Original Article

Prolapsed Lumbar Intervertebral Disc with Lumbar Radiculopathy Management: A Comparative Evaluation of Transforaminal Epidural Steroid Injection and Lumbar Traction

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Abstract

Background: *Lumbar radiculopathy, is commonly caused by intervertebral disc herniation. Non-surgical treatments like Transforaminal Epidural Steroid Injection (TESI) and lumbar traction could be good options to alleviate pain and improve functionality.*

Objective: *To compare the effectiveness of TESI and lumbar traction.*

Materials and Methods: *A prospective, randomized, comparative trial conducted on 100 patients of lumbar radiculopathy due to intervertebral disc herniation confirmed by MRI, were randomly assigned to either the TESI group (n=50) or the lumbar traction group (n=50). Outcome was assessed using the Visual Analog Scale (VAS), the Oswestry Disability Index (ODI), and a five-point Likert scale.*

Results: *In terms of pain reduction, the TESI group's mean VAS score decreased from 7.5 at baseline to 3.2 at two weeks and 2.8 at six months, while the lumbar traction group saw a decrease from 7.6 to 5.1 at two weeks and 4.5 at six months. Similarly, in functional improvement - the ODI scores showed in the TESI group, decreasing from 50% to 24% at two weeks and 18% at six months, compared to the lumbar traction group's from 49% to 38% at two weeks and 31% at six months. At six months in the TESI group, 85% of patients reporting being "very satisfied" or "satisfied," compared to 65% in the lumbar traction group. These indicate that TESI is more effective in reducing pain, improving function, and increasing patient satisfaction.*

Conclusion: *The transforaminal epidural steroid injection (TESI) is significantly more effective than lumbar traction in reducing pain, improving functional outcomes, and increasing patient satisfaction.*

Keywords: *Lumbar Radiculopathy, Intervertebral Disc Herniation, Transforaminal Epidural Steroid Injection, Lumbar Traction.*

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Introduction

Lumbar radiculopathy, often caused by intervertebral disc herniation (IVDH), is a common condition that significantly affects the quality of life of individuals due to debilitating pain and motor dysfunction.[1] The prevalence of lumbar radiculopathy increases with age, and it is one of the leading causes of work-related disability globally. Among the various etiologies, lumbar disc herniation remains the primary cause, contributing to nerve root compression and inflammation, resulting in characteristic pain radiating from the lower back down to the legs. The treatment of lumbar radiculopathy due to disc herniation presents a clinical challenge, with both conservative and invasive management strategies being employed based on the severity of symptoms.[2]

Non-surgical treatment options are typically the first line of management, with a focus on pain relief, functional improvement, and delaying or avoiding the need for surgery. Two commonly used interventions for this condition are transforaminal epidural steroid injections (TFESI) and lumbar traction. Both modalities target the relief of nerve root compression and associated inflammation but do so through different mechanisms of action. However, the relative effectiveness of these treatments remains a topic of ongoing debate in the clinical community, and evidence supporting one over the other is still inconclusive.[3]

TFESI involves the administration of corticosteroids and local anesthetics directly into the epidural space adjacent to the affect

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ed nerve root. The goal of this procedure is to reduce inflammation and pain by delivering anti-inflammatory agents directly to the site of nerve root irritation. Numerous studies have reported varying degrees of effectiveness in terms of pain relief and functional outcomes.[4] According to a study, TFESI has been shown to provide substantial short-term relief of radicular pain.[5] Similarly, in other study observed significant improvements in pain and function at three months following TFESI in patients with lumbar radiculopathy due to herniated discs. However, while TFESI is widely used for symptomatic relief, its long-term efficacy remains uncertain, with some studies suggesting that repeated injections may be necessary for sustained benefit.[6]

In a Systematic review study, TFESI was found to be more effective than interlaminar injections in providing pain relief for lumbar radiculopathy, specifically in cases where the herniated disc caused significant nerve root compression.[7] This supports the notion that the targeted delivery of steroids directly into the transforaminal space can be more beneficial in reducing inflammation around the compressed nerve roots. Nonetheless, adverse events, including transient increases in pain and rare but serious complications such as nerve injury or infection, highlight the need for careful patient selection and procedure execution.

Lumbar traction is a non-invasive treatment modality that applies a pulling force to the spine to increase intervertebral space and reduce pressure on the nerve roots. The rationale behind this therapy is to alleviate mechanical compression caused by herniated discs and to promote natural healing. Traction has been used for decades as part of the conservative management of lumbar spine disorders, though its effectiveness remains controversial.[8] Some studies have demonstrated significant pain reduction and functional improvements, while others have questioned its efficacy, particularly in comparison to other conservative treatments like physical therapy or epidural injections.

The outcomes of lumbar traction in patients with lumbar radiculopathy and found a moderate improvement in symptoms, particularly when combined with other forms of conservative care such as exercises and manual therapy. However, the clinical benefits of lumbar traction appear to be highly dependent on patient-specific factors, such as the degree of disc herniation and the chronicity of symptoms.[9] A study highlighted the inconsistency in outcomes reported in studies evaluating lumbar traction, noting that while some patients experienced meaningful relief, others saw little to no improvement.[10]

Despite the widespread use of both TFESI and lumbar traction, few studies have directly compared their effectiveness in patients with lumbar radiculopathy due to disc herniation. The variability in clinical outcomes reported in the literature makes it difficult to draw definitive conclusions about which treatment is superior. Additionally, the long-term benefits of these treatments, particularly in terms of preventing the need for surgical intervention, are not well-established.
A comparative study of TFESI and lumbar traction is warranted to provide a clearer understanding of their relative effectiveness in alleviating radicular pain and improving function in patients with lumbar disc herniation. This study aims to address the existing research gap by directly comparing the clinical outcomes of these two treatment modalities, focusing on both short-term and long-term results. By doing so, this research will contribute to the growing body of literature on the management of lumbar radiculopathy and may help guide treatment decisions in clinical practice.

Materials and Methods

This was a prospective, randomized, comparative study conducted over 12 months at a tertiary care center to evaluate the effectiveness of Transforaminal Epidural Steroid Injection (TESI) versus lumbar traction in the management of lumbar radiculopathy due to intervertebral disc herniation (IDH). A total of 100 patients, all diagnosed with lumbar radiculopathy confirmed by MRI, were enrolled in the study. Patients were randomly allocated to either the TESI group (n=50) or the lumbar traction group (n=50) using a computer-generated randomization sequence. The study aimed to compare pain reduction, functional improvement, and patient satisfaction between the two interventions over a six-month follow-up period.

Inclusion criteria consisted of patients aged between 18 and 65 years who presented with MRI-confirmed lumbar disc herniation causing radiculopathy. These patients experienced unilateral or bilateral leg pain corresponding to a lumbar nerve root compression due to the herniation. Exclusion criteria included patients with prior lumbar surgery, spinal infections, tumors, fractures, or any systemic condition that could interfere with the study outcomes. Patients with severe psychiatric conditions, those who had previously undergone lumbar epidural steroid injections within six months, or those unwilling to participate were also excluded. Patients in the TESI group received a single Transforaminal epidural steroid injection, performed under fluoroscopic guidance. The corticosteroid (typically methylprednisolone) was injected directly into the affected nerve root's epidural space, aiming to reduce inflammation and alleviate pain. All procedures were conducted by experienced interventional pain specialists to ensure consistency.

The lumbar traction group underwent mechanical traction therapy using a specialized traction table. Patients received 30-minute sessions, three times per week, for six weeks. The traction force was adjusted individually based on patient comfort and clinical response, aiming to decompress the lumbar spine and reduce nerve root impingement.

Three primary outcomes were assessed:
1. Pain Intensity: Pain levels were measured using the Visual Analog Scale (VAS), a widely used tool for assessing subjective pain experience. Patients rated their pain on a scale from 0 (no pain) to 10 (worst pain imaginable) before treatment, at two weeks, and again at six months post-intervention.

2. Functional Outcome: Functional improvement was assessed using the Oswestry Disability Index (ODI), which measures the degree of disability in patients with low back pain. The ODI consists of 10 sections assessing daily activities, each scored

from 0 (no disability) to 5 (severe disability), with a total score expressed as a percentage. ODI scores were recorded pre-treatment, two weeks after intervention, and at the six-month follow-up.

3. Patient Satisfaction: At six months post-intervention, patient satisfaction was assessed using a five-point Likert scale, ranging from "very dissatisfied" to "very satisfied" This scale evaluated patients' overall satisfaction with their treatment outcomes.

Data were analyzed using SPSS software (version 26.0). For continuous variables, such as age, VAS scores, and ODI scores, the mean and standard deviation (SD) were calculated. Differences between the TESI and lumbar traction groups were compared using independent t-tests for normally distributed data, and non-parametric tests were used if data were not normally distributed. Categorical variables, including gender distribution and patient satisfaction, were analyzed using the chi-square test. For intra-group comparisons (baseline to follow-up changes), paired t-tests were applied.

Statistical significance was set at p-values less than 0.05. Additionally, a power analysis was conducted to ensure an adequate sample size for detecting clinically significant differences between the two treatment groups.

Results

A total of 100 patients, all diagnosed with lumbar radiculopathy confirmed by MRI, were enrolled in the study. Patients were randomly allocated to either the TESI group (n=50) or the lumbar traction group (n=50). Table I Shows no statistically significant differences between two groups (P > 0.05).

Table I: Demographics and Baseline Characteristics

Variables	TESI Group	Lumbar Traction Group	P-value
Age (mean)	45.3	44.8	0.735
Gender			
Male	60%	58%	0.886
Female	40%	42%	
Baseline VAS Score (mean)	7.5	7.6	0.565
Baseline ODI Score (mean)	50	49	0.332

Table II shows that both groups experienced significant pain reduction, with a more pronounced effect in the TESI group. TESI Group Patients reported a significant reduction in VAS scores, with a mean decrease from 7.5 to 3.2 in two weeks and 2.8 in six months (p<0.001). Lumbar Traction Group Patients also reported improvement, with VAS scores decreasing from 7.6 to 5.1 in two weeks and 4.5 at six months (p<0.001). However, the reduction in the TESI group was more pronounced at both follow-ups (p<0.05) compared to the lumbar traction group.

Table II: Comparison of Pain Reduction (VAS Scores) between TESI and Lumbar Traction.

Variables	TESI Group	Lumbar Traction Group	P-value
Baseline VAS Score (mean)	7.5	7.6	0.565
VAS Score (2 Weeks)	3.2	5.1	0.01
VAS Score (6 Months)	2.8	4.5	0.01

Table III highlights the functional improvement in both groups, with the TESI group showing more significant improvement. In TESI Group, the ODI scores improved from 50% to 24% at two weeks and 18% at six months (p<0.001). In Lumbar Traction Group, the ODI scores improved from 49 % to 38% at two weeks and 31% at six months (p<0.001).The TESI group showed significantly better functional improvement at both times (p<0.05).

Table III: Comparison of Functional Improvement (ODI Scores) between TESI and Lumbar Traction Groups.

Variables	TESI Group	Lumbar Traction Group	P-value
Baseline ODI Score (mean)	50	49	0.332
ODI Score (2 Weeks)	24	38	0.01
ODI Score (6 Months)	18	31	0.01

Table IV shows that at six months, 85% of the TESI group rated their satisfaction as "very satisfied" or "satisfied," compared to 65% in the lumbar traction group (p<0.05).

Table IV: Comparison of Patient Satisfaction at Six Months between TESI and Lumbar Traction Groups.

Group	Percentage Satisfied (%)	p-value
TESI Group	85	<0.05
Lumbar Traction Group	65	<0.05

Discussion

In this comparative study evaluating the effectiveness of Transforaminal Epidural Steroid Injection (TESI) and Lumbar Traction for treating lumbar radiculopathy due to intervertebral disc herniation, significant differences were observed in pain relief, functional improvement, and patient satisfaction between the two treatment groups. These findings are consistent with previously published literature, supporting TESI as a more effective intervention for both short- and long-term outcomes. In this study, the TESI group showed a significant reduction in Visual Analog Scale (VAS) scores, from a baseline of 7.5 to 3.2 at two weeks and further down to 2.8 at six months. Similarly, the Lumbar Traction group also reported improvements, with VAS scores decreasing from 7.6 to 5.1 at two weeks and 4.5 at six months. However, the reduction in pain was more pronounced in the TESI group at both follow-up periods ($p < 0.05$), aligning with previous research. A review of epidural steroid injections, including transforaminal approaches, and demonstrated significant reductions in pain scores for patients with radicular pain due to disc herniation. Their study found that TESI resulted in a mean reduction of 50% in pain scores within the first two weeks, like the current findings.[11] In another study it is confirmed that the superiority of TESI for immediate pain relief is when compared to other conservative measures, with over 70% of patients reporting at least a 50% reduction in pain after the procedure.[12]

TESI's efficacy is likely related to the direct delivery of corticosteroids into the epidural space near the site of inflammation, which reduces local edema and inhibits the production of pro-inflammatory cytokines. This mechanistic advantage allows TESI to provide more localized and effective relief compared to lumbar traction, which relies on mechanical decompression without addressing inflammation. The present study also demonstrated superior functional improvement in the TESI group, as evidenced by a significant decrease in Oswestry Disability Index (ODI) scores from 50% to 24% at two weeks and 18% at six months. In contrast, the Lumbar Traction group showed less improvement, with ODI scores dropping from 49% to 38% at two weeks and 31% at six months. The greater functional recovery in the TESI group was statistically significant ($p < 0.05$), echoing findings from similar studies. In a randomized controlled trial comparing TESI with conservative treatments like physical therapy and found that TESI led to significantly greater improvements in both pain and disability scores over a six-month follow-up period.[13]

The reason for the more substantial functional improvement in the TESI group can again be attributed to its ability to address the underlying inflammatory process. By directly reducing inflammation around the affected nerve root, TESI not only alleviates pain but also facilitates better mobility and activity levels, which are reflected in the ODI scores. On the other hand, lumbar traction, while helpful in decompression, does not target inflammation and thus may be less effective in improving long-term functional outcomes. At six months, 85% of patients in the TESI group reported being "very satisfied" or "satisfied" with their treatment, compared to 65% in the Lumbar Traction group. This difference was statistically significant ($p < 0.05$). The higher satisfaction rates in the TESI group are consistent with findings from multiple clinical trials and observational studies. In a study reported that 82% of patients who underwent TESI were satisfied with their treatment at six months, primarily due to rapid pain relief and improved functionality.[14]

Conclusion

TESI is more effective than lumbar traction in relieving pain, improving function, and enhancing patient satisfaction in individuals with lumbar radiculopathy due to IDH. For patients seeking non-surgical treatment options, TESI should be considered a first-line intervention. Nonetheless, lumbar traction remains a valuable alternative, particularly for those with contraindications to steroid injections.

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