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# Study on the functional outcome of fluoroscopically guided transforaminal epidural steroid injections in patients suffering from lumbar disc herniation

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## ABSTRACT

**Background:** Intervertebral disc herniation of the lumbar region is one of the common causes of acute low back ache and lower extremity pain. While multiple treatment modalities exist, the efficacy of the usage of a transforaminal steroid injection as a tool to either alleviate pain or delay surgery needs to be further evaluated. The aim of this study is to determine the functional outcome of patients suffering from lumbar disc herniation treated with fluroscopically-guided transforaminal epidural steroid injections.
**Methods:** This is a prospective case study in which total of 43 patients were included in the study dating between August 2014 and July 2015. These patients were evaluated and identified with lumbar disc herniation, confirmed with a magnetic resonance imaging prior to the procedure. A pre-injection VAS score was taken. These patients were administered TFESI under fluoroscopic guidance using 2ml of 40mg of Methylprednisolone with 1 ml of 2% xylocaine. They were then evaluated during follow up at 2 weeks, 6 weeks, 12 weeks, and 6 months. Their pain outcome was evaluated using the VAS (visual analog scale) scores and functional outcome was evaluated using Oswestry disability index (ODI).
**Results:** All patients showed significant improvement in the VAS score during their regular follow up when compared to their pre injection levels. Patient satisfaction was the high at 2 weeks post operatively slightly declining over time. 3 patients underwent surgery during the follow up period. The ODI scores also showed significant improvements when compared to the pre injection scores at all follow up periods
**Conclusions:** TFESI provides significant short-term pain relief in patients suffering from a single level lumbar herniated disc and is a viable, effective short-term analgesic tool to address pain and may retard an early surgical intervention.

**Keywords:** TFESI, Fluoroscopic guided injection, Lumbar disc, ODI score

## INTRODUCTION

Intervertebral disc herniation of the lumbar spine is one of the common causes of chronic low back with radiculopathy radiating to the lower extremities. Lumbar disc herniations are a common manifestation of degenerative disease, which can contribute to the pathogenesis of secondary spinal disorders such as spinal stenosis and degenerative spondylolisthesis.[1] They tend to occur early within the degenerative cascade, representing the tensile failure of the annulus to contain the gel-like nuclear portion of the disc. With improvements in advanced imaging techniques, lumbar disc herniations have been increasingly recognized in symptomatic and

asymptomatic individuals.[2] Improved understanding of the pathophysiology has led to a resurgence of enthusiasm in development of new pharmacobiologics and treatment modalities for this common disorder. Various treatment techniques such as the administration of NSAID's, muscle relaxants, physical therapy, spinal strengthening exercises are available to address this condition. Epidural steroid injections are a valuable treatment alternative when patients fail to respond to such treatment within 4 to 6 weeks.[3] Chronic neural compression leads to irreversible changes in neural anatomy which leads to less favourable outcome in patients with more than 12 month symptoms duration. So it is advocated for early start of TFESI in this patients.[4]

The usage of epidural steroid injections in treatment of herniated lumbar discs date back half a century.[5] Multiple modes of administration epidural steroid injections are available such as translaminar, caudal, transforaminal injections. Out of which transforaminal epidural steroid injections have been found to have a superior efficacy in reducing radicular allodynia as they have a higher incidence of steroid placement in the ventral epidural space.[6,7] Translaminar approach refer to injections into the space between the laminae of adjacent vertebrae. In this approach the injected material disperses over a greater area and so this type of injection is commonly used for bilateral or multilevel symptoms.[8] TFESI target the foramen between the vertebrae through which the nerve roots exit. In this the injected material is deposited to the ventral epidural space at the suspected pathologic site.[9]

The objective of this study is to determine the functional outcome of patients suffering from single level lumbar disc herniation treated with fluroscopically guided transforaminal epidural steroid injections.

## METHODS

This is a prospective case study in which total of 43 patients were included in the study dating between August 2014 and July 2015 in Saveetha Medical College and Hospital, Thandalam, Chennai. A total of 49 patients were enrolled for the study comprising of 39 female and 10 male patients after approval from the systematic review board of the institution and an informed consent was taken from the patients. The inclusion criteria included (1) patients with chronic low back pain with lower limb radiculopathy that failed to resolve by conservative means such as medications, physiotherapy for a period of 2 weeks. (2) Patients with single level disc herniation as evidenced with a magnetic resonance image. The exclusion criteria were (1) patients with a 2 level disc disease. (2) Patients with previous lumbar surgery. (3) Patients suffering from neurologic conditions such as caudaequina syndrome. (4) Patients with spinal deformities such as spondylolisthesis and scoliosis. Three patients were lost during follow up. The condition of three patients worsened considerably during the study period and had to be taken up for surgery. These were considered as treatment failures, resulting in an effective study population of 43 patients

### *Procedure*

Patient was placed in the prone position on a radio-lucent table. Under fluoroscopy control, orthogonal and oblique plane images of the site were taken and the level of injection was marked (Figure 1). A povidone-iodine scrub followed by a povidone iodine painting of the lower back was done. Sterile draping of the site was done. Skin, subcutaneous tissue, muscle was infiltrated with 5 ml of 1% lignocaine with adrenaline. Using a lateral view, a 22G spinal needle was inserted at the site just below the pedicle along the ventral aspect of the intervertebral foramen (Figure 2, 3, 4). An extension cord is connected to the needle. 2ml of contrast media (Iohexol) was injected and the nerve root sleeve was visualized under fluoroscopy (Figure 5). After confirmation without changing the position of the needle a 3 ml solution comprising 2 ml of methylprednisolone (40 mg/ml) and 1 ml of 2% lignocaine was injected (Figure 6). Patient was then placed in the recovery room for observation and then sent back to the ward. Once the pain is subsided the patients were put on isometric spine exercises, spinal extension exercises and core strengthening exercises.

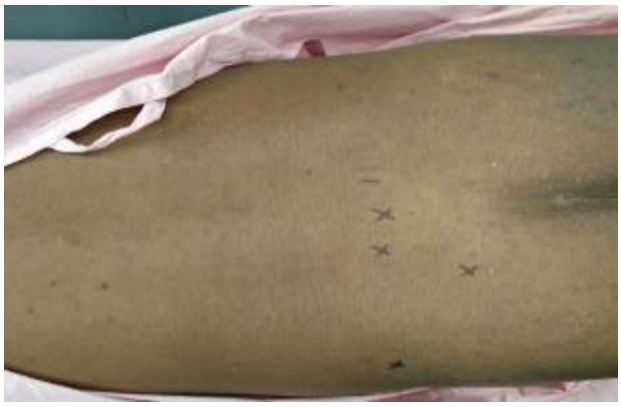

**Figure 1: Pre injection marking.**

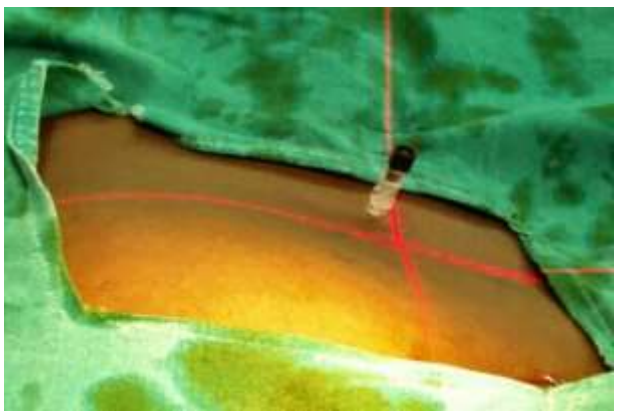

**Figure 2: Needle insertion.**

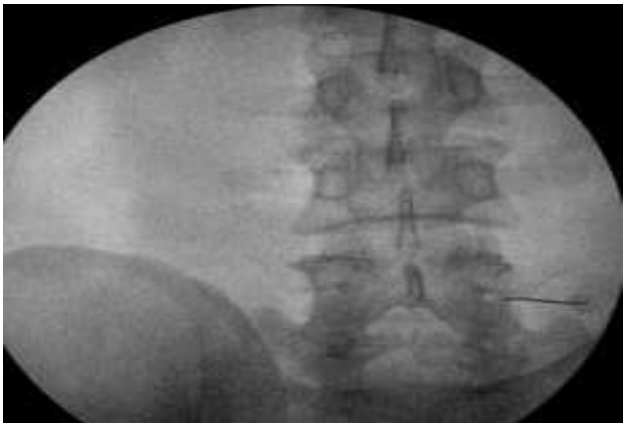

**Figure 3: Visualizing needle in image intensifier.**

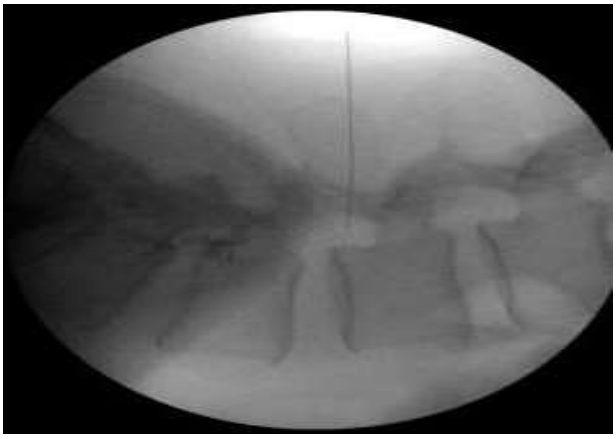

**Figure 4: Image intensifier picture showing position of needle in lateral view.**

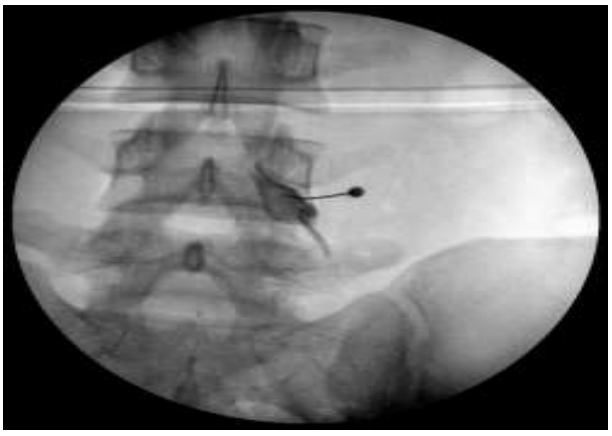

**Figure 5: Confirm needle position by dye injection.**

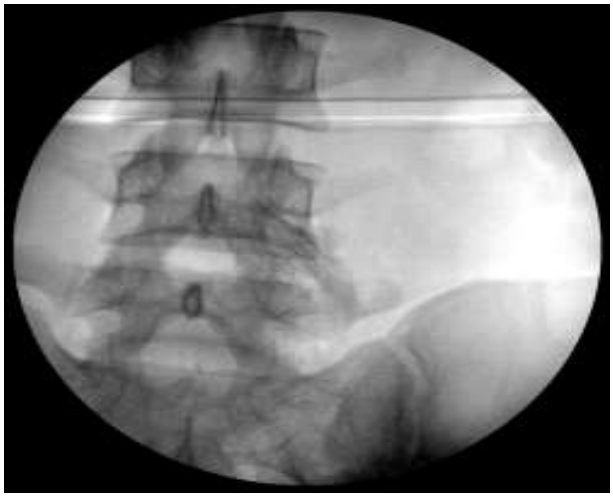

**Figure 6: Drug injection.**

Their VAS scoring and ODI scores was done at the pre-injection level and post-injection at 2 weeks, 6 weeks, 12 weeks and at the end of 6 months. ODI – Oswestry disability index is a questionnaire containing ten topics concerning pain, lifting ability, to care for oneself, ability to walk, ability to sit, sexual function, ability to stand, social life, sleep quality and ability to travel. Each question is scored on a scale of 0 to 5. 5 is maximum disability. The scores for all questions are summed and then multiplied by two to obtain the index. The score 0 to 20 is minimal disability, 21-40 is moderate disability, 41-60 is severe disability, 61-80 is crippling back pain, 81-100 are either bed ridden or having exaggeration of symptoms.[10]

***Statistical analysis***

The VAS scores were analysed using Wilcoxon signed rank test. The ODI scores were analysed using paired t test.

## RESULTS

A total of 49 patients (39 female and 10 male) were enrolled in the study (Table 1). All these patients experienced low back pain radiating to a unilateral lower limb and suffered from neurogenic claudication. The mean age of the patients was 38.95 years. The mean duration of symptoms prior to intervention was 8.38 weeks.

**Table 1: Distribution of patients according to age and sex.**

| Age (years) | Male | Female |
|---|---|---|
| **20 – 30** | 1 | 7 |
| **31 – 40** | 5 | 14 |
| **41 – 50** | 4 | 12 |
| **51 – 60** | 0 | 6 |
| **61 – 70** | 0 | 0 |

**Table 2: Level of injection.**

| Level of injection | Total |
|---|---|
| **L1 /L2** | 1 |
| **L2 /L3** | 2 |
| **L3 /L4** | 4 |
| **L4 /L5** | 29 |
| **L5 /S1** | 12 |

**Table 3: Distribution of number of patients and their VAS score.**

| Score/no of patients | Pre inj VAS score | 2 weeks | 6 weeks | 3 months | 6 months |
|---|---|---|---|---|---|
| **Score 0** | 0 | 2 | 0 | 0 | 0 |
| **Score 1** | 0 | 11 | 10 | 2 | 0 |
| **Score 2** | 0 | 23 | 23 | 19 | 9 |
| **Score 3** | 0 | 10 | 10 | 13 | 14 |
| **Score 4** | 0 | 4 | 1 | 9 | 14 |
| **Score 5** | 2 | 0 | 3 | 1 | 5 |
| **Score 6** | 12 | 0 | 3 | 1 | 4 |
| **Score 7** | 16 | 0 | 0 | 1 | 1 |
| **Score 8** | 16 | 0 | 0 | 1 | 2 |
| **Score 9** | 3 | 0 | 0 | 1 | 2 |
| **Score10** | 0 | 0 | 0 | 0 | 0 |

**Table 4: Distribution of number of patients with ODI scores.**

| Scoring/ ODI scores | Pre inj ODI score | 2 weeks ODI score | 6 weeks ODI score | 3 months ODI score | 6 months ODI score |
|---|---|---|---|---|---|
| **Score 0-10** | 0 | 1 | 0 | 0 | 0 |
| **Score 11-20** | 1 | 17 | 11 | 5 | 4 |
| **Score 21-30** | 0 | 19 | 19 | 20 | 9 |
| **Score 31-40** | 0 | 12 | 12 | 15 | 13 |
| **Score 41-50** | 2 | 2 | 2 | 6 | 9 |
| **Score 51-60** | 5 | 0 | 1 | 1 | 7 |
| **Score 61-70** | 17 | 0 | 2 | 1 | 2 |
| **Score 71-80** | 17 | 0 | 0 | 2 | 1 |
| **Score 81-90** | 7 | 0 | 0 | 0 | 1 |
| **Score 91-100** | 0 | 0 | 0 | 0 | 0 |

**Table 5: Wilcoxon signed rank test.**

| Data | Preinj and two weeks VAS | Preinj and six weeks VAS | Preinj and 12 weeks VAS | Preinj and six months VAS |
|---|---|---|---|---|
| **V** | 1274 | 1272.5 | 1216.5 | 1106.5 |
| **P value** | 2.83e-10 | 3.356e-10 | 7.647e-10 | 4.157e-09 |

The most common problematic site was the L4-L5 level (74.5%) followed by L5-SI (Table 2).

There was significant improvement in the VAS score levels at 2 weeks, 6 weeks, 12 weeks and at 1 year when compared to the pre-injection level (Table 3). The mean VAS scores at 2 weeks (2.07) were much lesser when compared to the scores at 6 weeks (2.35), 12 weeks (3.02) and at 6 months (3.86).

The ODI scores also improved dramatically when the patients were given injection (Table 4). The number of patients having better VAS score is higher when compared to pre injection numbers (Figure 7). Similarly the number of patients having better functional ODI scores is higher when compared to the pre injection patients at all follow ups (Figure 8).

All the p values in comparison to the pre injection scores show the results are statistically significant (Table 5) and results between pre injection ODI scores and all other post injection were less than 0.05 and hence statistically significant (Table 6).

No significant complications were reported post-operatively from the study group. Only one patient had transient increase in pain for two days which subsided spontaneously.

**Table 6: Paired t test for ODI scores.**

| | Pre Inj OWD | 2wk OWD | Pre Inj OWD | 6wk OWD | Pre Inj OWD | 3months OWD | Pre Inj OWD | 6months OWD |
|---|---|---|---|---|---|---|---|---|
| **Mean** | 69.122 | 25.578 | 69.122 | 29.53 | 69.122 | 33.572 | 69.122 | 39.218 |
| **Variance** | 165.759302 | 66.79603673 | 165.759302 | 135.1241837 | 165.759302 | 165.3008327 | 165.759302 | 231.3104857 |
| **Observations** | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| **Pearson Correlation** | 0.4525713295 | | 0.3192812986 | | 0.3445324471 | | 0.3492647199 | |
| **Hypothesized Mean Difference** | 0 | | 0 | | 0 | | 0 | |
| **Df** | 49 | | 49 | | 49 | | 49 | |
| **T Stat** | 26.27592061 | | 19.53802988 | | 17.06457416 | | 13.10645944 | |
| **P(T<=T) One-Tail** | 0 | | 0 | | 0 | | 0 | |
| **T Critical One-Tail** | 1.676550893 | | 1.676550893 | | 1.676550893 | | 1.676550893 | |
| **P(T<=T) Two-Tail** | 0 | | 0 | | 0 | | 0 | |
| **T Critical Two-Tail** | 2.009575199 | | 2.009575199 | | 2.009575199 | | 2.009575199 | |

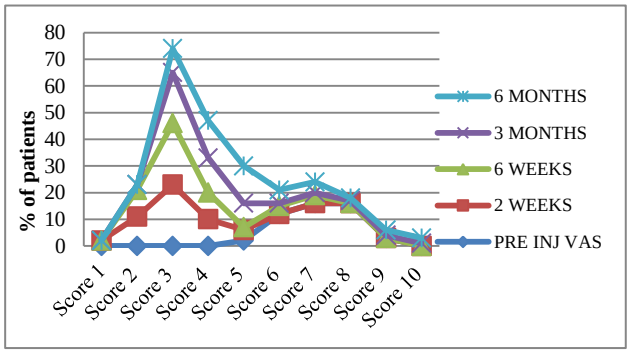


**Figure 7: Distribution of patients according to the VAS scores.**

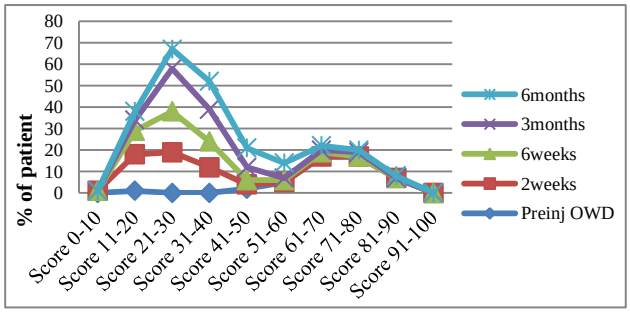


**Figure 8: Distribution of patients according to ODI scores.**

## DISCUSSION

The mechanism of discogenic back pain is an inflammatory change of the intervertebral disk.[11] It has been reported that substance P and calcitonin gene-related peptide are also contained in the nucleus pulposes and with the presence of penetrating nerves could be involved with transmitting nociceptive information from the disc.[12] Corticosteroid have been used for long time in lumbar disc herniations for its nociceptive and nerve membrane stabilizing properties and addition of xylocaine induces 'washout' effect, which will decrease local level of inflammatory mediators.[13-15]

Ghahreman et al performed a prospective randomized controlled trial assessing the efficacy of lumbar transforaminal epidural steroid injection for radicular pain secondary to disc herniation.[16] This study provides Level I therapeutic evidence that for patients with lumbar disc herniation: (1) LTFESI provides greater than 50% relief of pain for 54% of patients at one month after treatment; (2) LTFESI is significantly more often effective than sham and other treatments, with a number needed to treat (NNT) of three; (3) relief of pain is associated with restoration of function and virtual elimination of the need for other health care; (4) 25% of patients undergoing LTFESI have relief that persists for at least 12 months, without repeat treatment; and (5)

LTFESI substantially reduces the need for surgery. Additionally, duration of symptoms does not prejudice response to treatment.

TFESI delivers the steroids near the site of inflammation and reduces the inflammation and pain producing substances thereby allieviating the symptoms. Patients with radicular pain from an HIVD or central stenosis and/or lateral recess stenosis at the supra-adajacent intervertebral disc, obtain significant relief from a preganglionic LTFESI irrespective of age, gender, level of injection, symptom duration and pain intensity.[17]

Our study shows a statistically significant reduction in pain and improved functional scores. The reduction in symptoms was better in short term and gradually the gain is decreased over 6 months period but the pain and functional improvement are much better when compared to pre injection levels. The lasting effect of pain relief and low incidence of recurrence may be due to the spinal strengthening exercises.

We used particulate steroids along with lignocaine in our study. But we did not encounter any catastrophic complications such as dural tear, permanent neurological deficits or loss of vision. The reason for this low rate of complications may be due to the visualization of the position of the needle in c arm, confirmation by injection of contrast, use of extension cords to prevent change of position of needle while injecting steroid. We gave only one injection for all cases. In other studies when they used soluble steroids they have to give multiple injections.

Three patients had relief only temporarily for two to three weeks following injection. Their symptoms improved following discectomy. During surgery no abnormality of root was seen. The reason in these cases might be mechanical compressive effect producing root irritation rather than the inflammatory pain. The reason for temporary increase in pain in one case might be due to volume of drug injected into the tight space or may be due to the additive.

## CONCLUSION

TFESI provides significant short-term pain relief in patients suffering from a single level lumbar herniated disc and is a viable, effective short-term analgesic tool to address pain and retard an early surgical intervention. The complication rates are negligible if proper technique is followed. A single TFESI injection provides a lasting relief in many patients if combined with post injection exercise therapy.

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*Conflict of interest: None declared*
*Ethical approval: The study was approved by the institutional ethics committee*

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