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Optimal Timing and Outcome of Transforaminal Epidural Steroid Injection for the Management of Radicular Pain due to Extruded Lumbar Disc Herniation

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ABSTRACT

AIM: To evaluate the optimal timing and outcome of fluoroscopically guided transforaminal epidural steroid injections (TFESI) for the management of radicular pain due to extruded lumbar disc herniation (LDH).

MATERIAL and METHODS: In this clinical study, 305 individuals received fluoroscopically guided TFESI for the management of radicular pain due to extruded LDH. Preprocedural and 12-week postprocedural Visual Analog Scale (VAS) scores measuring radicular pain were statistically compared. The neurological conditions of the patients and the complications of the procedure were also recorded.

RESULTS: The intensity of radicular pain evaluated by the mean preprocedural and 12-week postprocedural VASs were 8.765 ± 0.559 and 2.281 ± 0.401, respectively (p=0.001, and t=119.01). A correlation was noted between the short duration of symptoms before the procedure and the effectiveness of the procedure. After 12 weeks of the procedure, 32 of the 58 patients showed improvement in terms of neurological deficit. There was no major complication. Nine patients required lumbar disc surgery after the procedure.

CONCLUSION: This clinical research demonstrated that TFESI for the management of extruded LDH may alleviate radicular pain and may decrease the neurological deficit and that it is more effective when performed at the earliest possible time point.

KEYWORDS: Extruded disc, Lumbar disc herniation, Transforaminal epidural steroid injection

INTRODUCTION

Radicular nerve root pain symptom is very common in clinical practice and causes economic problems (11). Mechanical compression of the nerve root by LDH is the most important cause of this kind of pain. Some patients with LDH need surgical treatment for alleviation of radicular pain. Even in times where the pain is very severe, some patients cannot be operated or do not want surgical intervention. Corticosteroids may inhibit inflammation and alleviate pain in these cases because severe compression of nerve root also aggravate inflammatory processes (21,24). Injection of corticosteroids to pathologic field can be done by TFESI method under fluoroscopic guidance (7). Fluoroscopically guided TFESI may alleviate radicular pain caused by LDH (12,16,23,27). TFESI may reduce pain scores in patients with lumbar radiculopathy better than conservative managements and lumbar interlaminar epidural injections (22). İf the length of a lumbar disc fragment from base to apex is more than width at the base, it is called extruded LDH. In this clinical research, we aimed to investighate the outcome of lumbar TFESI for the management of radicular pain due to extruded LDH and to find out the correlation between duration of symptoms before procedure and effectiveness of injection.

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MATERIAL and METHODS

We performed this clinical study retrospectively. This study was conducted in accordance with ethical principles of the Declaration of Helsinki (revised version of 2008), and was approved by local institutional ethics committee (2023/56). Radicular leg pain was the major presenting symptom of the patients. The LDH disease, the reason for radicular pain, the procedure, and the mechanism of the procedure to alleviate the pain were explained to the patient. All the individuals were informed in written and orally for the management of extruded LDH using TFESI under fluoroscopic guidance. Patients' consent was obtained before performing the procedures.

Patients

In this clinical study, 305 individuals with radicular pain due to extruded LDH were included. These individuals were treated with fluoroscopically guided TFESI from March 2012 to September 2022 at Pain Clinic, Republic of Turkey Ministry of Health, Arnavutkoy State Hospital, 34275 Arnavutkoy/Istanbul and Private Marmara Pain Center, 34144 Bakırkoy/Istanbul.

The inclusion criteria in this clinical study for the individuals were radicular pain caused by magnetic resonance imaging (MRI) confirmed extruded LDH, ineffective nonsurgical therapy and performance of TFESI under fluoroscopic guidance. Exclusion criteria for the individuals were metabolic diseases such as diabetes mellitus; paramedian or foraminal LDH; cauda equina syndrome; previous spinal surgery at herniated disc level; sagittal vertebral translation >3 mm or angulation >10° on flexion/extension x-rays; midsagittal spinal canal diameter <8mm. The intensity of radicular pain was evaluated and compared statistically by the mean preprocedural and 12 weeks postprocedural VASs (29). Neurologic conditions of the individuals before and 12 weeks after the procedure were recorded and complications were also noted.

MRI Data Analyses

All images were obtained 1.5 Tesla MRI scanners. Obtained lumbar MRI were analyzed by a good radiologist for existence of extruded LDH. The criteria for extruded LDH was the longer length of a lumbar disc fragment from base to apex than width at the base (Figure.1). Lumbar MRI was not obtained after TFESI for every patient.

Procedure

TFESI procedure was performed under aseptic conditions carefully. To perform the procedure, a C-arm compatible operating table was used. After positioning the patient in the prone position, 1% lidocaine was injected subcutaneously as a local anaesthetic. To perform the procedure, a 22-gauge Quincke spinal needle (Tae-Chang Industrial Co., Korea) was inserted. Then, 1 mL of contrast media (Pamiray, Dongkook Lifescience, Korea) was injected to be sure for the correct field. Then 3 mL of 0.33% lidocaine (Huons, Korea) together with 4 mg dexamethasone (Yuhan, Korea) were injected into lumbar transforaminal epidural area (Figure 2).

VAS Score Assessment

Average VAS scores for radicular pain due to extruded LDH, before and 12 weeks after the procedure were calculated for each patient. The VAS measures pain intensity. The VAS consists of a 10 cm line, with two end points representing 0 ('no pain') and 10 ('worst possible pain'). We calculated average VAS score for radicular pain by using three different measures. First of these measures was self-rated radicular leg pain at present, the other two were minimum, and maximum self-rated radicular leg pain during the last 3 days.

Statistical Analysis

We analyzed the results statistically by using paired sample t test (for VAS) and SPSS (21.0) software. This software did not need Bonferroni or any other corrections for statistical analysis because there was only one patient group. Using statistical analysis, p value and t value were calculated. If a p value was less than 0.05, this was considered statistically significant.

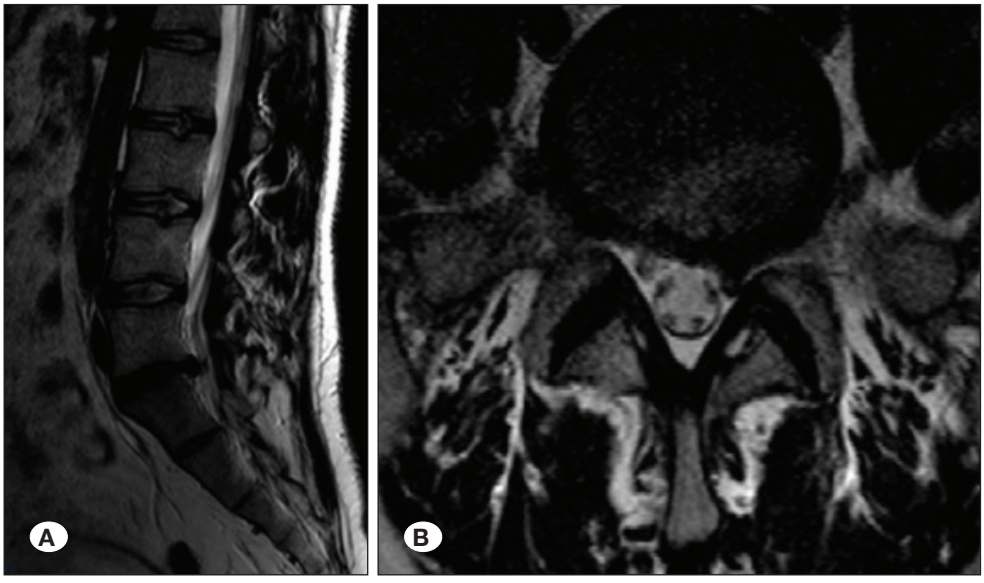

Figure 1: Extruded lumbar disc herniation. **A)** Sagittal, and **B)** axial T2W MRI scans of L5-S1 disc herniation.

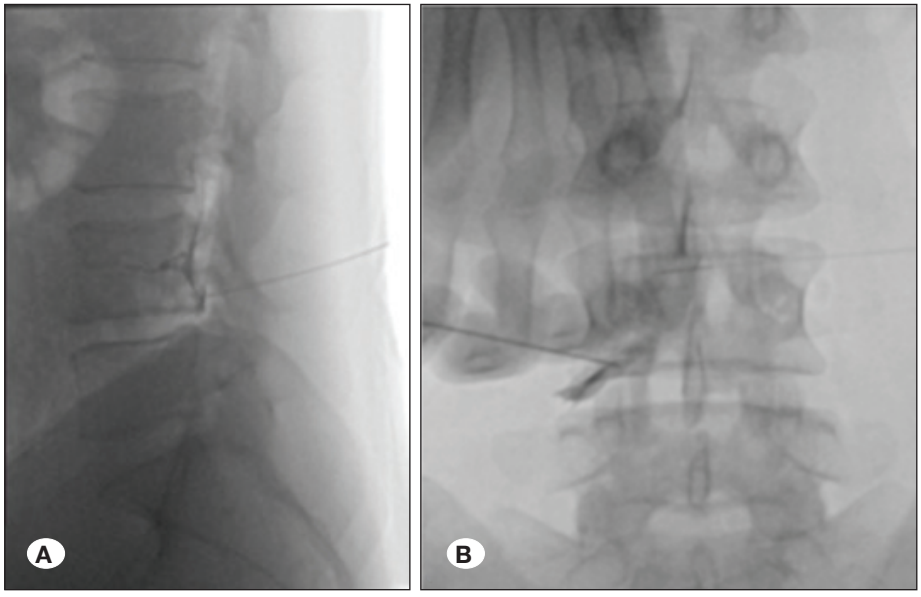

Figure 2: Lumbar transforaminal epidural steroid injection under C-arm fluoroscopy. **A)** Lateral view, **B)** anteroposterior view.

RESULTS

There were 305 individuals in this clinical study, 201 patients were male and 104 were female, mean age was 43.3 (range, 23–64) years (Table I). There were 2 extruded LDH at L2-L3, 7 at L3-L4, 151 at L4-L5, and 145 at L5-S1 (Table II). A total of 92 individuals with extruded LDH were treated by TFESI in less than 10 days after beginning of the symptoms and 213 patients were treated in more than 10 days after beginning symptoms. The mean duration of radicular pain before TFESI for early treated extruded lumbar disc herniation group was 6.1± 2.12 (range, 1– 10) days. The mean duration of radicular pain before TFESI for relatively late treated extruded lumbar disc herniation group was 27.2 ± 3.8 [range, 11– 76] days. For all the patients, the mean preprocedural and postprocedural VASs for radicular pain were 8.765 ± 0.559 and 2.281 ± 0.401, for each group. Preprocedural and postprocedural VASs difference was statistically significant, (p=0.001, and t=119.01) (Table III). The mean preprocedural and postprocedural VASs for early treated extruded disc herniation were 8.944 ± 0.645 and 1.616 ± 0.367 respectively, the mean preprocedural and postprocedural VASs for relatively late treated extruded disc herniation were 8.687± 0.712 and 2.568 ± 0.317 respectively. Preprocedural and postprocedural VASs difference for radicular pain was statistically significant between early and late treated extruded LDH patients, TFESI was more effective in alleviating radicular pain in early treated extruded LDH group compared to late treated group., and p value was p<0.05 (Table IV).

Of the 58 patients having neurological deficit before the procedure, 32 had no neurological deficit 12 weeks after the procedure. Nine patients needed surgical intervention after the procedure. There was no major procedural complication. There were ten (3.3 %) minor complications of the procedure, eight patients had cerebrospinal fluid fistula and two patients were infected.

Table I: Demographic Features of the Patients Who Underwent Transforaminal Epidural Steroid Injection

Feature		Value
Gender (n)	Male	201
	Female	104
Age (years) (mean ± SD)		43.3 ± 7.83

Table II: The Level of Extrude Disc Herniations Which were Treated by Transforaminal Epidural Steroid Injection

Level	Patients (n)
L2-L3	2
L3-L4	7
L4-L5	151
L5-S1	145

Table III: Table Showing Pre- and Post-Procedural VAS Score Means (305 patients), s.d., t Value, and p Value

	Preprocedural VAS score (mean and s.d.)	Postprocedural VAS score (mean and s.d.)	p	t value
VAS	8.765 ± 0.559	2.281 ± 0.401	**0.001***	119.01

*Paired sample t test, *p<0.05, statistically significant.*

Table IV: The Evaluation of the VAS Scores in Early and Late Treatment of Extrude Lumbar Disc Herniation Patients Who Underwent Single Lumbar Transforaminal Epidural Steroid Injections

Early treatment of extrude lumbar disc herniation TFESI patients (92 patients)		Late treatment of extrude lumbar disc herniation TFESI patients (213 patients)		p
Before TFESI	**After TFESI**	**Before TFESI**	**After TFESI**	
8.944 ± 0.645	1.616 ± 0.367	8.687 ± 0.712	2.568 ± 0.317	**0.001***

*Paired sample t test, *p<0.05, statistically significant.*

DISCUSSION

In some patients, extruded LDH regress spontaneously, this regression is confirmed by serial MRI and correlates with clinical improvement. Dehydration/degradation and inflammatory reaction with neovascularization may be the mechanisms of spontaneous regression (19). Conservative treatment may not provide adequate alleviation of pain in some individuals with extruded LDH. Before considering surgical therapy, we may expect that extruded LDH may regress and during that time TFESI could be helpful for a pain relief with anti-inflammatory effect. TFESI under fluoroscopy may provide significant alleviation of pain in individuals with LDH and may retard an early surgical intervention (20).

In general, radicular leg pain in extruded LDH is thought to be associated with direct nerve root compression of the herniated intervertebral disc (25,28). Although mechanical pressure on the nevre root causes some axonal damage and ischemia, inflammatory mediators due to disc damage have been shown in many articles (14). Degenerated and herniated lumbar disc, mainly the nucleus pulposus has some autoimmune properties and can cause some inflammatory reactions (15). Knowing that inflammatory mechanisms play an important role in the pathophysiology of radicular leg pain in LDH, explain the effect of epidural steroid injection in the treatment (2).

An epidural steroid injection can alleviate radicular pain by decreasing inflammation in the epidural space of the affected nerve root. Corticosteroids may cause neural blockade, may alter or interrupt the way of central neuronal activities, nociceptive input, self-sustaining activity of the neurons, and some reflex mechanisms of the afferent fibers (8,18). Corticosteroids may also cause a reversible local anesthetic effect, inhibit the synthesis and/or release of a number of pro-inflammatory mediators, and so alleviate inflammation (8,26). Corticosteroids can be injected interlaminar epidurally however transforaminal approach may have more analgesic efficacy. The increased spread of steroid solution by transforaminal approach may provide better contact of the solution with the ventral side of the affected nerve root and extruded nucleus pulposus. Extruded LDH have more surface to contact with nerve roots and this means that more nerve root surface may be in contact with extruded disc material and more steroid solution may reach extruded disc surface and affected nerve root surface. We thought that this increased contact of steroid solution with extruded disc material and nerve root may help more in alleviating radicular pain. Main purpose of this clinical research was to investigate optimal timing and outcome of fluoroscopically guided TFESI for the management of radicular pain due to extruded LDH.

The effectiveness of TFESI under fluoroscopy for the alleviation of radicular pain because of the LDH has been demonstrated in different studies (1,2,3,6,9). In individuals with extruded LDH, the mean VASs for radicular pain before and after the procedure were 8.765 ± 0.559 and 2.281 ± 0.401, for each group. There was statistically significant difference between VAS scores, (p=0.001, t= 119.01). The scientific articles show the effectiveness of lumbar TFESI for management of radicular pain between 0 % and 100 % and this may last approximately 3 months (4,30). In our study we found very good alleviation of radicular pain in patients with extruded LDH 12 weeks after TFESI. Our study also showed that TFESI procedure for alleviation of radicular pain due to extruded LDH was more effective if performed as early as possible after beginning the symptoms. TFESI in the management of extruded LDH effectively alleviates pain, and patients may return to normal life in a very short time, alleviation of radicular pain was better if the procedure was performed in a short time after the beginning of the symptoms.

In our study, no major complications of the procedure were noted. However, ten (3.3%) minor complications were observed. Experience is very important in performing TFESI procedure, even in experienced hands TFESI may be harmful to individuals, being careful is very important to avoid complications (5,17). Particulate steroids may be harmful if injected into the arterial system. Risk of the inaccurate needle placement was minimized by performing transforaminal epidural injections under fluoroscopy (10,16). If performed carefully TFESI does not cause any harm and appear to be cost effective. Beside this, cost of a surgical intervention is much more than TFESI. Our study showed that TFESI was very useful and safe in alleviating radicular pain in individuals with extruded LDH.

CONCLUSION

As a conclusion, extruded LDH may cause severe radicular pain and sometimes it is not possible to alleviate this pain with nonsurgical treatments. Surgical treatment is a last resort in spinal surgery, and so in the management of extruded LDH. Beside this, some patients may not be operated because they are old or are not suitable for anesthesia, and also some patients avoid surgery even they have severe pain and/or neurological deficit. TFESI under fluoroscopy is a very safe procedure for individuals with extruded LDH, and effectively alleviate radicular pain. After beginning the symptoms,

better pain control was achieved by early performed TFESI for the treatment of radicular pain caused by extruded LDH. Furthermore, alleviation or relief of neurological deficits can also be achieved after such procedure.

AUTHORSHIP CONTRIBUTION

Study conception and design: BG, SK
Data collection: BG, LD
Analysis and interpretation of results: BG, SK
Draft manuscript preparation: BG, AO
Critical revision of the article: BG, AO
Other (study supervision, fundings, materials, etc...): BG, LD
All authors (BG, LD, SK, AO) reviewed the results and approved the final version of the manuscript.

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