC, Kim JS, Park CK. Percutaneous Endoscopic

- Lumbar Discectomy as an Alternative to Open Lumbar Microdiscectomy for Large Lumbar Disc Herniation. *Pain Physician*, 2016; 19: 291-300.
3. Allegri M, Montella S, Salici F, Valenta A, Marchesini M, Compagnone C, et al. Mechanisms of low back pain: a guide for diagnosis and therapy. *F1000 Res.* 2016; 5: F1000 Faculty Rev-1530.
4. Deyo RA, Miza SK. Herniated Lumbar Intervertebral Disk. *N Engl J Med.* 2016; 374: 1763-72.
5. Wanivenhaus F, Buck FM, Betz M, Farshad-Amacker NA, Farshad M. Reliability of postoperative MR imaging in the determination of level and side of lumbar spinal decompression surgery. *Acta Radiologica.* 2017; 58 (5): 581–5.
6. Gugliotta M, da Costa BR, Dabis E, Theiler R, Juni P, Rechenbach S, et al. Surgical versus conservative treatment for lumbar disc herniation: a prospective cohort study. *BMJ Open*, 2016; 6: 012938.
7. Drazin D, Ugiliweneza B, Al-Khouja L, Yang D, Johnson P, Kim T, et al. Treatment of Recurrent Disc Herniation: A Systematic Review. *Cureus*, 2016; 8 (5): 622.
8. Tacconi L. Lumbar discectomy: has it got any ill-effects? *J Spine Surg.* 2018; 4 (3): 677–80.
9. Kosztowski T, Gokaslan ZL. Determining the Extent of Lumbar Discectomy in Patients with Herniated Lumbar Discs. *Neurosurg.* 2016; 1: 1.
10. Kumari K, Kamal M, Singariya G, Kishan R, Garg S, Thanvi S. Effect of epidural levobupivacaine with or without dexamethasone soaked in gelfoam for postoperative analgesia after lumbar laminectomy: A double blind, randomised, controlled trial. *Indian J Anaesth.* 2018; 62 (7): 509–15.
11. Akinduro OO, Miller BA, Haussen DC, Pradilla G, Ahmad FU. Complications of intraoperative epidural steroid use in lumbar discectomy: a systematic review and meta-analysis, *Neurosurgical Focus FOC.* 2015; 39 (4): 12.
12. Gan TJ. Poorly controlled postoperative pain: prevalence, consequences, and prevention. *J Pain Res.* 2017; 10: 2287–98.
13. Aljabi Y, Shawarby AE, Cawley DT, Aherne. Effect of epidural methylprednisolone on post-operative pain and length of hospital stay in patients undergoing lumbar microdiscectomy. *The Surgeon*, 2015; 13 (5): 245-9.
14. Cornefjord M, Olmarker K, Otani K, Rydevik B.

- Nucleus Pulposus-Induced Nerve Root Injury: Effects of diclofenac and Ketoprofen. *Eur Spine J.* 2002; 11 (1): 57–61.
- 15 rönblad M, Habtemariam A, Virri J, Seitsalo S, Vanharanta H, Guyer R. Complement Membrane Attack Complexes in Pathologic Disc Tissues. *Spine*, 2003; 28 (2): 114–118.
 - 16 Corneffjord M, Olmarker K, Otani K, Rydevik B. Nucleus Pulposus-Induced Nerve Root Injury: Effects of diclofenac and Ketoprofen. *Eur Spine J.* 2002; 11 (1): 57–61.
 - 17 Foulkes GD, Robinson JS Jr. Intraoperative dexamethasone irrigation in lumbar microdiscectomy. *Clin Orthop.* 1989; 261: 224–8.
 - 18 Gibson JN, Grant IC, Waddell G. Surgery for lumbar disc prolapse. *Cochrane Database Syst Rev.* 2000. CD001350.
 - 19 Weinstein JN, Lurie JD, Tosteson TD, Skinner JS, Hanscom B, Tosteson AN, et al. Surgical vs nonoperative treatment for lumbar disk herniation: the Spine Patient Outcomes Research Trial (SPORT) observational cohort. *JAMA.* 2006; 296 (20): 2451-9.
 - 20 Jamjoom BA, Jamjoom AB. Efficacy of intraoperative epidural steroids in lumbar discectomy: a systematic review. *BMC Musculoskelet Disord.* 2014; 146 (15): 1471-2474.
 - 21 Cai J, Jiang W, Qiu B, Song Y. Efficacy and safety of epidural steroid injection following discectomy for patients with lumbar disc herniation: a protocol. *Medicine*, 2020; 99 (29): e21220.
 - 22 Lowell TD, Errico TJ, Eskenazi MS. Use of epidural steroids after discectomy may predispose to infection. *Spine*, 2000; 25 (4): 516_9.
 - 23 Ishfaq, A., & Shahzad, M. Efficacy of intra operative use of triamcinolone in lumbar discectomy. *PAFMJ.* 2020; 70 (6): 1908-12.
 - 24 Hassanzadeh, Hamid, Bell, Joshua, Bhatia, Manminder DO, Puvanesarajah, Varun. *Journal of the American Academy of Orthopaedic Surgeons AAOS.* 2021; 29 (6): e279-e286.
 - 25 Tafazal SI, Sel PJ. Incidental durotomy in lumbar spine surgery: incidence and management. *Eur Spine J.* 2005; 14 (3): 287–290.

Additional Information

Disclosures: Authors report no conflict of interest.

Ethical Review Board Approval: The study conformed to the ethical review board requirements.

Human Subjects: Consent was obtained by all patients/participants in this study.

Conflicts of Interest:

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

AUTHOR CONTRIBUTIONS

Sr. No.	Author's Full Name	Intellectual Contribution to Paper in Terms of
1.	Shah Khalid	Study Design, Methodology, and Paper Writing.
2.	Abdul Aziz Khan	Data Calculation and Data Analysis.
3.	Faiza	Interpretation of Results.
4.	Shahbaz Ali Khan ¹	Statistical Analysis.
6.	Abdul Majid, Deen Muhammad	Literature Review.