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Short-Term Efficacy of Epidural Injection of Triamcinolone Through Translaminar Approach for the Treatment of Lumbar Canal Stenosis

Saeed Sabbaghan [1], Elham Mirzamohammadi [2], Maryam Ameri Mahabadi [3], Farshad Nikouei [1], Farhad Rahbarian [1], Susan Ahmadichaboki [1], Samira Eftekhari [1], Maryam Zamankhani [1] and Amir Aghaie Aghdam [1, *]

[1] Bone and Joint Reconstruction Research Center, Shafa Orthopedic Hospital, Iran University of Medical Sciences, Tehran, Iran
[2] Occupational Medicine, Faculty of Medicine, Iran University of Medical Sciences, Tehran, Iran
[3] Department of Forensic Medicine and Toxicology, Iran University of Medical Sciences, Tehran, Iran

[*] *Corresponding author*: Bone and Joint Reconstruction Research Center, Shafa Orthopedic Hospital, Iran University of Medical Sciences, Tehran, Iran. Email: amir.aghdam.2012@gmail.com

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Abstract

Background: Epidural steroid injection is a non-operative minimally invasive procedure for pain relief in spinal canal stenosis. However, there is no significant consensus regarding its efficacy.
Objectives: In this study, we aimed to evaluate the effectiveness of translaminar injection of triamcinolone in lumbar canal stenosis.
Methods: In a retrospective study, we included 111 patients with MRI-confirmed spinal canal stenosis who were irresponsive to 12 weeks of conservative treatment and underwent epidural injection of triamcinolone through the translaminar approach. Outcome measures were routinely checked before the intervention and four weeks after the intervention, which included the Visual Analog scale (VAS) for low back pain, VAS for lower-limb pain, and Oswestry Disability index (ODI).
Results: The study population included 32 (28.8%) males and 79 (71.2%) females with the mean age of 61 $\pm$ 13.4 years. The mean ODI, VAS for low back pain, and VAS for lower-limb pain significantly improved at the final evaluation session ($P < 0.001$, $P = 0.001$, and $P < 0.001$, respectively). The levels of improvement in ODI, VAS for low back pain, and VAS for lower-limb pain were considerably more in patients with single-level involvement ($P < 0.001$, $P = 0.04$, and $P < 0.001$, respectively). Improvement of lower-limb VAS was negatively correlated with age ($r = -0.400$, $P < 0.001$) and BMI ($r = -0.525$, $P < 0.001$). The ODI improvement was also negatively correlated with BMI ($r = -0.569$, $P < 0.001$).
Conclusions: Epidural injection of triamcinolone through the translaminar approach could be regarded as an efficacious method for the alleviation of pain and disability in patients with spinal canal stenosis.

Keywords: Spinal Canal Stenosis, Epidural Injection, Steroid, Translaminar Approach

1. Background

Chronic pain is a global health problem. Many pieces of research have focused on either developing new pain management strategies or optimizing the available pain management modalities (1-6). Back pain is a debilitating disorder with a variety of etiologies (2, 7-9). Spinal canal stenosis refers to the narrowing of the spinal canal, which results in the spinal cord and spinal nerve compression. The etiology of the disease is generally degenerative. This condition can cause a variety of symptoms, including pain, limb weakness, and numbness (10-12). In addition to the back and leg pain, patients with symptomatic spinal canal stenosis are at high risk for developing other serious complications due to their reduced activity (13). Acquired spinal canal stenosis is quite common among elderlies, with a prevalence of 1.7% - 13.1% (14, 15). Therefore, developing new strategies for the treatment of this disorder is of critical value.

Conservative treatment is considered the primary choice of treatment in spinal canal stenosis. However, in many cases, conservative therapy is not effective and therefore, surgical treatment is selected for the alleviation of pain (16). Even so, the surgery is not always effective and the symptoms may remain after the operation. In addition, in elderlies, anesthetic and postoperative complications should be taken into consideration, as they usually have other medical problems (17). For these reasons, surgical treatment of stenosis is associated with its own concerns and long-term benefits of surgical management have

been reported to be limited when compared to conservative management (18).

An epidural steroid injection is a non-operative minimally invasive procedure used for pain relief in spinal canal stenosis. The main goal of this treatment is to reduce pain so that patients can resume their rehabilitation programs. Although several investigations have been performed for assessing the efficacy of this treatment in the management of patients with spinal canal stenosis, there is still no consensus on its effect size nor on the timing of the trial, frequency, and duration of treatment (19). Therefore, further studies are required to remove the available uncertainties regarding the epidural steroid injection in the treatment of spinal canal stenosis.

2. Objectives

In this study, we aimed to evaluate the efficacy of translaminar injection of triamcinolone in 111 patients with spinal canal stenosis who were irresponsive to 12 weeks of conservative management.

3. Methods

This retrospective study was confirmed by the Ethics Committee of our institute under the code of IR.BJRC.ER.1398.390. The participants provided written consent to use their medical data for publication. Between 2017 and 2018, we recruited patients with radicular back pain and apparent spinal canal stenosis in magnetic resonance imaging (MRI) who underwent epidural injection of triamcinolone through translaminar approach and evaluated them for the eligibility to include in this study. The diagnosis was confirmed by two different spinal surgeons. The indication for epidural injection was a non-response to 12 months' conservative treatment (activity modification, nonsteroidal anti-inflammatory drugs, and physical therapy), the age of > 18 years, and diagnosis of severe spinal canal stenosis according to the criteria for classifying lumbar spinal canal stenosis (CLSCS) (20). This classification system is based on four parameters, including Hufschmidt-grade, grading of MRI, self-paced walking test, and stenosis ratio. Accordingly, the patients were divided into four grades: grade 0 (CLSCS < 7), grade 1 ($7 \leq$ CLSCS < 10), grade 2 ($10 \leq$ CLSCS < 13), and grade 3 or severe spinal canal stenosis ($13 \leq$ CLSCS ≤ 16.5).

Patients' inclusion was not restricted by body mass index (BMI) and patients with any BMI were included. The contraindications for epidural injection were current local or systemic infection, local malignancy, local anesthetic or steroid suspension allergy, adrenal suppression, American Society of Anesthesiologists Classification (ASA) class 3 and 4, hemodynamic instability, hypersensitivity to agents, coagulopathy, diathesis, congestive heart failure, diabetes mellitus, aortic stenosis, and increased intracranial pressure. Patients with a disc herniation at the same level as their stenosis, a history of spinal canal stenosis, and a history of spinal surgery for vertebral fracture were not selected for this study. Finally, a total of 111 patients were identified as eligible for the study.

3.1. Injection Procedure

All the injections were performed by a single fellowship-trained spine surgeon at the same center. The patients were placed in the prone position and prep and drape of the area were performed in a sterile fashion. Then, the C-arm was set in a posteroanterior position. After that, the midpoint of the intervertebral space at the target level was identified. The skin was infiltrated with a local anesthetic solution using a short 25-gauge needle down to the lamina. A Tuohy needle 18 gauge was used for epidural injection. The needle was introduced nearly 1 cm paramedian at the level of the tip of the spinous process. Then, the needle was angled slightly in the medial direction and advanced until contacting with the lamina. Once the bony contact was made, the needle was redirected with angle 45° with the parasagittal and 15° axial plane medial and cephalad. Then, the C-arm was positioned laterally and the needle was advanced with the loss of resistance technique. The stylet of the needle was removed afterward. A lubricated 5 ml syringe filled with saline was attached and advanced under fluoroscopy. In case a straight line image was visualized in the lateral vision, the injection solution was released slowly, which included Bupivacaine hydrochloride (Astrazeneca, France) 0.5% (3 mL) and triamcinolone acetonide (Hexal, Germany) 80 mg (2 mL). After the recovery, the patients were discharged from the hospital. No physical or manual therapy was allowed during the study period.

3.2. Outcome Measures

The demographic characteristics of the patients, including age, gender, and BMI, as well as the outcome measures, were extracted from the patients' profile. The outcome measures were routinely checked at our center before the intervention and four weeks after the intervention, which included the Visual Analog scale (VAS) for lumbar pain, VAS for lower-limb pain, and Oswestry Disability index (ODI). The VAS scores ranged from 0-10, where 0 represented no pain and 10 represented the extreme pain. The ODI score ranged from 0 - 100, where 0 meant no disability and 100 showed the maximum disability.

3.3. Post-Injection Protocol

All patients received oral Gabapentin 100 mg (Razak Darou, Iran) (100 mg/day) after the injection. They were asked to rest and avoid strenuous activities on the day of the epidural steroid injection. In case of severe pain, Diclofenac sodium 100 mg (Alborz Darou, Iran) (100 mg/day) was administered as the rescue medication. Routinely, the first follow-up of the patients was done four weeks after the injection. However, they were asked to refer if any adverse effect was noticed.

3.4. Statistical Analysis

We used SPSS version 16 for Windows (Chicago, Illinois, USA) for the statistical evaluation of the data. Demographic data were presented as mean ± standard deviation or number and percentages. A comparison of the outcome measures before and after the intervention was made using a paired *t*-test or its nonparametric counterpart (Wilcoxon signed-rank). The mean improvement of outcome measures was compared between different groups using an independent t test or its nonparametric counterpart (Mann-Whitney U test). Pearson's or Spearman's correlation coefficient test was used for the evaluation of potential correlations. A P value of less than 0.05 was considered significant.

4. Results

A total of 111 patients with radiologically confirmed spinal canal stenosis were evaluated in this study. The study population included 32 (28.8%) males and 79 (71.2%) females. The mean age of the patients was 61 ± 13.4 years, ranging from 32 to 84 years. Only was one level involved in the majority of the patients (69 patients). The characteristics of the patients are demonstrated in detail in Table 1.

The mean pre-treatment ODI was 57.2 ± 11 that improved to 33.4 ± 15 after the intervention. This difference was statistically significant (P < 0.001). The mean pre-treatment VAS for lumbar pain was 6.4 ± 1.9, which improved to 5.5 ± 1.6 after the intervention. This difference was statistically significant, as well (P = 0.001). The mean pre-treatment VAS for lower limb pain was 7.4 ± 1.5, which improved to 4.2 ± 1.6 after the intervention. This difference was statistically significant, too (P < 0.001).

The number of the involved levels was significantly associated with the improvement of ODI, VAS for lumbar pain, and VAS for lower extremity pain (P < 0.001, P = 0.04, and P < 0.001, respectively). In this respect, the level of improvement was considerably more in patients with single-level involvement (Table 2). No significant association was found between the sex of the patients and the improvement of outcome measures.

Table 1. The Characteristics of the Patients with Spinal Stenosis[a]

Variable	Patients (N = 111)
Age, y	61 ± 13.4
Gender	
Female	79 (71.2)
Male	32 (28.8)
Number of Involved levels	
1	69 (62.2)
2	33 (29.7)
3	9 (8.1)
Body mass index, kg/m^2	29.5 ± 2.8
Pre-treatment ODI	57.2 ± 11.7
Pre-treatment VAS for lumbar pain	6.9 ± 1.9
Pre-treatment VAS for lower limb pain	7.4 ± 1.5

Abbreviations: ODI, Oswestry Disability index; VAS, Visual Analogue scale.
[a]Values are expressed as mean ± SD or No. (%).

The improvement of lower limb VAS was negatively correlated with the age (r = -0.400, P < 0.001) and BMI (r = -0.525, P < 0.001) of the patients. The ODI improvement was also negatively correlated with the BMI of the patients (r = -0.569, P < 0.001). No other significant correlations were found between the outcome measures and the characteristics of the patients.

No injection-associated complication was recorded in the patients of this series until the date of the last follow-up (four weeks after the intervention).

5. Discussion

In this study, we evaluated the effect of translaminar injection of triamcinolone in 111 patients with spinal canal stenosis who were irresponsive to 12 weeks of conservative management. Based on the results of this investigation, the translaminar injection of triamcinolone significantly decreased the level of disability in the patients. In addition, both lumbar and lower limb pain significantly improved following the intervention. The improvement of outcome measures was associated with the number of involved levels, age, and BMI of the patients so that patients with single-level involvement, lower age, and lower BMI revealed more improvement.

The role of steroid injection in the alleviation of pain and disability in spinal canal stenosis has been assessed in many investigations. While some studies have shown the

Table 2. Association of Outcome Measures Improvement with the Number of Involved Levels[a, b]

Outcome Measure	One-Level Involvement	Two-Level Involvement	Three-Level Involvement	P Value
ODI improvement	27.2 ± 6.4	19.3 ± 4.7	14.7 ± 3.5	< 0.001
VAS for lumbar pain improvement	1.08	0.63 ± 0.7	0.88 ± 0.8	0.04
VAS for lower limb improvement	4 ± 1	1.8 ± 1.4	1.8 ± 1.3	< 0.001

Abbreviations: ODI, Oswestry Disability index; VAS, Visual Analogue scale.
[a]Values are expressed as mean ± SD or No. (%).
[b]P < 0.05 is considered significant.

positive effect of steroid injection on spinal canal stenosis, other investigations revealed no or minimal effect. For this reason, several systematic reviews with diverse conclusions have been published.

Manchikanti et al. (21) in 2012 reviewed the efficacy of transforaminal epidural injection therapy for low-back and lower extremity pain. The primary outcome measure was short-term (up to six months) and long-term (more than six months) pain relief. Secondary outcome measures were an improvement in activity level, psychological status, and reduction in opioid intake. A total of 25 studies met the inclusion criteria and included in the study. Based on their review, the results were fair for radicular pain secondary to spinal canal stenosis with local anesthetics and steroids (21). By contrast to the results of this review, our results revealed the excellent improvement of pain and disability following the steroid injection.

Liu et al. (22) in 2015 aimed to investigate the efficacy and safety of epidural steroid injections in the improvement of patients with lumbar spinal canal stenosis. Ten articles (1,010 participants) were consistent with the criteria of randomized controlled trials and included in this investigation. Based on their results, there was minimal evidence demonstrating the better efficacy of epidural steroid injections in comparison with lidocaine alone. They concluded that the short-term and long-term benefits of local anesthetics and steroids for the treatment of spinal canal stenosis are minimal (22).

Manchikanti et al. (23) in 2015 aimed to systematically review the efficacy of different approaches of anatomical epidural injection (caudal, interlaminar, and transforaminal) in the treatment of spinal canal stenosis. The level of evidence was II for long-term improvement in managing lumbar spinal canal stenosis for caudal and lumbar interlaminar epidural injections. The level of evidence was III for short-term improvement only by transforaminal epidural injections. The interlaminar injection appeared to be more efficacious than the caudal injection, and the caudal injection appeared to be more efficacious than the transforaminal one (23). We evaluated the effect of translaminar (interlaminar) steroid injection in patients with spinal canal stenosis, which revealed to be efficacious, at least for short-term implications.

A literature review revealed that several factors such as the injection approach (19), type of anesthetic (24, 25), the number of injections (26), and type and dose of steroids could be different from study to study (27). Therefore, such differences should be kept in mind when comparing the results of different investigations.

Song et al. (24) aimed to compare the long-term efficacy of translaminar epidural steroid injection in spinal canal stenosis patients, with or without local anesthetics. Similar to the present study, the steroid selection of choice was triamcinolone. Based on their results, the Functional Rate index (FRI) and VAS significantly improved in both groups (24). The results of the present study were in accordance with the results of a study by Song et al. (24) Such similarity further supports the need for more homogeneity in future studies.

In spite of the potential advantages of epidural steroid injections, the attributed risks to these injections should also be considered. Recently, multiple reports have referred to the potential complications of epidural steroid injections, including infections, spinal fluid leaks, urinary retention, allergic reactions, headaches, stroke, blindness, neurological deficits, seizures, etc. (28). Even so, none of the above-mentioned complications was seen in the present series.

The present study was not free of limitations. The main limitation of the study was the absence of a control group managed with an anesthetic alone. Therefore, we suggest performing future investigations using such a control group. In addition, the long-term follow-up of the patients is proposed to evaluate the long-term effects of epidural injection.

5.1. Conclusions

Epidural injection of triamcinolone through the translaminar approach could be regarded as a safe and efficacious method for the alleviation of pain and improvement of disability in patients with spinal canal stenosis who are not responsive to conservative management.

However, future controlled trials are required to support the findings of the present study.

Footnotes

Authors' Contribution: Saeed Sabbaghan did study design. Elham Mirzamohammadi did data collection. Maryam Ameri Mahabadi did data collection. Farshad Nikoei did epidural injections. Farhad Rahbarian did critical revision of the manuscript. Susan Ahmadichaboki did statistical analysis. Samira Eftekhari involved anesthesiologist. Maryam Zamankhani did data collection. Amir Aghaei Aghdam did drafting the manuscript.

Conflict of Interests: None.

Ethical Approval: This retrospective study was confirmed by the Ethics Committee of our institute under the code of IR.BJRC.ER.1398.390.

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