

TO EVALUATE THE ABILITY TO MAINTAIN POSTURAL BALANCE IN PATIENTS WITH LOWER BACK PAIN AND LUMBOSACRAL RADICULOPATHY

Urinov Muso Boltaevich, Dogaeva Difuza Botirovna

Abstract:

Objective: To evaluate the ability to maintain postural balance in patients with lower back pain and lumbosacral radiculopathy. **Methods:** The object of the study was selected patients who were referred for electromyography in connection with lower back pain in the period from September 2023 to May 2024. Based on the EMG results, the patients were divided into groups with and without lumbosacral radiculopathy. **Results:** The risk of falls (73.25 vs. 38.00; $p < 0.05$), the weight distribution index (8.57 vs. 5.00; $p < 0.05$) and the stability index (21.19 vs. 13.16; $p < 0.05$) were significantly higher in the group with lumbosacral radiculopathy than in the group without lumbosacral radiculopathy. The Fourier index at high and medium frequencies was significantly increased in the group of diseases of the lumbosacral disc (8.27 vs. 5.56; $p < 0.05$), while the load on the side of radiculopathy was significantly reduced. **Conclusion:** Patients with lumbosacral radiculopathy had postural balance disorders compared to patients without radiculopathy. Somatosensory disorders in lumbosacral radiculopathy can lead to a violation of postural balance.

Keywords: Back pain, Radiculopathy, Postural balance, Somatosensory disorders, EMG.

Introduction

Relevance: Lower back pain (PD) is one of the most common problems of the musculoskeletal system, the prevalence of which during life is more than 70% [1]. The progression of most forms of low back pain can affect functional status and quality of life, and some reports indicate a correlation between pain, disability, and quality of life in PD patients [2]. Radiculopathy, also known as lumbar spine-related lower limb pain or lumbosacral radicular syndrome, is a common form of PD with a prevalence of over 70% [3]. It is one of the most common forms of PD; the symptoms of radiculopathy are reported to be more persistent and severe than the symptoms of PD, and the outcome of radiculopathy is less favorable and more resource-intensive [3].

Electrophysiological tests such as needle electromyography (EMG) are the most common method for detecting radiculopathies and have long been considered highly specific for radiculopathy or nerve dysfunction [4,5]. In recent years, magnetic resonance imaging (MRI) has become widely used for the diagnosis of radiculopathy with the increasing availability of medical imaging equipment. However, EMG is still of additional importance for detecting current nerve denervation as the main predictor of X-ray compression of nerve roots. A previous study demonstrated the effectiveness of EMG in patients with suspected radiculopathy LS in the absence of involvement of nerve roots on MRI [5].

Controlling postural balance is an important skill necessary for successful gait and daily life. The control of postural balance includes several organs with visual, auditory, vestibular, proprioceptive, positional, muscular and cognitive functions [6-8]. A decrease in the ability to control postural balance is associated with an increased risk of gait disorders and falls [9]. Balance disorders are often observed in people who have suffered a stroke, and 83% of them have balance disorders after an acute stroke [10]. Recent studies have shown that patients with moderate and severe osteoarthritis have poorer balance control than patients with mild osteoarthritis [11]; studies of the ability to postural balance in patients with LBP have revealed a decrease in postural balance in these patients [12-15]; and LS Several studies of the ability to postural balance in patients with radiculopathy have been conducted, but In most of them, the diagnosis of radiculopathy was made solely on the basis of the symptoms of radiculopathy [16-18].

Methods for assessing the ability to maintain balance include the functional support test and the Berg balance scale test. It has been reported that these methods have high intra-class correlation and high test reproducibility [6], but these methods cannot evaluate various aspects of Tetrax balance, an objective tool for assessing the ability to postural balance. This is an objective device for assessing the ability to postural equilibrium, which has been used in several previous studies and has shown high reliability on the principle of "test-retest". The aim of this study was to compare the ability of patients with and without lumbosacral radiculopathy to maintain postural balance using the posturography system (Tetrax).

MATERIALS AND METHODS: The study selected patients who were referred for electromyography due to lower back pain in the period from September 2023 to May 2024. Patients who were diagnosed with neuropraxis LS based on EMG results were considered sick, and those who were not diagnosed with neuropraxis LS were considered a control group comparable in age, gender, weight and height. Demographic data were recorded, including age, gender, height, weight, and body mass index (BMI).

RESULTS: We recruited 35 patients with radiculopathy LS and 35 matched control patients without radiculopathy LS. The variables were not normally distributed ($p>0.05$). The group with radiculopathy LS consisted of 18 men and 17 women with an average age of 56.36 ± 13.30 years, whereas the group without radiculopathy LS consisted of 19 men and 16 women with an average age of 56.23 ± 15.82 years. There was no significant difference between the two groups by age or gender ($p>0.05$). Moreover, there was no significant demographic difference in weight, height, and BMI between the two groups. However, there was a significant difference in radiating pain and scores on the visual analog scale, which were higher in the group with radiculopathy LS (Table 1). The results of LS spinal MRI were obtained in 15 patients in the group with LS radiculopathy and in 11 patients in the group with non-LS radiculopathy. The number of symptomatically associated MRI lesions was 15 in the group with LS radiculopathy and 2 in the group with non-LS radiculopathy. EMG showed that 6 patients had bilateral radiculopathy, and the other 29 patients had unilateral radiculopathy. Of the 29 patients with unilateral radiculopathy, multilevel lesion was observed in 10 patients, and the remaining 19 patients had only a single-level lesion (L4 level in 1 patient, L5 level in 6 patients and S1 level in 3 patients).

Таблица – 1. Demographic and clinical data of patients

	With radiculopathy LS (n=35)	Without radiculopathy LS (n=35)	p-value
Age (year)	56,36±13,30	56,23±15,82	0,495
sex			0,343
Male	18	19	
Female	17	16	
Weight (kg)	69,52±9,72	67,25±11,44	0,344
Height (cm)	165,36±9,08	164,14±9,59	0,871
BMI (kg/m ²)	25,44±3,21	24,85±3,03	0,398
YOUR	5,68±2,18	3,95±2,74	0,012 *
Pain spreading			0,006 *
Not really	31	18	
Age (year)	4	17	

The values are presented as an average value ± standard deviation.

LS — lumbosacral region; BMI — body mass index; VAS — visual analog scale.* p<0.05.

The group with radiculopathy LS showed a significantly higher risk of falling (73.25 vs. 38.00; p < 0.05), WDI (8.57 vs. 5.00; p < 0.05) and ST (21.19 vs. 13.16; p < 0.05) than the control group (Table 2). The group with radiculopathy LS showed a higher FI value at higher-average frequency (8.27 vs. 5.56; p < 0.05) than the control group; however, there were no significant differences at low frequency (17.81 vs. 18.08; p > 0.05) and low-average frequency (27.49 vs. 22.07; p > 0.05).

Table 2. Comparison of the average risk of falling, the weight distribution index and the stability index between the two groups

	With radiculopathy LS (n=35)	Without radiculopathy LS (n=35)	p-value
Risk of falling	73,25±24,50	38,00±16,05	0.000 *
Weight distribution index	8,57±5,36	5,00±2,30	0,038 *

The values are presented as an average value ± standard deviation.

LS is the lumbosacral region. * p<0.05.

We additionally analyzed the synchronization depending on the side of the radiculopathy lesion. Seventeen patients were diagnosed with radiculopathy on only one side (14 patients on the right and 15 patients on the left). The load on the affected side was significantly reduced (synchronization index: 42.46 vs. 57.53; p<0.05), and the same results were obtained in patients with right-sided radiculopathy (synchronization index: 40.32 vs. 59.67, p<0.05) and in patients with left-sided radiculopathy (synchronization index: 44.36 vs. 55.63, p<0.05). There was no significant difference in the load on the forefoot and heel (Table 3).

Table 3. Comparison of the synchronization index between the affected and unaffected side, forefoot and heel side

	The side of	The side	p-	Forefoot	Heel	p-value
--	-------------	----------	----	----------	------	---------

	defeat	not affected by defeat	value			
Total patients (n=29)	42,46±6,62	57,53±6,62	0,000 *	50,48±3,03	49,51±3,03	0,653
Rt. rad (n=14)	40,32±8,64	59,67±8,64	0,012*	50,83±3,83	49,16±3,83	0,674
Lieutenant rad (n=15)	44,36±2,84	55,63±2,84	0,008*	50,26±2,29	49,82±2,29	0,767

The values are presented as an average value ± standard deviation.

*Rt. rad, right-sided lumbosacral radiculopathy; Lt. rad, left-sided lumbosacral radiculopathy. * p<0.05*

As for WDI, the group with LS radiculopathy showed elevated values of >8 in each of the 4 positions, indicating a problem of weight distribution in patients with LS radiculopathy. When evaluated with pillows, WDI was significantly increased in the group without LS radiculopathy (position PO 7.82 vs. position NO 5.00, $p < 0.05$; position PC 6.50 vs. position NC 4.16, $p < 0.05$). The group with LS radiculopathy showed significantly higher WDI than the control group in positions NO and NC. However, there were no significant differences in WDI between the two groups in the PO and PC positions (Table 4).

Table 4. Comparison of the weight distribution index between the normal position and the position on the pillows in two groups

	NO	PO	p-value	NC	PK	p-value
With radiculopathy LS (n=35)	8,57±5,36	8,07±4,32	0,709	9,45±5,78	8,17±4,43	0,108
Without radiculopathy LS (n=35)	5,00±2,30	7,82±3,43	0,003*	4,16±2,35	6,50±2,84	0,002*
p-value	0,038 *	0,925		0.000 *	0,265	

The values are presented as an average value ± standard deviation.

*LS radiculopathy, lumbosacral radiculopathy; NO, normal position with eyes open; PO, eyes open on pillows; NC, normal position with eyes closed; PC, eyes closed on pillows. * p<0.05.*

In our study, patients with radiculopathy LS diagnosed with EMG showed a decrease in postural balance compared to patients without radiculopathy LS. The weight load on the radiculopathy side was significantly reduced, and somatosensory function was impaired in the group with radiculopathy LS. The prevalence of radiculopathy in various studies ranged from 1.2% to 43% [3]. It has been suggested that radiculopathy causes more severe pain than lower back pain, as well as reduces the quality of life and leads to prolonged disability and absence from work. Drug therapy, including both monotherapy and combination therapy, has been shown to be effective in reducing pain, improving sleep disorders and relieving anxiety.

Postural balance control is an important skill for gait and daily activities, and a decrease in the ability to control postural balance has been associated with impaired outpatient function and an increased risk of falls [9]. Postural balance control is a complex interaction between sensory and motor systems and involves the perception of external stimuli, responding to changes in body orientation in the environment and maintaining the body's center of gravity within the support. Some studies on the ability to balance in patients with LBP have been published [12,14]. Mientjes and Frank [15] observed that patients with chronic LBP had increased oscillation compared to healthy people, and increased body oscillation was detected when subjects were tested with their eyes closed. Patients with LBP and radiculopathy showed significant differences from participants

in the control group in terms of muscle activation time, sequence, and overall balance control. Differences between the two groups were found, especially in the lower extremities, and the authors suggested that radiculopathy may play a role in altering the control of postural balance. In previous studies, radiculopathy was diagnosed only using a history of symptoms such as pain, tingling or numbness in the legs. It is unknown whether the reason for the decrease in postural balance in patients with LBP and radiculopathy is the cause of LBP or radiculopathy. Thus, we investigated the ability to postural balance in patients with radiculopathy diagnosed with EMG and compared groups with and without radiculopathy LS to find out the effect of radiculopathy on the ability to postural balance.

In radiculopathy LS, large and small sensory afferent nerve fibers are affected. Yamashita et al. demonstrated that the functions of A-beta, A-delta, and C fibers deteriorate in patients with LS radiculopathy. Somatosensory dysfunction is associated with impaired motor activity, and our results are consistent with the results of previous studies showing that in the group with radiculopathy LS, the value of high and medium frequency FI increased significantly, which implies that somatosensory impairment affects postural balance in patients with radiculopathy. WDI was higher than normal in the NO, PO, NC and PC positions in the group with LS radiculopathy, since somatosensory function was already impaired in these patients. In addition, there were no significant changes after closing the eyes or standing on pillows in the group with radiculopathy LS, probably due to the underlying pathology of the somatosensory system. In contrast, in the group with non-LS radiculopathy, WDI was within the normal range in the NO and NC positions, but was significantly higher than the norm in the PO and PC positions. Standing on pillows caused disturbances of the somatosensory system, thereby reducing the ability to postural balance. When managing patients with LS radiculopathy, assessment and treatment plans should be considered not only to reduce pain, but also to improve postural balance. The study had several limitations. The first limitation was the relatively small sample size. We included patients with LS radiculopathy based only on EMG results to clarify the effect of radiculopathy on the ability to postural balance. Secondly, we did not perform other equilibrium tests, such as the Berg balance scale test or the functional reach test, and used Tetrax to assess postural equilibrium. As we were trying to figure out the pathophysiology of postural balance decline in patients with LS radiculopathy, we used Tetrax, which can evaluate various organ systems related to the ability to postural balance. Further studies of the effects of balance training in patients with sciatica LS are needed.

Conclusion: the ability to postural balance in LBP patients was compared between groups with and without LS radiculopathy diagnosed with EMG. The group with radiculopathy LS showed a decrease in postural balance compared to the group without radiculopathy LS. Somatosensory function was impaired in the group with radiculopathy LS, and the weight load on the side of radiculopathy was significantly reduced. Postural balance ability should be evaluated in patients with LS radiculopathy to prevent fall injuries, and an exercise program focusing on proprioception and postural balance ability will be required to treat these patients.

Literature.

1. Andersson GB. Epidemiological features of chronic low back pain. *Lancet* 1999;354:581-5.
2. Aminoff M.J., Goodin D.S., Parry G.J., Barbaro N.M., Weinstein P.R., Rosenblum M.L. Electrophysiological assessment of lumbosacral radiculopathy: electromyography, late responses and somatosensory evoked potentials. *Neurology* 1985;35:1514-8.
3. Alexander K.M., Lapierre T.L. Differences in static equilibrium and weight distribution between normal subjects and subjects with chronic unilateral lower back pain. *J Orthop Sports Phys Ther* 1998;28:378-83.

4. Brandt T., Dieterich M. Postural imbalance in peripheral and central vestibular disorders. In: Bronstein A.M., Brandt T., Woollacott M.H., Nutt J.G., editors. Clinical disorders of balance, posture and gait. 2nd ed. London: Arnold; 2004. pp.146-62.
5. Dvir Z., Daniel-Atrakchi R., Mirowski J. The effect of frontal loading on static and dynamic equilibrium reactions in patients with chronic lumbar dysfunction. *Basic Appl Myol* 1997;7:91-6.
6. Kovacs FM, Abaira V, Zamora J, Teresa Gil del Real M, Llobera J, Fernandez C, etc. Correlation between pain, disability and quality of life in patients with widespread lower back pain. *Spine (Phila Pa 1976)* 2004;29:206-10.
7. Konstantin K., Dann K. M. Sciatica: a review of epidemiological studies and prevalence estimates. *Spine (Phila Pa 1976)* 2008;33:2464-72.
8. Kim HS, Yun DH, Yu SD, Kim DH, Jung YS, Yun JS, etc. Control of balance and severity of osteoarthritis of the knee joint. *Ann Rehabil Med* 2011;35:701-9.
9. Koster S., de Bruyne S.F., Tavi D.L. Diagnostic value of anamnesis, physical examination and needle electromyography in the diagnosis of lumbosacral radiculopathy. *J Neurol* 2010;257:332-7.
10. Prieto TE, Micklebust JB, Hoffmann RG, Lovett EG, Micklebust BM. Measures of postural stability: differences between healthy young and elderly people. *IEEE Trans Biomed Eng* 1996;43:956-66
11. Salomova, N. K. (2023). Kaita ischemic stroke training clinic potogenitic hususiyatlarini aniklash. *Innovations in Technology and Science Education*, 2(8), 1255-1264.
12. Kakhhorovna, S. N. (2023). Secondary Prevention of Ischemic Stroke in the Outpatient Stage. *American Journal of Language, Literacy and Learning in STEM Education* (2993-2769), 1(8), 464-468.
13. Salomova, N. Q. (2022). The practical significance of speech and thinking in repeated stroke. *scienceasia*, 48, 945-949.
14. Salomova, N. Q., & Radjabova, G. B. (2021). Diagnostics of night breathing disorders clock and respiratory therapy for copd patients. *Europe's Journal of Psychology*, 17(3).
15. Salomova, N. K. (2023). Kaita ischemic stroke training clinic potogenitic hususiyatlarini aniklash. *Innovations in Technology and Science Education*, 2(8), 1255-1264.
16. Salomova, N. (2023). CURRENT STATE OF THE PROBLEM OF ACUTE DISORDERS OF CEREBRAL CIRCULATION. *International Bulletin of Applied Science and Technology*, 3(10), 350-354.
17. Salomova, N. K. (2022). Risk factors for recurrent stroke. *Polish journal of science N*, 52, 33-35.
18. Kakhhorovna, S. N. (2022). Features of neurorehabilitation itself depending on the pathogenetic course of repeated strokes, localization of the stroke focus and the structure of neurological deficit.
19. Salomova, N. K. (2021). Features of the course and clinical and pathogenetic characteristics of primary and recurrent strokes. *Central Asian Journal of Medical and Natural Science*, 249-253
20. Kakhhorovna, S. N. (2023). Secondary Prevention of Ischemic Stroke in the Outpatient Stage. *American Journal of Language, Literacy and Learning in STEM Education* (2993-2769), 1(8), 464-468.

21. Qahharovna, S. N. (2023). Thromboocclusive Lesions of the Bronchocephalic Arteries: Treatment Options and Phytotherapy Options. AMERICAN JOURNAL OF SCIENCE AND LEARNING FOR DEVELOPMENT, 2(2), 41-46.
22. Salomova, N. Q. (2022). The practical significance of speech and thinking in repeated stroke. scienceasia, 48, 945-949.
23. Schieppati M, Nardone A. Free and supported posture in Parkinson's disease: the effect of posture and "posture attitude" on the reaction of leg muscles to disturbance and its relationship to the severity of the disease. Brain 1991;114(Pt 3): 1227-44.
24. Fernie GR, Greif KEY, Holliday PJ, Llewellyn A. The relationship between fluctuations in posture in the standing position and the frequency of falls in the elderly. Age Aging 1982;11:11-6.
25. Tyson S.F., Hanley M., Chillala J., Selly A., Tallis R.K. Imbalance after stroke. Phys Ther 2006;86:30-8.
26. Radebold A., Holevitsky J., Poltshofer GK., Green H.S. Violation of postural control of the lumbar spine is associated with delayed muscle reaction time in patients with chronic idiopathic lower back pain. Spine (Phila Pa 1976) 2001;26:724-30