

Short-Term Outcomes of Transforaminal Epidural Injections in Unilateral Lumbosacral Radiculopathy

Caner Sarıkaya^{1*}, Cansu Egilmez Sarıkaya², Abdulmutalip Karaaslanlı³

¹Department of Neurosurgery, Maltepe University Hospital

²Department of Neurology, Bahçeşehir University Medical Park Hospital

³Department of Neurosurgery, Van Yüzüncü Yıl University

ABSTRACT

This study aimed to evaluate the short-term clinical outcomes of transforaminal epidural steroid injections performed by a single surgeon at a single center and to determine in which patient groups the procedure is most effective.

A retrospective analysis was conducted on 100 patients who underwent transforaminal epidural injections for unilateral lumbosacral radiculopathy between 2022 and 2023 and were followed for at least 6 months. Clinical benefit was defined as a $\geq 50\%$ reduction in visual analogue scale (VAS) scores on the 15th postoperative day.

Of the 100 patients (45 male, 55 female; mean age 56 years, range 19–81), 86.84% of those treated at a single level experienced significant improvement compared with 13.16% of patients treated at two or more levels (Pearson Chi-Square test, $p=0.001$). Among patients with isolated lumbar disc pathology, 77.63% benefited from the procedure, whereas only 15.79% of those with concomitant disc and lumbar stenosis did (Pearson Chi-Square test, $p=0.001$). For patients with lumbar spondylolisthesis ($n=8$), interpretation should be made cautiously due to limited subgroup size. No significant differences were found among disc types (bulging, protruded, extruded, sequestered) (Kruskal-Wallis test, $p>0.05$).

Transforaminal epidural steroid injection is a highly effective short-term treatment option for patients with isolated lumbar disc pathology. In cases with concomitant lumbar stenosis or spondylolisthesis, the procedure primarily provides symptomatic relief rather than addressing the underlying pathology.

Keywords: Transforaminal epidural injection, lumbosacral radiculopathy, pain management, lumbar disc pathology

Introduction

Transforaminal epidural injection is an increasingly popular treatment for unilateral radiculopathy related to lumbar disc pathology. Lumbosacral radiculopathy affects 3-5% of the population. (1). For patients experiencing severe pain, transforaminal epidural injections can provide sufficient analgesia to enable physical therapy. (2) This injection has proven effective for pain control in conditions such as radiculitis, spinal stenosis, discogenic pain, and post-lumbar surgery syndrome. (3,4) For patients unresponsive to conservative treatments and without signs of cauda equina syndrome, transforaminal injections are the next therapeutic step.

Previous studies have demonstrated the short-term effectiveness of transforaminal epidural injections in treating lumbosacral radiculopathy. (5,6,7) However, studies specifying which patient groups benefit most from this procedure are limited. This study retrospectively examines the clinical outcomes of patients who received

transforaminal steroid injections for unilateral radiculopathies.

Materials and Methods

This study included 100 patients who underwent transforaminal epidural injection treatment at a single center, performed by a single surgeon, between 2022 and 2023. Patients who completed 6 months post-procedure were retrospectively analyzed.

Inclusion criteria were unilateral lumbosacral radicular leg pain, lack of response to at least 6 weeks of conservative treatment, absence of strength loss or urinary incontinence on neurological examination, a visual analogue scale score of 5 or higher, and MRI showing lumbar disc pathology, lumbar spinal stenosis, or lumbar spondylolisthesis. Informed consent was obtained from all patients before the procedure, with detailed explanations of risks and the process.

*Corresponding Author: Caner Sarıkaya, Department of Neurosurgery, Maltepe University Hospital, İstanbul, Turkey

Email: canersk@gmail.com, Phone: 0090-532-512-06-51

ORCID ID: Caner Sarıkaya: 0000-0002-2325-3903, Cansu Egilmez Sarıkaya: 0000-0002-5790-8488, Abdulmutalip Karaaslanlı: 0009-0005-1046-3484

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Patients were evaluated based on age, gender, level of injection, number of levels, imaging findings, and clinical benefit. A reduction in VAS score by 50% or more post-procedure was considered a beneficial outcome.

In this study, the term “two or more levels” refers specifically to the number of levels treated with transforaminal epidural injection, rather than the number of radiologically identified pathological levels.

In all surgeries, a 19 G Sciba needle was used with a subpedicular technique under fluoroscopic guidance to accurately determine the pathological level. Confirmation of the target level and corresponding nerve root was achieved through the administration of 2 ml of OMNIPAQUE 350 mg contrast agent. Subsequently, a total of 2 ml of injectate per level—comprising 1 ml of methylprednisolone acetate and 1 ml of 5% Marcaine—was delivered to the affected area. No post-procedural complications were observed.

Statistical Analysis: Statistical analysis was performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Normality of distribution was assessed with histogram plots and the Kolmogorov-Smirnov test. Continuous variables were expressed as mean $\pm$ standard deviation when normally distributed, or as median (minimum–maximum) when non-normally distributed.

Comparisons of categorical variables between two groups were conducted using the Pearson Chi-Square test; when expected frequencies were below 5, Fisher’s Exact test was applied. For comparisons among more than two independent groups with non-normally distributed variables, the Kruskal-Wallis test was used, followed by pairwise post-hoc tests where applicable.

A p-value of less than 0.05 was considered statistically significant. In accordance with journal guidelines, all very small p-values (e.g., $p=0.0005$, $p=0.0002$) were reported as $p=0.001$.

Results

A total of 100 patients were included, 45 male and 55 female, with a mean age of 56 years (range 19–81). Eighty-three patients received treatment at a single level, 15 at two levels, and 2 at three levels. MRI findings revealed isolated lumbar disc pathology in 71 patients, lumbar disc plus stenosis in 21 patients, and grade 1 lumbar spondylolisthesis in 8 patients.

Post-procedure, 76 patients demonstrated significant improvement, with their average VAS scores decreasing from 7.23 (range 6–8) to 2.13 (range 1–3) on the 15th day, corresponding to a reduction of more than 50%.

Among the 8 patients who eventually underwent surgery, the average VAS score decreased initially from 7.11 (range 7–9) to 2.48 (range 2–8) but rose again to 6.77 (range 5–8) by the 15th day, necessitating surgical intervention for pain control.

The mean age of patients who benefited from the injection was 55.61 ± 14.44 (range 28–81), whereas the mean age of non-responders was 62 ± 12.96 (range 30–77). Patients who later required surgery had a mean age of 46.25 ± 16.5 (range 19–72).

Statistically, 86.84% of patients treated at a single level experienced significant benefit, compared with only 13.16% of those treated at two or more levels (Pearson Chi-Square test, $p=0.001$). MRI findings showed that 77.63% of patients with isolated lumbar disc pathology benefited, whereas only 15.79% of those with both lumbar disc and stenosis did; among non-responders, 56.25% had concomitant disc and stenosis (Pearson Chi-Square test, $p=0.001$).

There was no statistically significant difference in outcomes among patients with bulging, sequestered, extruded, or protruded discs (Kruskal-Wallis test, $p>0.05$).

Discussion

Outcomes of transforaminal epidural steroid injections are influenced by multiple factors, including practitioner experience, patient selection, symptom duration, accompanying pathophysiology, imaging guidance during the procedure, previous conservative treatments, and socioeconomic status. This study aimed to minimize variability by having a single surgeon perform the same techniques at the same center.

Patients with a prolonged duration of symptoms tend to derive less benefit from transforaminal epidural injections. (8) Literature indicates that transforaminal steroid injections are effective for pain control in radiculopathy due to lumbar disc herniation, both short- and long-term. (9,10,11) Studies suggest that suitable patients can avoid surgery through effective pain control via transforaminal injections. (11,12,13) Our findings support this, as only 8 patients required surgery post-injection.

For radiculopathy due to lumbar stenosis, short-term benefits are observed, but long-term effectiveness diminishes. (9,14,15) Of the patients with spinal stenosis who were followed for two years, 44% did not require surgery. (16)

Our study demonstrated greater efficacy of transforaminal epidural injections in patients with isolated lumbar disc pathology. In contrast, among patients with lumbar spinal stenosis or spondylolisthesis, the injections served primarily as symptomatic relief without addressing the underlying structural abnormalities. Furthermore, treatment effectiveness was observed to decline as the number of involved spinal levels increased.

In patients with chronic nerve pathology and fibrosis post-disc operation, maximum pain control is achieved within the first month post-epidural injection, decreasing between 3-6 months afterward. (17)

The drugs used during transforaminal epidural injections vary. Injections with local anesthetics alone are as effective as those with both local anesthetics and steroids. (18) Adding steroids to local anesthetics provides slightly more effective pain relief, (19) although some studies report no additional benefit. (9,20)

Both particulate and non-particulate steroids are effective for radiculopathy. Complications such as spinal cord infarction following betamethasone suspension or methylprednisolone have been reported. (21,22) To prevent this, contrast material was used to visualize intraarterial flow before drug injection.

Minor complications occur in 2.4% to 9.6% of patients, including vascular penetration, excessive bleeding, local hematoma, vasovagal reaction, and nerve root irritation (18). Major complications, although rare, include epidural abscess (23), epidural hematoma (24), and spinal cord infarction. (21) Most complications are minor and infrequent. (25) Transforaminal epidural injection is considered safe for lumbar radicular pain. (25)

One limitation of this study is the relatively small sample size in certain subgroups, particularly the patients with lumbar spondylolisthesis (n=8). The limited number of cases in this subgroup reduces the statistical power and may restrict the generalizability of the results. Therefore, the findings regarding these smaller groups should be interpreted with caution.

Transforaminal epidural injections are highly preferred due to lower complication rates compared to surgery, lower costs, no need for surgical equipment, and no anesthesia

dependency. Although long-term results for isolated lumbar disc conditions are equivalent to surgery, larger patient groups are needed for replication.

Transforaminal epidural injection is highly effective for controlling pain in lumbar radicular pain due to isolated lumbar disc disease without accompanying lumbar stenosis or instability. The treatment's effectiveness is determined on the quantity of impacted spinal levels and the particular underlying disease.

Compliance with Ethical Standards: The Ethics Committee of Ümraniye Training and Research Hospital granted ethical approval, with the reference number B.10.1.TKH.4.34.H.GP.0.01/20.

Conflict of Interest: The authors have disclosed that they have no conflicts of interest in connection with this article.

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