

ORIGINAL RESEARCH

Transforaminal epidural steroid injection in treatment of Sciatica: an outcome analysis

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ABSTRACT

Transforaminal epidural steroid injection (TFESI) is a non-operative treatment option for lower limb radicular pain caused by different pathologies, including lumbosacral prolapsed intervertebral disc (PIVD), canal stenosis and recurrent PIVD. The aim of study was to assess the outcome of TFESI in conservatively managed patient of lower limb radicular pain. The technique involved fluoroscopic guidance and needle placement targeting the affected root in safe triangle by conventional approach. Retrospective data of 54 patients was analysed, assessing pain intensity using Visual Analog Scale (VAS) before, 30 minutes, 15 days, one month, three month and six month after the procedure. Results indicated significant pain reduction following TFESI, with mean VAS scores decreasing from 8.9 before the procedure to 0.82, 30 minutes after the procedure. At follow-up period of 15 days, one month, three month and six month, none of TFESI patient reported lower limb pain. Complication were minimal, and the study suggested that TFESI is effective in both diagnostic and therapeutic roles for various pathologies causing radicular lower limb pain. TFESI is an effective procedure for radicular lower limb pain caused by variety of pathologies. Procedure related complications are minimal. For foraminal and extraforaminal lumbosacral PIVD this may be considered for both diagnostic as well as therapeutic role.

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INTRODUCTION

Most of the cases of sciatica have benign and self-limiting course as the inflammatory effect of nucleus pulposus diminishes within 2 months, and is temporary.¹ Mechanical compression and chemical irritation of nerve root both the factors are responsible for symptoms in sciatica.^{2,3,4} Transformational epidural steroid injections (TFESI) under fluoroscopic guidance on compressed and inflamed root is an effective non-operative treatment option.⁵ Macnab in 1971 described selective nerve root block as a diagnostic procedure in radicular pain with negative radiological findings, considered it as therapeutic option in patients who had opting nonoperative treatment.⁶ TFESI has a diagnostic sensitivity of 100% in disc protrusions with a positive predictive value of 75 – 90% in foraminal stenosis.^{7,8,9} Aim of our study is to assess the outcome of TFESI in conservatively treated patients of paracentral / foraminal / extraforaminal disc protrusions and lumbar canal stenosis with radicular lower limb pain.

PATIENTS AND METHODS

All the patients of lumbosacral prolapsed intervertebral disc (PIVD), canal stenosis, recurrent lumbosacral PIVD with definite root compression on MRI, who were not relieved after 6 weeks of conservative treatment were advised surgery in our Neurosurgical centre. Patients who had refused surgery with distressing radicular symptoms were only offered TFESI. Retrospective data was analysed from December 2020 to December 2021 with following inclusion and exclusion criteria. INCLUSION CRITERIA: 1. Persistent radicular pain 6 weeks after conservative treatment in lumbosacral PIVD and lumbar canal stenosis with severe radicular lower limb pain, not willing for surgery 2. Foraminal and extraforaminal disc with distressing lower limb pain 3. Previously operated lumbosacral PIVD with recurrent disc or radicular pain due to facet hypertrophy 4. Multilevel disc in imaging study, side and level of symptoms not consistent with radiological findings 5. Classical radicular lower limb pain with normal MRI finding. EXCLUSION CRITERIA: 1. Lumbosacral PIVD with motor deficit

or cauda equina syndrome 2. Central canal stenosis and PIVD patients who required surgery after TFESI 3. TFESI patients with a follow up period of less than 2 weeks or lost to follow up. 67 patients were treated with TFESI during this period, 11 required surgery, two patients could not be followed up, hence 13 patients were excluded and a total of 54 patients were taken in the study. Data was analysed for pain intensity with visual analogue scale (VAS) (from 0-10) before block and 30 minutes after TFESI. Follow up data was noted at 15 days, 1month, 3 and 6 months after TFESI for any radicular pain in VAS scores.

TECHNIQUE

TFESI was performed as a minor procedure with image intensifier without premedication in prone position and under sterile conditions. Informed consent was taken, Xylocaine sensitivity test was done before the procedure. We performed the procedure as described by Bogduk N by targeting safe triangle or conventional approach, needle tip above the exiting nerve root and below the corresponding pedicle.⁵ After preparation, skin was anaesthetized with 2% Xylocaine at the marked entry point. A 22G spinal needle (12cm length) was inserted in craniocaudal direction, needle was advanced slightly after the bony contact was encountered, loss of resistance was felt immediately once foramina was entered, position of needle tip was verified on image

intensifier with contrast (0.5ml) in AP as well as lateral view. Non-ionic water soluble contrast containing 370 mg/ml of iodine was used, 0.5 ml was taken after 1:10 dilution. 0.5ml of 0.25% Bupivacaine and 1ml of Methylprednisolone (40mg) was injected. For S1 root block, image intensifier was positioned perpendicular to S1 foramen, spinal needle was inserted perpendicular to the surface of sacrum. Needle position was checked with contrast in both the planes then drug was injected. For foraminal disc TFESI was given in the distribution of radicular pain usually one level above the affected PIVD. Patients were kept under observation for 30 minutes to check for any complications and VAS score was recorded for lower limb pain. Complications like aggravation of back pain, paraesthesia in lower limb or allergic reaction were noted. All the patients were given one day of oral antibiotic to avoid risk of infection/discitis. Clinical follow up was done at 15 days, 1month, 3 and 6 months.

RESULTS

Retrospective data of 54 patients was analysed by unpaired student 't' test and ANOVA using SPSS software version 27. Mean age was 50.74 (\pm 13.20) years, with 31 male and 23 female patients. Mean duration of symptoms were 60.3 days with a range of 5 – 180days.

Table I. Demographic characteristics of TFESI patients

Features	Number of patients
Age(years) Mean \pm SD (Range)	50.74 \pm 13.2
Gender Male	31
Female	23
Duration of symptoms in days N (Range)	60.3(5-180) days

[Table I] Patients of lateral disc (foraminal/extraforaminal) had severe incapacitating lower limb pain of very short duration also surgery is extensive hence TFESI was performed very early (3-5 days of presentation), explaining surgery would be needed in case of recurrent pain. There were 4(7.4%) patients of foraminal stenosis and all of them had complete pain relief even upto 6 months and did not

require surgery. There were 28 (51.8%) cases of Lumbosacral PIVD, 11(18.5%) central canal stenosis, 4 (7.4%) cases of lateral disc. 7(9.25%) had immediate post op radicular pain after PIVD or listhesis surgery which might be due to root inflammation or root handling. 4 (7.4%) patients were previously operated for PIVD developed facet joint hypertrophy with severe lower limb pain.

Table II. Distribution of TFESI patients according to pathology and level of block

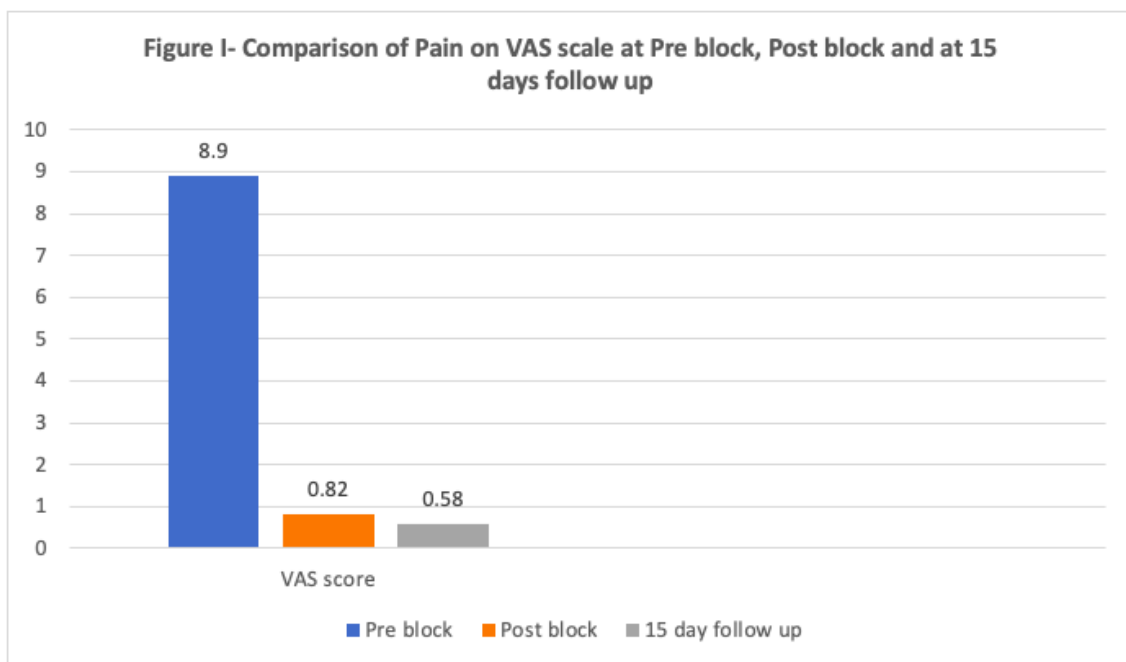
Diagnosis	Number of patients N (%)
Lumbosacral disc herniation	28 (51.8%)
Lumbar canal stenosis	11 (20.4%)
Lateral disc (Foraminal/extraforaminal)	04 (7.4%)
Immediate post op case of surgery with radicular pain	05 (9.3%)
Post-op cases of PIVD with facet joint arthropathy	04 (7.4%)
Normal MRI findings (no root compression)	02 (3.7%)
Total	54

[Table II] In 2(3.7%) patients MRI did not show any root compression, only mild disc bulge but they had classical lower limb unilateral radicular pain hence, TFESI was given, all of them had immediate pain relief and did not require repetition of the procedure. Maximum number of TFESI were given at L5 (18right side + 14 left side) then at S1 level (4 right + 5 left).

Table III. Level of TEFESI

Level of root block	N (%)
Right L2	2(3.7%)
Right L3	1(1.9%)
Right L4	5(9.3%)
Right L5	18(33.3%)
Right S1	4(7.4%)
Left L3	1(1.9%)
Left L4	7(12.5%)
Left L5	14(25.9%)
Left S1	2(3.7%)
Total	54

[Table III] Mean pain score (VAS) before TEFESI was 8.9 ± 0.57 , it reduced to 0.82 ± 1.52 thirty minutes after block and there was highly significant association between pre-block VAS with post block VAS and 15 days follow-up VAS scores ($p=0.001$) [Figure I].



None of the patients of TEFESI had lower limb pain at 3 and 6 months of clinical follow-up. Five patients had mild back pain after procedure on the day of block, improved in 2-3 days. There were no other complication in the study.

DISCUSSION

Nerve root irritation is combined response of direct chemical effect (leakage of substances such as phospholipase A2 from intervertebral disc), mechanical compression and indirect effects like vascular compression and other pathogenic factors.^{2,3,4,11} The nucleus pulposus causes inflammatory reaction by leukotaxis and increased vascular permeability.³ Otani and co-authors have documented that inflammatory effect of nucleus pulposus is temporary, it is maximum after 7 days and diminishes within 2 months which explains benign and self-limiting course of sciatica in majority of cases.¹ Similarly, Bozzao and co-authors have suggested that most of the disc gradually reabsorb on their own.¹² Henrik Webner in 1982 in their prospective study has shown that nonoperative and operative treatment of disc herniations are equally

effective upto 4 to 10 years of follow-up but had a drawback of slow recovery and patients were disabled for prolonged period of time in non-operative group.¹³ Pathophysiology hypothesized for neurogenic claudication is impairment of vascular and/or CSF flow.¹⁴ Venous pooling leads to decrease blood flow in turn causes metabolic build-up and nutrient deficient state causing nerve dysfunction hence neurogenic claudication. Ambulation increases venous return to the pelvic veins causing engorgement of Batson plexus and increased arterial perfusion and erect posture increase epidural pressure.¹⁴ Local corticosteroid relieve reversible inflammatory changes and vascular changes.¹⁵ Lee HM and co-authors in their experimental study have shown that epidural steroid injection inhibits phospholipase A2 activity.¹⁸ Olmarker K and co-authors in their experimental study on pigs have shown that nucleus

pulposus induced effects on nerve function can be reduced significantly with high dose of Methylprednisolone within 24-48 hours after epidural application of autologous nucleus pulposus.¹⁷ Local anesthetics suppress neuronal transmission, inhibit propagation of action potential across the membrane, also alter the function of sodium channels in the membrane resulting in higher threshold for depolarization and decrease in amplitude of action potential and rate of rise and hence, the conduction velocity is diminished.^{18,19} TFESI is less invasive intervention, and an adjuvant to non-operative treatment.^{20,21} Other Suggested mechanisms for anti-inflammatory properties of local anesthetic agents are inhibition of phagocytosis, decrease in phagocyte oxygen consumption, reduction in polymorphonucleocyte lysosomal enzyme release, decrease in superoxide anion production and reversible inhibition of granulocyte adherence.^{15,22,23} Local anesthetic restore the blood flow, this might explain their effect in foraminal stenosis and herniated nucleus pulposus.²⁴ Riew KD et al suggested that non-operative treatment of sciatica with therapeutic TFESI to deliver local corticosteroids has good outcome,²¹ also, Narozny and Co-authors reported TFESI as an effective and less invasive non-operative management.²⁰ Studies have reported good efficacy of transforaminal injections for diagnostic and therapeutic purposes.^{7,8} Weiner & Fraser have evaluated result of nerve root blocks in 30 patients of foraminal and extraforaminal disc herniation, showed immediate pain relief in 27 patients in which 3 required surgery due to recurrent leg pain, 2 were lost to follow up. In his study 22 out of 28 (79%) patients had substantial and permanent pain reduction during 1 – 10 year follow up.²⁵ Our study has 4 cases of lateral disc, all had complete relief of pain even at sixth month follow up. Derby et al have mentioned that in TFESI needle is positioned without provoking pain hence procedure related pain is very less and needle is targeted in the safe triangle needle tip lies above and lateral to the nerve in the lateral half of the foramen at its superior margin, there is minimal risk of dural puncture.^{26,27}

Pfirrmann et al have also suggested the lateral part of the safe triangle as the best target point for TFESI as it causes minimal treatment induced pain.²⁸ In our study none of the patients had procedure related pain or dural puncture as we have also used safe triangle as the target point, however, five patients had mild back pain, resolved without treatment. Steroid with short and mid-term effectiveness is generally accepted.²⁹ Jamison RN have taken two weeks of follow up which is related to duration of action of steroid chosen.³⁰ Similarly we had also taken 15 days as first follow-up after the procedure. Few studies have shown markedly declining effect after 3 months.³¹ However, some studies report potential long term effect of corticosteroids.³² Studies have documented that TFESI are safe and accurate when performed

with image guidance.³³ In a prospective study of 139 diagnostic TFESI procedures, no major complications were reported.³⁴ North RB et al in their study mentioned TFESI as nonspecific in diagnosing radiculopathy, but, volume of local anaesthetic used was 3ml. - a relatively large volume which is expected to spread in adjacent tissue thereby reducing specificity.³⁵ Reported complications from TFESI include infection, bleeding, allergic reaction, nerve root injury, spinal cord injury, seizure, stroke. One case report had 3 cases of paraplegia or paraparesis, undetected needle penetration and injection of depot steroid into spinal artery or artery of Adamkiewicz resulting in spinal cord infarction was the proposed mechanism.³⁶ Proper needle placement within neuroforamen can prevent spinal cord / intramedullary infarction.³⁷ In a series of 888 fluoroscopically guided spinal injection procedures (including TFESI, facet joint and lumbar sympathetic blocks), there were 8 reversible complications, 3 subarachnoid needle placement, 2 allergic reaction to local anaesthetic, 1 vasovagal response with severe bradycardia and one case of pain exacerbation, but the study had included multiple types of spinal injections.²⁷ No major complication was noted in our study which may also be related to the use of very low volume of contrast agent (0.5ml), local anaesthetic (0.5ml), corticosteroid (1ml), safe triangle as target point under fluoroscopic guidance, check aspiration before injection and also use of oral antibiotics.

LIMITATIONS

This is a retrospective study of just one year duration with very limited number of cases because of COVID-19 pandemic, hence sensitivity and specificity of the procedure could not be calculated. Number of lateral disc (foraminal/extraforaminal) in our study were only four, we suggest well designed prospective study with larger number of patients.

CONCLUSION

TFESI is an effective procedure for radicular lower limb pain caused by variety of pathologies. Procedure related complications are minimal. For foraminal and extraforaminal lumbosacral PIVD this may be considered for both diagnostic as well as therapeutic role.

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ABBREVIATIONS

TFESI- Transformational epidural steroid injections

PIVD- Prolapsed intervertebral disc

VAS- visual analogue scale

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