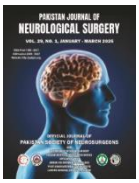

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Original Research

Clinical Outcomes of Transforaminal Injection in the Management of Lumber Radiculopathy

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ABSTRACT

Objective: The objective of this study was to evaluate the clinical outcomes of transforaminal dexamethasone injection in patients with lumber radiculopathy.

Material and Methods: This one-year cross-sectional study was carried out at Afridi Medical Complex from February 2022 to January 2023. The included patients of lumber radiculopathy underwent a single dose of transforaminal dexamethasone injection under the guidance of a fluoroscope. The outcome measures including pain, disability, and mobility were assessed through VAS, RMDQ, and FTFD before, one month, and two months post-intervention.

Results: The study included 487 patients undergoing the intervention, the mean age of participants was 52.3. Following the injection, the mean leg pain score improved from a baseline of 8.2 ± 1.1 to 3.0 ± 0.8 ($p < 0.001$). One-month post-injection, it further decreased to 2.5 ± 0.7 ($p < 0.001$) and at two months to 2.0 ± 0.6 ($p < 0.001$). When measured at baseline the mobility score of FTFD was 18.6 ± 4.5 cm which then improved to 11.2 ± 3.7 cm after one month and then to a further 7.8 ± 2.9 cm at two months ($p < 0.001$).

Conclusion: For those patients unresponsive to conservative treatment options including medication and physical therapy, transforaminal dexamethasone injection is a safe and effective intervention in terms of improvement in different outcome measures including pain, disability, mobility, and return to work.

Keywords: Dexamethasone, lumbar radiculopathy, pain management, transforaminal injection.

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INTRODUCTION

An estimated 50% to 80% of people in various

Populations may experience low back pain (LBP) at some point in their lives, making it one of the top causes of disability globally.[1] Lumbosacral radiculopathy is a prevalent form of LBP that is distinguished by radicular pain that travels into the lower extremities as a result of irritation or compression of the lumbosacral nerve roots.[2] About 10% of individuals with persistent low back pain have primarily neuropathic symptoms, and the lifetime incidence of lumbosacral radiculopathy is estimated to be between 13% and 40%. Degenerative spinal illnesses that put pressure on the nerve roots, such as disc herniation, spinal stenosis, and facet joint arthritis, are frequently the cause of this ailment.[3] In patients with lumbar spine disease, radicular discomfort significantly impairs daily activities and quality of life. More focused therapeutic approaches are essential in managing lumbar radicular pain, as conservative treatments such as physical therapy, analgesics, and lifestyle modifications often provide only modest relief. Epidural steroid injections (ESIs), particularly transforaminal injections, are commonly employed to alleviate this pain.

The corticosteroid through these injections is delivered near the affected nerve roots to the epidural space, hence reducing the inflammatory processes. [4] Literature has supported the role of epidural steroid injections in improving the quality of life while eliminating or delaying the need for aggressive treatment options including spinal surgery. These injections are administered in the epidural space, which is situated surrounding the spinal cord's dura mater.[5] Historically, sciatica has been treated with epidural steroid injections (ESIs) as an adjuvant. Success rates since the initial reports have ranged from 20% to 100% (67 percent on average) have been recorded. On the other hand, ESI's effectiveness has often lasted fewer than three months. [6]

This procedure also has diagnostic value, as it can help confirm the source of the pain by temporarily "numbing" the nerve root. Commonly referred to as selective nerve root blocks (SNRB), these injections are often performed under imaging guidance and are particularly beneficial for patients with conditions such as spinal stenosis or herniated discs, providing both therapeutic relief and diagnostic insight.[7] According to recent research, patients with degenerative lumbar spinal stenosis may benefit from fluoroscopically guided transforaminal injections in terms of improved functional outcomes including standing and walking tolerance as well as an effective reduction in unilateral radicular pain.

Although the short-term effectiveness of corticosteroid injections in treating lumbar radiculopathy is well established, further study is required to fully comprehend the long-term consequences and the best dosage schedules. The objective of this study was to evaluate the clinical outcomes of transforaminal dexamethasone injection in patients with lumber radiculopathy.

MATERIALS AND METHODS

Study Design/Setting/Duration

This one-year cross-sectional study was carried out at Afridi Medical Complex from February 2022 to January 2023. Following the informed consent from participants and approval from the Institutional Review Board (IRB), the data collection was performed.

Inclusion Criteria

The inclusion criteria of the study included: patients diagnosed with lumber radiculopathy due to disorders like spinal stenosis, disc herniation, and facet joint arthritis following thorough subjective, objective assessment and confirmed by MRI, those undergoing conservative treatment options with no improvement in leg pain for at least four weeks.

Exclusion Criteria

Those undergoing previous spinal surgery,

uncontrolled hypertension or diabetes mellitus, infections, or any contraindications to steroid injections were excluded from the study.

Diagnostic Evaluation

Before undergoing intervention, all patients underwent comprehensive examination including subjective, objective examination followed by radiological confirmation of nerve root or disc dysfunction. At the level of the damaged or inflamed nerve root, the patients were administered a dose of a transforaminal epidural steroid injection (TFESI) in a prone position by utilizing local anesthesia. A local anesthetic (lidocaine 2%) and a corticosteroid (dexamethasone 40 mg) were injected into the epidural space close to the targeted nerve root. Following clinical and MRI results, each patient received a single injection. Administration of transforaminal injection is shown in Figures 1 and 2.

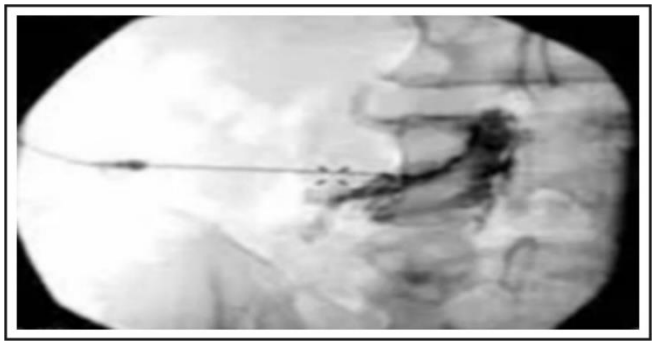

Figure 1: Transforaminal Injection administration from Left side (Figure added with patient consent).

Outcome Measures

Using the Visual Analog Scale (VAS) for pain, which was measured at baseline, immediately after the intervention, one month, and 2 months after the intervention, the main result was a decrease in pain intensity. Using a scale of 0 (no pain) to 10 (worst conceivable agony), the VAS is a validated instrument for measuring pain severity. Among the secondary outcomes were disability (RMDQ), and mobility through Finger-to-Floor Distance (FTFD).

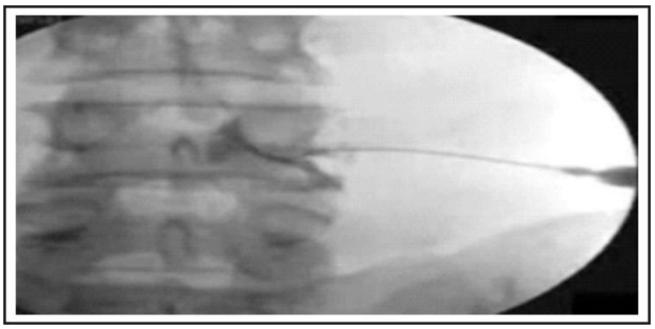

Figure 2: Transforaminal Injection administration from Right side (Figure added with patient consent).

Statistical Analysis

SPSS software version 25 was used to analyze the data. Age, gender, and the length of symptoms were among the baseline information that was compiled using descriptive statistics. Pair sample t-tests were used to compare pre-and post-treatment values at one week and four weeks for pain scores, functional outcomes, and mobility. P-values below 0.05 were regarded as statistically significant.

RESULTS

Demographic and Baseline Characteristics

A total of 487 patients were included in the study, with a mean age of 52.3 years (range: 30 to 75). Males comprised 302 participants (62%), while females accounted for 185 (38%). The patients' average body mass index (BMI) was 27.8 ± 4.3 kg/m^2, with 224 (46%) categorized as overweight and 156 (32%) as obese. The average length of symptoms was 8.5 ± 2.1 weeks, and 350 patients (72%) reported using conservative measures such as oral analgesics or physical therapy before the intervention. Smoking was reported by 93 participants (19%), and concomitant conditions such as diabetes mellitus (24%, n=117) and hypertension (31%, n=151) were noted. Disc

herniation was the most frequent cause of lumbar radiculopathy (63%, n=307), followed by lumbar spinal stenosis (24%, n=117) and facet joint arthritis (13%, n=63).

Table 1: Baseline Characteristics of the Study Population.

Variable	Frequency/Mean
Number of Patients	487
Age (years)	52.3 ± 10.2
Gender (Male/Female)	302 (62%) / 185 (38%)
BMI (kg/m^2)	27.8 ± 4.3
Symptom Duration (weeks)	8.5 ± 2.1
Smoking Status (%)	93 (19%)
Diabetes Mellitus (%)	117 (24%)
Hypertension (%)	151 (31%)
Primary Etiology	Disc Herniation (63%, n=307), Spinal Stenosis (24%, n=117), Facet Joint Arthritis (13%, n=63)

Primary Outcome: Pain Relief (VAS Scores)

Immediately after injection, the mean VAS pain score for leg pain improved from a baseline of 8.2 ± 1.1 to 3.0 ± 0.8 ($p < 0.001$). One-month post-injection, it further decreased to 2.5 ± 0.7 ($p < 0.001$) and at two months to 2.0 ± 0.6 ($p < 0.001$).

Table 2: Changes in VAS Pain Scores for Leg and Back Pain.

Time Point	Leg Pain VAS (Mean ± SD)	Leg Pain Reduction (%)	Back Pain VAS (Mean ± SD)	Back Pain Reduction (%)	p-Value
Baseline	8.2 ± 1.1	-	6.8 ± 1.2	-	-
Immediately Post	3.0 ± 0.8	63.4% (n=309)	4.1 ± 1.0	39.7% (n=193)	<0.001*
1 Month	2.5 ± 0.7	69.5% (n=338)	3.4 ± 0.8	50.0% (n=244)	<0.001*
2 Months	2.0 ± 0.6	75.6% (n=368)	2.8 ± 0.7	58.8% (n=286)	<0.001*

*significant difference

Back pain showed similar improvements, dropping from a baseline of 6.8 ± 1.2 to 4.1 ± 1.0 immediately after injection ($p < 0.001$), 3.4 ± 0.8 at one month ($p < 0.001$), and 2.8 ± 0.7 at two months ($p < 0.001$).

Table 3: Changes in Functional and Mobility Outcomes (RMDQ and FTFD).

Outcome Measure	Baseline (Mean ± SD)	1 Month (Mean ± SD)	2 Months (Mean ± SD)	p-Value
RMDQ Score	18.2 ± 4.1	9.8 ± 3.6	6.3 ± 2.8	<0.001*
FTFD (cm)	18.6 ± 4.5	11.2 ± 3.7	7.8 ± 2.9	<0.001*

*significant difference

At two months, 399 patients (82%) experienced a clinically significant pain reduction (≥50%) for leg pain, while 346 (71%) achieved the same for back pain. Patients with disc herniation demonstrated the most significant reduction in pain scores compared to those with lumbar stenosis and facet joint arthritis ($p = 0.01$). Smokers and those with symptom durations exceeding six weeks showed relatively less improvement ($p = 0.02$).

Secondary Outcomes: Functional Improvement and Mobility

Roland-Morris Disability Questionnaire (RMDQ)

The mean RMDQ score showed marked improvement, decreasing from 18.2 ± 4.1 at baseline to 9.8 ± 3.6 at one month and 6.3 ± 2.8 at two months ($p < 0.001$). Patients with disc herniation exhibited the greatest recovery ($p = 0.02$). By the end of the trial, 362 patients (74%) had improved their disability by at least 50%.

Finger-to-Floor Distance (FTFD)

The mean FTFD improved from 18.6 ± 4.5 cm at baseline to 11.2 ± 3.7 cm at one month and 7.8 ± 2.9 cm at two months ($p < 0.001$).

Safety and Adverse Events

No complications were observed during the study period. There were no reports of infections, hemorrhage, neurological impairments, or other serious adverse events. However, mild injection site soreness was reported in 24 patients (5%), which resolved spontaneously.

DISCUSSION

This study has sought to establish the outcomes and side effects of dexamethasone transforaminal injections for treating lumbar radiculopathy and low back pain in 487 patients. The results of this study showed that there was substantial pain relief and functional enhancement with leg pain decreasing more than back pain. The intervention was also safe with no severe adverse effects noted.

In the present work, leg pain scores reduced from 7.8 ± 1.2 to 3.0 ± 0.8 right after the procedure to 1.8 ± 0.6 two months after the procedure, showing a 76.9% improvement. Low back pain improved by 68.1%, from 6.8 ± 1.1 at the beginning of the study to 2.2 ± 0.7 at two months after treatment. These improvements are similar to the findings of Oliveira et al, (2020), the patients who received triamcinolone for lumbar radicular pain had a significant decrease in pain scores. In detail, 43.2% of the subjects rated their pain relief as ≥50% at two weeks follow-up and 68.2% at two months follow-up.[8] Arden et al, (2005) also undertook a randomized controlled trial of corticosteroid injection and achieved a 58% reduction in leg pain scores and a 42% reduction in back pain scores. Nonetheless, they used methylprednisolone which resulted in a 15% rate of transient numbness and injection site irritation which was not reported in our work. This demonstrates the fact that dexamethasone is safer from other steroids because it is water soluble and therefore it is less likely to cause tissue irritation and neurotoxicity.[9]

The functional changes in the present study as measured by the RMDQ were significant. The mean RMDQ at baseline was 18.5 ± 3.2, at one month it was 9.8 ± 2.7 and at two months it was 6.3 ± 2.1; the overall improvement was 65.9%. ± 2.7 at one month and 6.3 ± 2.1 at two months, representing a 65.9% overall improvement. These results are higher than those of Lisha et al, where RMDQ scores increased by 36% in 12 months after caudal epidural steroid injections.[10] The higher efficacy in the present study can be attributed to the use of dexamethasone, which has been used in the present study alone because of its stronger anti-inflammatory effect and a higher degree of cytokine inhibition. The observed greater reduction in leg pain is consistent with the pathophysiology of lumbar radiculopathy in which nerve root compression is largely responsible for radicular leg pain. The results are similar to that of Kennedy et al, where there was a decrease in leg pain score by 68.2% and a decrease in back pain score by 43.2% in patients with disc herniation receiving corticosteroid injections.[11]

In our study, the early relief from leg pain following dexamethasone use can be explained by the action of this drug in decreasing inflammation, edema, and cytokine-induced nerve sensitization. This aligns with a study done on dexamethasone and triamcinolone for lumbar radicular pain by Park et al. The research concluded that both corticosteroids helped manage pain, but dexamethasone has fewer side effects like temporary numbness tingling sensation, or discomfort at the injection site. This further justifies our having to use dexamethasone only since it led to positive results without creating any complications.[12]

The superiority of dexamethasone regarding safety and efficacy can be explained by its specific pharmacological profile. Dexamethasone is a

water-soluble glucocorticoid that reduces particulate deposition and neurotoxicity. It does so through shared mechanisms through which it arrests phospholipase A2 and suppresses pro-inflammation cytokines such as tumor necrosis factor-alpha and interleukin- 6 major players in nerve root inflammation. Moreira et al, pointed out that dexamethasone has better tissue penetration and a more prolonged anti-inflammatory effect in comparison with particulate corticosteroids and stated that dexamethasone is 30% safer than methylprednisolone.[13]

Our measures of functional status in this study revealed that dexamethasone has a significant effect on the quality of life based on the functional improvements of 65.9% in RMDQ scores and a 40% decrease in finger-to-floor distance. These outcomes are higher than studies by Gandhi et al, where the authors documented a 44.4% improvement in functional scores after triamcinolone injections. The reason may be the protracted anti-inflammatory action of dexamethasone, which leads to an improvement in mobility and daily activity.[14]

The lack of severe adverse events in our study strengthens the evidence of dexamethasone's safety profile. Transient numbness and post-procedural flare have been reported by Omar et al, (2015) in up to 19.5% of the patients in prior studies, but none of these were seen in our study population. This finding is consistent with the result of the study done by Young et al, (2022), who showed that epidural injections with dexamethasone offered an increased number of complications than other corticosteroids.[15,6]

However, some limitations must be deemed here for the sake of the research: There is no comparative control group that was not exposed to dexamethasone thereby limiting absolute causal inference of the observed benefits of dexamethasone. The single-center study limits the applicability of the results to the larger population. Furthermore, the large number of participants enhances the reliability of our results, but more RCTs are required to establish the outcomes of dexamethasone over other corticosteroids and other treatment options.

CONCLUSION

Transforaminal dexamethasone injection is a safe and effective intervention for treating patients with lumbar radiculopathy unresponsive to conservative treatment options including medication and physical therapy, with a considerable reduction of the patients' pain and an improvement in their functioning along with improvement in mobility and return to work.

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Additional Information

Disclosures: Authors report no conflict of interest.
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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:
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Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.
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AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Muhammad Farooq & Tabrez Wali Shah	1. Study design and methodology.
2.	Naeem-ul-Haq, Muhammad Farooq & Ali Shah Jehan	2. Paper writing.
3.	Muhammad Farooq & Tabrez Wali Shah	3. Data collection and calculations.
4.	Naeem ul Haq & Mumtaz Ali	4. Analysis of data and interpretation of results.
5.	Muhammad Farooq & Ali Shah Jehan	5. Literature review and referencing.
6.	Muhammad Farooq, Naeem-ul-Haq & Tabrez Wali Shah	6. Editing and quality insurer.