



## ORIGINAL ARTICLE

# Pain and neurogenic claudication control in lumbar stenosis, which is the most common cause of spinal surgery in the geriatric population

*Geriatrik popülasyonda omurga cerrahisinin en yaygın nedeni olan lomber stenozda ağrı ve nörojenik kladikasyo kontrolü*

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## Summary

**Objectives:** The authors aim to present when to do physical therapy or surgery in geriatric patients with degenerative lumbar stenosis.

**Methods:** The authors retrospectively analyzed 250 patients who underwent physical therapy due to lumbar degenerative stenosis between December 2014 and April 2017. The patients were divided into two groups: Central canal stenosis and lateral recess/foraminal stenosis groups. Visual analogue scale and neurological claudication values of both patient groups were evaluated before and after physical therapy. The association between comorbid diseases and the frequency of surgery was also evaluated.

**Results:** 142 of the patients were female and 108 were male, and the mean age of these patients was 69 years. The mean onset of symptoms was 55 months. In the visual analog scale value of patients after physical therapy, the authors observed decreases of 4–6° in patients with central canal stenosis and 2–3° in patients with lateral recess/foraminal stenosis. In addition, the authors observed that patients with lateral recess/foraminal stenosis together with diabetes mellitus benefit less from physical therapy.

**Conclusion:** Physical therapy and rehabilitation play an important role in the treatment of lumbar stenosis. Physical therapy is the primary treatment option for patients who do not have motor muscle strength losses and incontinence and who have pain control through medications. The authors can consider surgical interventions in patients with lateral recess/foraminal stenosis who do not benefit from physical therapy at a satisfactory level.

Keywords: Pain; pain management; physical therapy modalities; visual analog scale.

## Özet

**Amaç:** Çalışmada, dejeneratif lomber stenozu olan geriatrik hastalarda ne zaman fizik tedavi veya cerrahi yapılacağı araştırılması amaçlandı.

**Gereç ve Yöntem:** Aralık 2014 ile Nisan 2017 tarihleri arasında lomber dejeneratif stenoz nedeniyle fizik tedavi gören 250 hasta retrospektif olarak analiz edildi. Hastalar santral kanal darlığı ve lateral reses/foraminal darlık olmak üzere iki gruba ayrıldı. Her iki hasta grubunun vizüel analog skala ve nörolojik kladikasyo değerleri fizik tedavi öncesi ve sonrası değerlendirildi. Komorbid hastalıklar ile ameliyat sıklığı arasındaki ilişki de değerlendirildi.

**Bulgular:** Hastaların 142'si kadın 108'i erkek olup, yaş ortalaması 69'du. Semptomların ortalama başlangıcı 55 aydı. Fizik tedavi sonrası hastaların vizüel analog skala değerlerinde santral kanal darlığı olan hastalarda 4–6°, lateral reses/foraminal stenozu olan hastalarda 2–3° düşüşler gözlemlendi. Ayrıca, diabetes mellitus ile birlikte lateral reses/foraminal stenozu olan hastaların fizik tedaviden daha az fayda sağladığı tespit edildi.

**Sonuç:** Fizik tedavi ve rehabilitasyon lomber darlığın tedavisinde önemli bir rol oynamaktadır. Motor kas gücü kayıpları ve inkontinans olmayan ve ilaçlarla ağrı kontrolü olan hastalar için fizik tedavi birincil tedavi seçeneğidir. Fizik tedaviden tatmin edici düzeyde fayda görmeyen lateral reses/foraminal stenozlu hastalarda cerrahi girişim düşünülebilir.

Anahtar sözcükler: Ağrı; ağrı yönetimi; fizik tedavi yöntemleri; vizüel analog skala.

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## Introduction

Lumbar spinal stenosis is defined as the narrowing of the neural foramen and lateral recess due to disc protrusion, ligament and bone hypertrophy, or osteophyte formation. It was first clinically identified by Dr. Verbiest in 1950.<sup>[1]</sup>

The incidence of lumbar stenosis increases parallel to the increase in the elderly population. In the general population, the incidence of lumbar stenosis is between 9.3% and 11%.<sup>[2,3]</sup>

Congenital spinal stenosis is relatively less and can be asymptomatic for a long time. It is often seen in men. In congenital stenosis, symptoms appear in older ages, mostly between 30 and 40 years old. Classical degenerative lumbar stenosis is mostly seen in people over 65 years of age, and it is the most common cause of spinal surgery in geriatric patients. It is a serious cause of morbidity in geriatric patients.<sup>[4-6]</sup>

Computed tomography (CT) and magnetic resonance imaging (MRI) are very important in diagnosing.<sup>[7]</sup> The normal anterior-posterior diameter of the spinal canal is 15–25 mm. If the anterior–posterior diameter of the spinal canal is between 12 and 15 mm, it is defined as relative stenosis and below 10 mm as absolute stenosis.<sup>[8]</sup> Lateral recess stenosis is defined as lateral recess height of  $\leq 2$  mm and/or lateral recess depth of  $\leq 3$  mm. It is thought that the neural foramen should be 2–3 mm in diameter to indicate foraminal stenosis.<sup>[9]</sup>

Due to compression of the neural canal and/or nerve roots in lumbar stenosis, patients commonly experience back pain, leg pain, neurogenic claudication, and sphincter defect. The symptoms of the patients depend on the posture and increase with extension and weight-bearing positions and decrease with flexion and unloaded postures.<sup>[10]</sup>

The goal of treatment is to reduce pain and ensure that the patients continue their daily activities. Non-surgical approach is the first widely accepted treatment option.

Lumbar stenosis is an important morbidity in the geriatric population. Considering that the geriatric population will increase day by day, we can predict

that it will be an important public health problem in the future. We will need to carefully select the best treatment options for patients. Considering the patients' existing comorbid diseases, when should we apply physical therapy and when should we apply surgical treatment? The purpose of the authors is to seek answers to these questions in this article.

## Material and Methods

The authors retrospectively analyzed 250 patients with degenerative lumbar stenosis who undergone physical therapy between January 2014 and April 2017. MRI and CT examinations were performed to the patients. These patients were divided into two groups: Central canal stenosis and lateral recess/foraminal stenosis groups. In addition, comorbid diseases of the patients were examined.

All of the patients were treated in the same physical therapy clinic. In the physical therapy program, ultrasonography at 1.5 watts/cm<sup>2</sup> for 5 minutes, conventional transcutaneous electrical nerve stimulator for 20 min, and hot packs for 20 min were performed in addition to medical treatment. Furthermore, lumbar range of motion, Williams' pelvic tilt, and hamstring stretching exercises were repeated 10 times at the end of the physical therapy session, and home exercise programs were given to the patients to be done 10 times twice at home.

The patients' pain was clinically evaluated with Visual analog scale (VAS) of 0–10. The most severe pain the patients encountered in their lives merits the score of 10, while their painless periods are considered 0.

Neurogenic claudication in the patients was evaluated before and after physical therapy and rehabilitation.

This study was approved by the Medical Ethics Committee of Tekirdag Namik Kemal University (2020.69.03.19). This study followed the ethics rules in the 1964 Declaration of Helsinki, which was amended in 2013 and informed consent was obtained from every participant.

## Statistical Analysis Methods

Descriptive statistics are used to define continuous variables (average, standard deviation, minimum,

**Table 1.** Evaluation of visual analogue scale (VAS) scores before and after physical therapy in patients with lumbar stenosis

	VAS before physical therapy		VAS after physical therapy		p
	Mean±SD	Med (Min–Max)	Mean±SD	Med (Min–Max)	
Lateral recess/foraminal stenosis n=115	8.0±0.8	8 (6–9)	4±1.3	4 (2–6)	<0.001
Central canal stenosis n=135	7.0±1.1	7 (5–9)	2.0±1.1	2 (1–5)	<0.001

The VAS change between the lateral recess/foraminal stenosis group and the central canal stenosis group before and after physical therapy is statistically significant (Mann-Whitney U test,  $p < 0.001$ ). Separately, both groups had statistically significant changes in VAS before and after physical therapy (Wilcoxon signed-rank test,  $p < 0.001$ ). SD: Standard deviation; Min: Minimum; Max: Maximum.

**Table 2.** Average neurogenic claudication distance in patients with lumbar stenosis before and after physical therapy

	Distance (m) before physical therapy		Distance (m) after physical therapy		p
	Mean±SD	Med (Min–Max)	Mean±SD	Med (Min–Max)	
Lateral recess/foraminal stenosis n=115	69.8±20.4	65 (50–100)	299.6±153.8	300 (100–1000)	<0.001
Central canal stenosis n=135	120.4±46.6	100 (50–200)	700±161.5	650 (400–1000)	<0.001

The neurogenic claudication change between the lateral recess/foraminal stenosis group and the central canal stenosis group before and after physical therapy is statistically significant (Mann-Whitney U test,  $p < 0.001$ ). Both groups had statistically significant neurogenic claudication change before and after physical therapy (Wilcoxon signed-rank test,  $p < 0.001$ ). SD: Standard deviation; Min: Minimum; Max: Maximum.

median, and maximum). The availability of the data for normal distribution was examined with the Shapiro-Wilks test. The comparison of two variables that are not available for independent distribution and normal distribution was made using the Mann-Whitney U test. The comparison of two variables that are not dependent and not available for normal distribution was made with the Wilcoxon signed-rank test. The relationship between categorical variables was evaluated by a chi-squared test (Fisher’s exact test or Yates’ correction for continuity where appropriate). The statistical significance level was determined at 0.05 using the IBM SPSS Statistics Version 26 for Windows (IBM Corp., Armonk, NY, USA). It will be carried out using the program.

## Results

142 of the patients were female and 108 were male. The average age was  $69 \pm 6.4$  years (range 65–86 years). It was observed that the duration of symptoms of the patients was on average 55 months. The average follow-up period of the patients after physical therapy and rehabilitation is 36 months. CT and MRI were performed on the patients. Dynamic graphs were drawn on the patients with instability. Patients with instability were not included in the study.

**Table 3.** Comorbid diseases accompanying lumbar stenosis

	n	%
Hypertension	58	23.2
Diabetes mellitus	44	17.6
Osteoporosis	33	13.2
Coronary artery disease	32	12.8
Chronic obstructive pulmonary disease	12	4.8
Mixes	24	9.6

All the patients received physical therapy due to lumbar stenosis. The canal diameter of patients with central canal stenosis is  $< 12$  mm. The canal diameter of patients with lateral recess/foraminal stenosis is  $< \text{height } 2 \text{ mm and dept } 3 \text{ mm}$ . 135 of the 250 patients had central canal stenosis and 115 had lateral recess/foraminal stenosis.

Patients’ VAS scores were evaluated before and after physical therapy. Despite that the VAS scores statistically decreased in both groups, the decrease is more pronounced in the central canal stenosis group (Table 1).

Neurogenic claudication in the patients before and after physical therapy was evaluated. Although it was statistically significant in both groups, the improve-

**Table 4.** Evaluation of visual analog scale scores and neurogenic claudication before and after physical therapy and rehabilitation in patients with diabetes mellitus

	VAS before physical therapy		VAS after physical therapy		p*	Distance (m) before physical therapy		Distance (m) after physical therapy		p*
	Mean±SD	Med (Min–Max)	Mean±SD	Med (Min–Max)		Mean±SD	Med (Min–Max)	Mean±SD	Med (Min–Max)	
<b>Lateral recess/foraminal stenosis</b>										
DM (-) n=96	7.9±0.8	8 (6–9)	3.8±1.3	4 (2–6)	<0.001	73.1±20.6	65 (50–100)	309.9±162.8	300 (100–1000)	<0.001
DM (+) n=19	8.7±0.5	9 (8–9)	5.2±0.7	5 (4–6)	<0.001	53.2±6.3	50 (50–65)	247.4±80.7	300 (100–300)	<0.001
<b>Central canal stenosis</b>										
DM (-) n=110	6.8±1.0	7 (5–9)	1.6±0.6	2 (1–3)	<0.001	125.1±46.7	150 (50–200)	745.5±140.4	700 (650–1000)	<0.001
DM (+) n=25	8±0.8	8 (7–9)	4.0±0.8	4 (2–5)	<0.001	100±40.8	100 (50–150)	500±70.7	500 (400–600)	<0.001

\*: Wilcoxon signed-rank test, There was a statistically significant change in VAS between the patients with and without DM in the lateral recess/foraminal stenosis group before and after physical therapy (Mann-Whitney U test, p=0.732), There was no statistically significant change between the patients with and without DM in the lateral recess/foraminal stenosis group before and after physical therapy (Mann-Whitney U test, p=0.732), There was a statistically significant change in VAS between the patients with and without DM in the central canal stenosis group before and after physical therapy (Mann-Whitney U test, p<0.001), There was a statistically significant change in claudication distance between the patients with and without DM in the central canal stenosis group before and after physical therapy (Mann-Whitney U test, p<0.001), There were statistically significant changes in VAS and claudication distance between the patients with and without DM in both groups before and after physical therapy (Mann-Whitney U test, p<0.001), DM: Diabetes mellitus; SD: Standard deviation; Min: Minimum; Max: Maximum.

ment in neurogenic claudication values was higher in the central canal stenosis patient group (Table 2).

When the comorbid diseases of the patients were examined, it was observed that hypertension and diabetes mellitus (DM) were the most common ones (Table 3). The relationship between the comorbid diseases and the effectiveness of physical therapy was examined, and it was observed that the improvement in VAS value after physical therapy was less in patients with DM. Patients in the lateral recess/foraminal stenosis group, especially those with DM, made the group the highest in VAS score and the least in improvement after physical therapy. Although DM coexistence did not have a statistically significant effect on the improvement in neurogenic claudication after physical therapy in the lateral recess/foraminal stenosis group, this group had the lowest neurogenic claudication before and after physical therapy. However, in the central canal stenosis group, DM had a negative effect on the improvement in neurogenic claudication after physical therapy (Table 4).

Patients were followed up after 36 months. After physical therapy, 42 patients whose pain complaints and neurogenic claudication did not decrease into satisfactory levels undergone surgery. In these patients, the canal diameter was found to be 9 mm less in patients with central canal stenosis. The depth was 2 mm less in patients with lateral recess/foraminal stenosis. As surgical interventions, laminectomy and foraminotomy were performed in patients whose medial facet joints could be preserved during surgery, and in patients with advanced facet hypertrophy, stabilization and decompression were performed. 34 of these 42 patients had advanced lateral recess/foraminal stenosis. Again, 18 of the 42 patients were found to have DM. In the lateral recess/foraminal stenosis group with DM, there is a statistically significant difference in terms of surgery frequency, because the patients had high VAS scores and low neurogenic claudication distances. More surgeries were performed to these patients (Table 5).

The HbA1C values of diabetic patients were analyzed; it was seen that the average HbA1C value in women was 7.1% and 6.9% in men. The average HbA1C value of the 18 diabetic patients who needed surgical treatment after physical therapy was found to be 8.2%.

**Table 5.** Association between surgical intervention and diabetes mellitus (DM) by groups

	Surgical intervention	No surgery	DM (-)	DM (+)
Central canal stenosis	8 (5.9)	127 (94.1)	110 (81.5)	25 (18.5)
Lateral recess/foraminal stenosis	34 (29.6)	81 (70.4)	96 (83.5)	19 (16.5)
p	<0.001 <sup>1</sup>		0.805 <sup>1</sup>	

1: Yates' correction for continuity, While there is no statistically significant difference in the presence of DM between central canal stenosis and lateral recess/foraminal stenosis groups, there is a statistically significant difference between these groups in terms of frequency of surgery.

The results of the operated patients in the post-operative period were examined. It was seen that the VAS scores decreased by an average of 2° after the surgical intervention. It was found that neurogenic claudication improved after surgery and there were no patients who defined walking distance <1000 meters. One patient underwent a second operation for screw revision.

## Discussion

Degenerative lumbar stenosis is a disease especially seen in patients over 65 years of age and adversely affects quality of life. It limits the walking and exercise capacity of these patients. This situation causes loss of labor. The decrease in quality of life and loss of labor are associated with the severity of the symptoms.<sup>[11]</sup> Patients experience neurogenic claudication symptoms such as increased pain with walking and standing, numbness, tingling, and weakness that are reduced at rest.<sup>[12]</sup> In the natural course of patients with lumbar stenosis, 60% of the patients may recover spontaneously or have the same course. Essentially, the group that needs treatment is the remaining patients. There are options such as medical therapy, physical therapy, and surgical therapy among the treatment options.<sup>[13]</sup> Since these symptoms can also be seen in other diseases, vascular insufficiency and peripheral neuropathy should be considered as differential diagnoses.<sup>[14]</sup>

The ligamentum flavum is thicker in patients with lumbar stenosis than in asymptomatic people, and this thickness leads to height loss in disc distance, causing stenosis in the spinal canal. The main cause of the narrowing is the compression caused by the degeneration of spinal components such as the intervertebral disc and ligamentum flavum, which is more common in elderly patients.<sup>[15-17]</sup> These degenerative changes become more common as life expectancy increases. Therefore, the number of patients with stenosis is increasing gradually.<sup>[18]</sup>

Lumbar stenosis is a more common disease in older-age individuals, so some comorbid diseases may be present. In recent years, there are publications related to the association of DM and lumbar spinal canal narrowing, stating that DM may be a trigger for lumbar stenosis.<sup>[19,20]</sup>

The authors can divide treatment of lumbar stenosis into two: surgical and conservative treatment. Conservative treatment is the first option, and some of them can be listed as medical treatment, epidural injections, change in lifestyle, and physical therapy.<sup>[21]</sup> The authors can perform lumbar decompression only or lumbar decompression and fusion as surgical treatment. There are many articles in the literature about which treatment is better, surgery or conservative treatment. In the study conducted by Amundsen et al.,<sup>[22]</sup> surgical treatment was found to be superior over conservative treatment in patient experiencing moderate to severe pain. This result is correlated in this study. In this study, the authors first performed physical therapy; then, the authors performed surgical treatment to our patients whose pain did not decrease to satisfactory levels after physical therapy, and satisfactory results were achieved after surgery. In the study of Malmivaara et al.,<sup>[23]</sup> patients in both groups who underwent surgery and conservative treatment benefited as shown in a 2-year follow-up. This result is correlated in this study. In addition, it was statically observed that lower back and leg pain improved in the group who undergone surgical treatment. In this study, patients with lateral recess/foraminal stenosis required more surgical interventions because lateral recess/foraminal stenosis causes pain in the lower back and legs due to compression of the affected nerve root. Since radicular findings are more severe in lateral recess and foraminal stenosis, more surgical treatment is needed in these patients. In another study by Delitto et al.,<sup>[24]</sup> it was shown that there was no significant

difference between the group with conservative treatment and group with surgery after 2 years of follow-up and also stated that even the patients who are candidates for surgery may benefit from conservative treatment. This result is not correlated in this study. In this study, 16.8% (n=42) of the patients underwent surgical intervention. The authors observed that in patients who underwent surgery, the average VAS score decreased by 2 and the claudication reached at least 1000 meters.

In this study, the authors retrospectively analyzed 250 patients with lumbar stenosis for 36 months. The authors first performed physical therapy to the patients. The authors saw that physical therapy was beneficial in 83.2% (n=208) of the patients. Majority of the 42 patients who underwent surgery had lateral recess/foraminal stenosis. The authors have observed that only DM, among all the comorbid diseases studied, has a significant effect. It has been observed that due to diabetes, patients have symptoms related to neuropathy in addition to canal and root compression, resulting in more complaints. In addition, the authors observed that there was a statistically significant change in the VAS score in diabetic patients, and the authors found that the average HbA1C value in patients who underwent surgery was 8.2%.

Lumbar stenosis is more common in older-age people, and in this case, it is accompanied by comorbid diseases. Physical therapy is the treatment method that should be considered primarily in patients without motor muscle strength loss and incontinence. Most of the patients benefit from physical therapy. The authors observed that the patient group that benefited the least from the physical therapy was the patient group with DM (with high HbA1C values) and lateral recess/foraminal stenosis. Surgical treatment should be preferred for patients who do not benefit from conservative treatment and have motor muscle strength loss and incontinence.

**Ethics Committee Approval: The Tekirdağ Namik Kemal University Non-Interventional Clinical Research Ethics Committee granted approval for this study (date: 25.03.2020, number: 2020.69.03.19).**

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