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## **Risk of falling in patients with unilateral discogenic sciatica**

**Youmna Salah Kandil**

Department of physical therapy for neurology, Faculty of Physical Therapy, Cairo University, Cairo, Egypt

**Ebtessam Mohamed Fahmy**

Professor at Department of Neurology, Faculty of medicine, Cairo University, Cairo, Egypt.

**Reem Alwhaibi**

Department of Rehabilitation Sciences, College of Health and Rehabilitation Sciences, Princess Nourah bint Abdulrahman University, P.O.Box 84428, Riyadh 11671, Saudi Arabia.

**Hossam Mohammed Alsaid**

Lecturer at Department of Physical Therapy for Neurology, Faculty of Physical Therapy, Cairo University, Cairo, Egypt.

**Rasha Mohamed Elrewainy**

Assistant Professor at Department of Physical Therapy for Neurology, Faculty of Physical Therapy, Cairo University, Egypt.

Corresponding author email: [rasha.elrewainy@pt.cu.edu.eg](mailto:rasha.elrewainy@pt.cu.edu.eg)

**Abstract**--Background: Unilateral Discogenic Sciatica is low back pain radiating into one limb, in addition to one or more positive neurological signs. This pain may cause loss of function and reduce quality of life and working capability. Objective: This study was performed to assess the risk of falling in patients with unilateral discogenic sciatica. Methods: Sixty subjects participated in the study (30 patients with unilateral discogenic sciatica and 30 healthy controls). All participants undergone balance assessment using PROKIN system to evaluate static and dynamic balance. The risk of falling was evaluated via Berg Balance Scale (BBS). Results: There was significant improvement in static balance variable (sway range forward backward and mediolateral) and significant decrease in dynamic balance variable (limit of stability LOS) in the study group in comparison with the control group ( $P < 0.05$ ). There was substantial positive correlation between BBS score and dynamic balance (LOS) in patients with unilateral discogenic sciatica, whereas, the correlation

between BBS score and static balance (sway range forward backward and mediolateral) was non-significant. Conclusion: Sciatica affects both static as well as dynamic balance and so increases the risk of falling in patients with unilateral discogenic sciatica.

**Keywords**---Discogenic Sciatica, Risk of Falling.

## **Introduction**

Sciatica is pain that is caused by sciatic nerve or sciatic nerve root compression, it is worsened by flexion of the lumbar spine, twisting and bending, [1] Prevalence of sciatica varies greatly between studies ranging from 1.6%-43%, [2]. Studies found that it affects people who live sedentary life style greater than active ones, also it affects females more than males [3]. Sciatica could appear immediately after physical activity or gradually, most of cases it appears in one side (unilateral) [4]. Disc bulges or herniations, lumbar canal stenosis, spondylolisthesis, traumatic injuries, piriformis syndrome, tumors, as well as morbid obesity are the most prevalent causes of sciatica [5] . But, a herniated disc is responsible for sciatica in around 90% of patients [6].

In order to stimulate motor activity and maintain control, the central nervous system (CNS) controls sensory input from other systems, upright posture. The most important sensory systems engaged in postural control are the visual, vestibular and somatosensory systems [7]. Patients suffering from low back pain and radiculopathy differ significantly from healthy controls in terms of the timing and sequencing of muscle activation and, more generally, balance control, especially in the lower limbs. These variations suggested that radiculopathy contributed to altered balance control in these individuals, and this may negatively influence balance of patients and increase risk of falling [8].

The functional reaching test and the Berg Balance Scale are only two of the many available ways for assessing a patient's balance. It has been found that these exams had a high intra-class correlation as well as a high reliability across tests; nevertheless, they were not able to evaluate balance in a number of other areas [9].

One of posturography tools is PROKIN 252 which is an objective tool that is used to assess postural balance ability. Several prior investigations have utilized this instrument, demonstrating its good test-retest reliability. It is useful for diagnosing and assessing visual, somatosensory, neurological, and orthopedic disorders that may influence one's capacity for maintaining balance in standing. The mechanical system and electrical stability control at 50 levels are integrated into the software for full control by gestures on the PROKIN 252 [10].

## **Subjects and methods:**

This cross sectional observational study was performed at the faculty of physical therapy, Cairo University and Fizik Center for physiotherapy and rehabilitation in the period from December 2021 to May 2022. The whole procedure was well

explained for subjects that involved in the study, and they signed an informed consent form which was approved by Cairo University's Faculty of Physical Therapy's Ethical Committee (**P.T.REC /012/003593**).

### **Sample Size Calculation:**

The number of subjects required for this study was approximately 30 for each group. G\*POWER statistical (G\*power version 3.1) was utilized to calculate the sample size with power of 80%,  $\alpha$ -level of 0.05 and effect size 0.73.

### **Participants:**

Sixty subject from both sexes involved in this study. They were distributed into two groups of equal number, the control group (A) included 30 healthy subjects and the study group (B) included 30 patients suffering from unilateral discogenic sciatica.

**Inclusion Criteria were:** Patients from both sex with unilateral discogenic sciatica diagnosed clinically and by Lumbosacral MRI, Age ranged between 30-40 years, Body mass index BMI between 18.5 to 25 kg/m<sup>2</sup>, duration of illness at least 3 months and normal hearing and vision.

### **Exclusion Criteria were:**

Visual problems that affect balance (Nystagmus, blurred vision, double vision), Vestibular disorders that affect balance such as benign paroxysmal positional vertigo (BPPV), Pregnant females, Diabetes Mellitus (DM), concomitant neurological disorders affecting balance (as Ataxia , Parkinson disease), uncontrolled hypertension and orthopedic conditions that affect and limit function of foot (e.g.: ankle sprain).

### **Procedures:**

**-Assessment of Static Balance:** Assessment was done using PROKIN system (Prokin 252, Pro-Kin Software Stability, TecnoBody S.r.l., Dalmine, 24044 Bergamo, Italy). Static stability is measured using center of foot pressure (COP), the main parameter measured was sway range in forward backward and mediolateral axes. As values increase this indicates lesser postural stability and better body sway. As postural control necessitates visual processing, the assessment was done in eyes open (EO) condition **[10]**.

**-Assessment of Dynamic Balance:** Assessment was done using PROKIN system. Dynamic balance was measured using limit of stability test (LOS). The stability limit is the maximum distance one may move away from their base of support without becoming unbalanced. This evaluation requires patients to shift their weight around their supporting structure. At the beginning of each trial, the patient is instructed to stand on one foot while the other is placed on a balance beam and move the cursor from the central target to a flashing target and return as rapidly and accurately as possible. Every one of the eight targets went through the same procedure. Randomly blinking targets on the screen **[10]**.

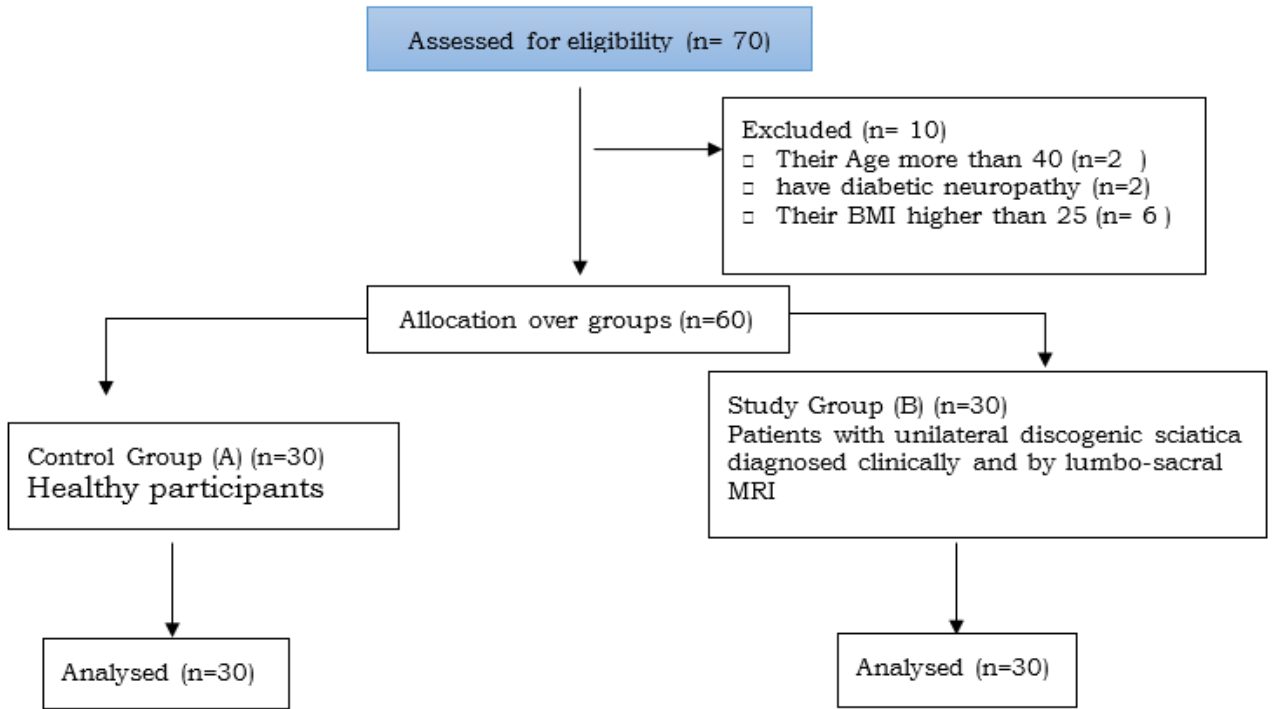
**-Assessment of Risk of Falling:** The Berg Balance Scale (BBS) is considered as the gold standard for evaluating a patient's risk of falling because it involves a wide range of postural control factors, from the ability to sit and stand safely to the individual's ability to reach and stoop. It evaluates balance through the performance of a variety of functional activities, such as reaching, bending, transferring, as well as standing. Every grade is assigned a value from 0 to 4 based on a consistent set of criteria, and the items are scored on a scale from 0 to 4. The lowest possible function level is 0, while the greatest possible is 4. Scores might be anything from 0 to 56. Inter- and intra-rater consistency, as well as concurrent and concept validity, have been demonstrated for the BBS [11].

### **Statistical analysis:**

Data analysis was done using SPSS for Windows (IBM, Armonk, NY, USA), a social science statistics tool. Subject characteristics were compared using an unpaired t test to determine differences between experimental groups. Analysis of the gender distribution of each group was compared using the Chi-square statistic. The groups' static and kinetic balance were compared using an unpaired t test. the correlation among BBS, both static and dynamic balance in patients who had unilateral discogenic sciatica was conducted using Pearson correlation coefficients. All statistical tests were conducted with a p-value of fewer than 0.05, is considered significant.

### **Results**

60 subjects participated in this study, 30 healthy subjects and 30 patients with unilateral discogenic sciatica. The flow diagram of the study's cases is displayed in Figure 1.



**Figure 1. Flow chart of the study- subject characteristics.**

### General characteristics of the participants:

The general characteristics of the involved patients and healthy subjects are shown in table (1).

**Table 1.**  
**Mean age, weight, height and BMI of the study and control groups.**

	Study group	Control group	MD	t-value	p-value	Sig
	$\bar{X} \pm SD$	$\bar{X} \pm SD$				
<b>Age (years)</b>	34.4 ± 3.33	33.2 ± 3.25	1.2	1.41	0.16	<b>NS</b>
<b>Weight (kg)</b>	68.36 ± 9.16	70.9 ± 9.22	-2.54	-1.06	0.29	<b>NS</b>
<b>Height (cm)</b>	171.36 ± 8.5	173.63 ± 9.38	-2.27	-0.98	0.33	<b>NS</b>
<b>BMI (kg/m<sup>2</sup>)</b>	23.11 ± 1.28	23.38 ± 1.11	-0.27	-0.85	0.39	<b>NS</b>

$\bar{X}$ : Mean

t value: Unpaired t value

SD: Standard deviation

p value: Probability value

MD: Mean difference

NS: Non-significant



**Table 3.**  
**Comparison of LOS between the study and control groups.**

	Study group	Control group	MD	t-value	p-value	Sig
	$\bar{X} \pm SD$	$\bar{X} \pm SD$				
<b>LOS (%)</b>	73.49 ± 13.84	96.72 ± 2.44	-23.23	-9.05	0.001	<b>S</b>

$\bar{X}$ : Mean

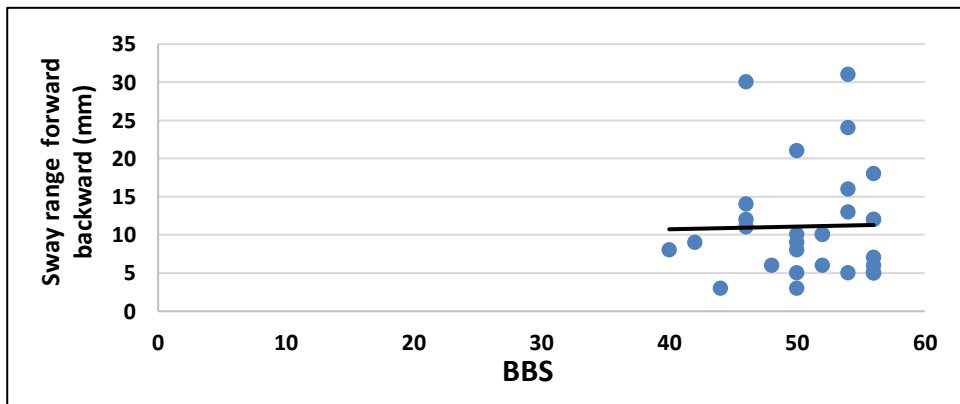
SD: Standard deviation

MD: Mean difference

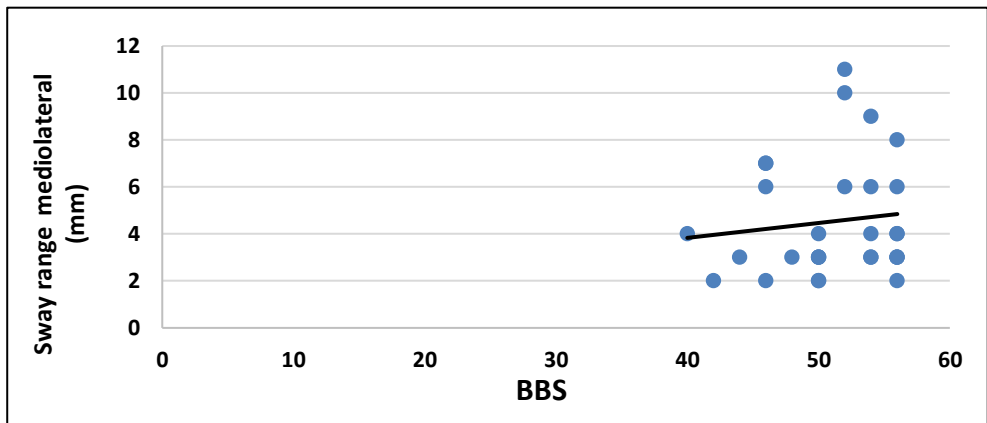
t value: Unpaired t value    p value: Probability value    S: Significant

**Correlation among BBS and static balance in patients with unilateral discogenic sciatica:**

The correlation between BBS and sway range forward backward and mediolateral was non-significant correlation ( $r = 0.022, 0.117, p = 0.907, 0.539$  respectively). (Figures 2, 3).



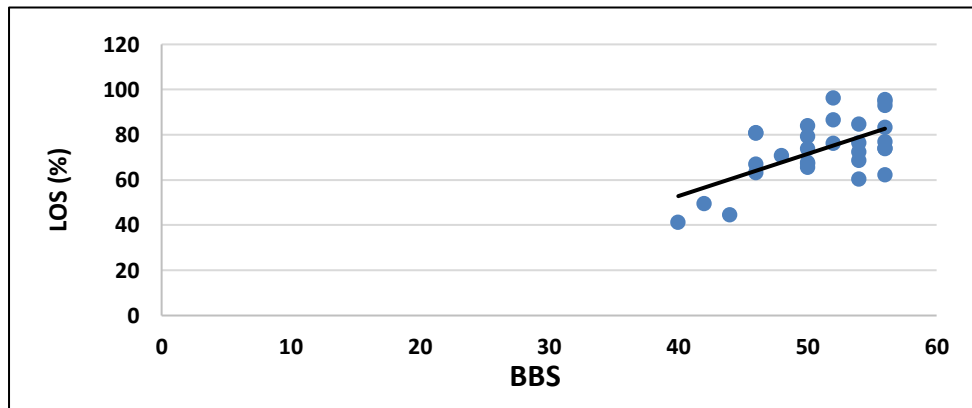
**Figure (2).** Correlation between BBS score and sway range forward backward in the patients with unilateral discogenic sciatica.



**Figure (3). Correlation between BBS score and sway range mediolateral in patients with unilateral discogenic sciatica.**

**Correlation between BBS score and LOS in patients with unilateral discogenic sciatica:**

Patients diagnosed with unilateral discogenic sciatica demonstrated a positive correlation among BBS score and LOS ( $r = 0.62$ ,  $p = 0.001$ ). (Figure. 4)



**Figure (4). Correlation between BBS score and LOS in patients with unilateral discogenic sciatica.**

### Discussion

Prior studies on discogenic sciatica has mostly concentrated on finding methods for reducing the pain patients experience. Medication, both alone and in combination, has been demonstrated to be effective in decreasing pain, enhancing sleep quality, and decreasing anxious feelings. Having poor postural balance is associated with decreased ambulatory ability and greater risk of falling, making it an essential skill for mobility and daily life, although few studies have concentrated on Risk of falling in patients having discogenic sciatica [12].

An increase in sway range was seen in the study group in both the forward backward as well as mediolateral axes, in comparison with the control group. This finding was consistent with studies evaluating patients' capacity to maintain balance while experiencing low back pain [13]. When comparing those with and without persistent low back pain, **Mientjes and Frank** [14] discovered that those with the former condition swayed more with their eyes closed. Patients having low back pain (LBP) as well as radiculopathy showed significant differences from controls in the timing, sequencing, as well as overall control of their muscle activation, according to study **by Frost and Brown** [8]. The investigators hypothesized that radiculopathy would have a bad impact in disrupting postural balance regulation because of the pronounced differences in lower extremity function between the two groups.

On the contrary, **Paalanne, [15]**, demonstrated that there were no substantial differences in body sway in standing position among healthy adults and patients having non-specific low back pain (LBP) which might be explained by using different methods in assessing body sway. Another study by **Karimi, et al., [16]**, found a substantial difference in mediolateral stability index and overall stability index among patients with or without LBP, on the other hand, no substantial difference was noticed in anterior-posterior stability index (APSI) between the two groups, which partially contradicts with this study results.

The study group's LOS was substantially lower than the control group's when comparing the two groups' dynamic balance. This result supported the findings of **Kuai et al. [17]**, who found that LDH (lumbar disc herniation) patients participated in higher muscle activity, generated more intradiscal stresses, and required more facet treatments than healthy controls throughout trunk flexion and two forms of picking up activities. These modifications may have developed as a compensatory strategy to reduce spinal pain and increase spinal stability. However, during functional tasks like forward reaching, these reactions imposed additional stress on the trunk's muscles, passive soft tissue, as well as spinal structure. The investigators also came to the conclusion that the compensatory reaction of kinetics in LDH patients had a bad impact on spinal stability and contributed to the progression of disc herniation.

In the current study, the correlation between BBS score and sway range forward backward and mediolateral was non-significant, however, the correlation between BBS score and LOS in patients with unilateral discogenic sciatica was a significant positive correlation. This finding supported the findings of **Rainer et al. [18]**, who determined that various kinds of balancing performance are relatively independent and also task-specific, and therefore, must be examined separately. Therefore, practitioners are advised against using a single test, but rather to employ test batteries examining many forms of balance, if the aim is to evaluate performance on the balance-related tasks. Training programs should include workouts for dynamic/static steady-state, proactive, as well as reactive forms of balance, according to the findings of low correlations.

Another study done by **Karimi and Solomonidis, [19]**, revealed a non-significant correlation between static and dynamic stability parameters, which agreed with the result of correlation between BBS and sway range forward backward and mediolateral which was non-significant. According to Strini et al. [20], there is no "ideal" instrument that can be utilized to conduct a perfect risk assessment because of the multidimensional character of falling risk. Therefore, it is advised to use numerous instruments at once, and a direct and thorough analysis by the healthcare expert is required. Therefore, the Berg Balance Scale as well as a posturography device might be used jointly to evaluate the subject's ability to maintain balance.

Another study done by **Soliman, et al., [21]**, agreed with our result of the significant correlation between BBS and dynamic balance in patients with unilateral discogenic sciatica. They found that there were variations in the deterioration of postural stability indices and also the limit of stability between

individuals with chronic LBP of varying intensities, suggesting that pain intensity is a factor impacting dynamic balance in these patients.

Patients having discogenic sciatica should have their postural balance examined to reduce the risk of damage from falls, and an exercise program should be implemented to improve proprioception as well as postural balance. Also PROKIN system could be a good indicator to severity of dysfunction in patients with unilateral discogenic sciatica.

### **Conclusion**

The study findings suggest that discogenic sciatica increases the risk of falling by impairing both types of balance (static & dynamic). Therefore, patients having discogenic sciatica should have an evaluation of their postural balance ability, as well as an exercise regimen targeting proprioception and postural balance capability will be necessary for the therapy of these patients in order to prevent fall injuries.

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There was a lack of funding for the study

### **Conflict of interest**

The authors declared that there was no conflict of interest regarding the publication of this paper.

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