

## Research Article

# The Accuracy of Slump Test for Diagnosis Spinal Stenosis with Sciatica Pain

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## Abstract

**Introduction:** Slump test is a neurodynamic test, used to assessment of the increased mechanosensitive of neural tissues, due to more tension on the nerve root increases root ischemia, which explains the possibility of sciatica through mechanisms other than compression. Previous study reported more sensitive in diagnosis lumbar disc herniation, however no study reported accuracy, sensitivity, and specificity.

**Research question:** The correlation between slump test and zone of stenosis in MRI.

**Material and methods:** This diagnostic study was performed at Phramongkutklao hospital between November 2020 and July 2021. 75 patients with moderate to severe VAS were included and examined by single orthopaedic surgeon. All MRI were confirmed by radiologist.

**Results:** Mean age was  $65.9 \pm 9.6$  years. Most stenosis level at L<sub>4,5</sub>. Slump test was positive in 23 patients, negative in 52 patients. Most patients shown lateral recess stenosis alone or combined with central stenosis, correlation between zone of stenosis from MRI spine and slump test positive was no significant difference between groups.

**Discussion:** Study shown minimal effect of slump test when compare between accuracy, sensitivity, and specificity between slump test in lumbar disc herniation in previous studies and spinal stenosis with sciatica pain, slump test in spinal stenosis poor diagnostic value with less sensitivity and specificity.

**Conclusions:** Slump test is poor diagnostic testing with low accuracy for diagnosis spinal stenosis with lumbar radicular pain. Slump test positive associate with more visual analog scale and severity of zone spinal stenosis in axial T2 MRI.

**Keywords:** Slump test; Diagnosis spinal stenosis; Spinal stenosis

## Introduction

Prevalence low back pain was reported to be over 70% - 84%, while with accompanying radicular symptoms has a reported prevalence of variation reflects upon the lack of consensus in diagnosing lumbar radicular pain. Diagnosis of low back pain with sciatica pain is important physical examination which physical tests for nerve root tension signs, such as Straight Leg Raise Test (SLRT), slump test, Lasègue test, Bowstring test [1-3]. Guidelines of low back pain and sciatica pain also suggest a subsequent MRI if the symptoms fail to improve. MRI can detect lumbar spine derangements including bulging disc, protrusions or herniated discs, nerve root compression, zone of stenosis, facet joint pathology and spinal instability. The clinical test results and the MRI findings are the basis of the diagnosis,

thus, the inter-correlations between the clinical tests and the MRI findings are of clinical importance. The clinical examination consists of neurodynamic tests and neurological examination tests. The slump test is an example of a neurodynamic test, used for the assessment of the increased mechanosensitive of the meningeal and neural tissues, due to more tension on the nerve root increases the root ischemia, which explains the possibility of sciatica through mechanisms other than compression. Previous study reported that the slump is more sensitive than the SLR test in diagnosis lumbar disc herniation [4-7], however no study reported accuracy, sensitivity and specificity in spinal stenosis with unilateral sciatica pain so primary objective in this study we are focusing on slump test in these patients. Secondary objective study is correlation between slump test and zone of spinal stenosis in MRI.

## Material and Methods

This study was designed as diagnostic study, no blind study. This study was performed in Phramongkutklao hospital between November 2020 and July 2021. Inclusion criteria were age more than 40 years old with unilateral sciatica pain. Seventy-five patients were included in our study. All patients had moderate to severe pain with visual pain score more than 5 of 10. Subjects were excluded if they had piriformis syndrome, previous infection, previous spinal surgery, diabetic neuropathy, peripheral vascular disease, hip pathology, psychology disorders, neck pain, spinal trauma. Prior to participating in any study-related procedures, participants read and signed an informed written consent form and were informed about

**Citation:** Srichandraphan N, Poopitaya S, Chitragran R. The Accuracy of Slump Test for Diagnosis Spinal Stenosis with Sciatica Pain. Ann Short Rep Clin Image. 2021; 3(1): 1021.

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**Publisher Name:** Medtext Publications LLC

**Manuscript compiled:** Aug 02<sup>nd</sup>, 2021

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the procedure. All patients were tested with slump test by single orthopaedic surgeon. MRI spine was performed in all patients to obtain confirmatory sagittal, cross-sectional axial imaging of the spinal stenosis at one or more levels. No blind participant and orthopaedic surgeon when the test was performed. MRI were confirmed diagnosis by musculoskeletal radiologist. The study protocol was approved by Phramongkutklao hospital Institutional Ethical Committee.

## Procedure

The slump test is usually performed on patients presenting with lower back pain and sciatica (radiating pain along the route of sciatic nerve, often described by patients as shooting pain from the buttock to the foot) to examine for neural tissue irritability and restriction in mobility. In the present study we used the positioning proposed by Maitland. The following are the steps of the procedure. The patient in sitting on the side of the examination bed or chair with back straight. The examiner passively flexes the patient's thoracic and lumbar spines fully to place the patient in a slump position, while asking the patient to maintain their gaze in front. The examiner passively flexes the patient's neck to a maximum by bringing the patient's chin towards his/her chest. With patient in the slump position and their neck fully flexed, the examiner passively extends one of the patient's knees as much as possible. The last step is ankle dorsiflexion. The patient maintaining trunk flexion, neck flexion and knee extension, the examiner passively dorsiflex the patient's foot and ankle where the knee is extended. Slump test is considered positive if the patient's symptom is reproduced during the procedure, especially so if the symptom improved after cervical extension. Statistical analysis was conducted using SPSS version 14.0 and p values of <0.05 were consider significant. Descriptive statistics were used to characterize the sample's demographic data and data related to spinal stenosis and physical examination findings. Positive and negative results from MRI were cross tabulated table with positive and negative results from each index test (Table 1). A confidence interval calculator was used to determine the sensitivity, specificity, Positive Predictive Value (PPV), Negative Predictive Value (NPV), Negative Likelihood Ratio (NLR) and Positive Likelihood Ratio (PLR) for test at the 95% confidence level. The accurate test was determined as the one reflecting result more like those of the MRI. The limitations of this study were the small sample size. No randomization, no blind technique when exam the patient. There was only one examiner to exam the patient in this study.

## Result

There were 75 patients available for the study. 37 patients were female while 38 patients were male. The mean age was  $65.9 \pm 9.6$  years. Most lumbar spinal stenosis was at L4-5. The mean BMI was  $24.47 \pm 3.6$ . The mean pain score was  $6.08 \pm 1.12$  [5-9]. The mean onset of sciatica pain was  $3.89 \pm 2.12$  months. The right sciatica pain 34 patients, left sciatica pain 41 patients. The slump test was positive 23 patients. (30.67%), negative 52 patients (69.33%). Sensitivity, specificity, PPV, NPV and Likelihood ratio of slump test are shown in Table 2. In our study most of patients showed lateral recess stenosis alone or lateral recess stenosis combined with central stenosis more than central stenosis alone, correlation between zone of spinal stenosis from axial T2 MRI spine imaging and slump test positive, no significant difference between groups (p-value 0.556), however slump test was positive in case with more severity of spinal stenosis with significant difference (p-value 0.003) information was shown in Tables 3 and 4, also patient with more VAS pain score show slump test

positive more than less VAS pain score (median of VAS pain score in slump test positive was 7 [6-9], slump test negative 5 [5-7], p-value 0.001).

**Table 1:** Positive and negative results from MRI were cross tabulated.

Test/MRI	Spinal stenosis without spondylolisthesis	Low grade spondylolisthesis, spondylolysis	Total
Slump test positive	19	4	23
Slump test negative	39	13	52

## Discussion

Lumbar radicular pain previously known as sciatica pain, was first described by Hippocrates in the fourteenth century BC [8]. The lifetime occurrence of lumbar radicular pain has been estimated to vary between 12.2% and 43%, a review of the literature relying on more stringent clinical criteria found estimates of prevalence to vary between 2.2% and 25% [1,2]. Lumbar radicular pain can be caused by herniation of the nucleus pulposus, spinal stenosis, and spondylolisthesis. These result in inflammation at the nerve roots themselves, and irritation of the dorsal root ganglion, and leads to nerve root dermatomal symptoms such as sharp pain, burning pain, numbness, and weakness. Classic physical nerve root tension exam signs help identify if symptoms are associated with lumbar disc herniation: the straight leg raise, slump test, Lasègue test, Bowstring test. Many studies were shown good sensitivity and specificity in diagnosis lumbar disc herniation with unilateral sciatica pain and it help to diagnosis and treatment those patients however no study in slump test and patient with spinal stenosis and unilateral sciatica pain [4-7]. In our study show low accuracy (42.7%), sensitivity (32.8%), specificity of slump test in diagnosis with spinal stenosis and unilateral sciatica pain. From our study show minimal effect of slump test because in our study likelihood ratio positive was 1.39. (likelihood ratio 1-2 is minimal effect), low positive predictive value so it can conclude that slump test in spinal stenosis with unilateral sciatica pain is poor diagnostic value testing. The mechanism of neurodynamic test are increase more stretching and tension at dural sac and nerve roots. Other factors that result in test are inflammation of nerve root and mechanical compression. Many investigators have focused on the role of the nucleus pulposus as a driver of inflammation around the nerve root, affecting its electrophysiologic function and the surrounding biochemical milieu. Studies have shown that the nucleus pulposus is both inflammatogenic and leukotoxic evidence for the inflammatory basis for radicular pain is provided by the increased levels of cytokines including interleukin 1a (IL-1a), IL-1b, IL-6, IL-8, tumor necrosis factor a (TNF-a), and prostaglandin [9-11]. In particular, TNF-a, present at increased levels within the nucleus pulposus, has been shown to induce the synthesis of nitric oxide. In turn, nitric oxide levels within herniated disc material also show strong correlation with thermal hyperalgesia, induced by placing annulus fibrosus and nucleus pulposus in the epidural space [12]. Zwart et al. [13] assessing the warm and cold thresholds in patients with unilateral radicular pain in L5 and S1 distribution, found that warm sensation was significantly more impaired, compared with cold sensation, in patients with confirmed disc herniation. This finding suggests that inflammation may be a more dominant driver of lumbar radicular pain compared with mechanical compression. Lumbar radicular pain is usually self limiting because of the resolution of inflammation and frequently regression of the compressive elements. However, local, spinal, and even supraspinal changes can take place, leading to complex cascades that result in chronic radicular pain. In our study shown slump test

**Table 2:** PPV, NPV and Likelihood ratio of slump test are shown.

	Sensitivity	Specificity	PPV	NPV	Likelihood ratio positive	Likelihood ratio negative
Slump test	0.33 (95%CI 0.21-0.46)	0.77 (95%CI 0.50-0.93)	0.83 (95%CI 0.61-0.95)	0.25 (95%CI 0.14-0.39)	1.39 (95%CI 0.55-3.54)	0.25 (95%CI 0.14-0.39)
Accuracy	43% (95%CI 31.3%-54.6%)					

**Table 3:** Significant difference (p-value 0.003) information was shown.

Zone of stenosis	Central stenosis N (%)	Lateral recess stenosis N (%)	Central and lateral recess stenosis N (%)
Slump test negative	3 (75)	25 (75.76)	24 (63.16)
Slump test positive	1 (25)	8 (24.24)	14 (36.84)

**Table 4:** Significant difference (p-value 0.003) information was shown.

Severity of zone stenosis	Mild N (%)	Moderate N (%)	Severe N (%)
Slump test negative	19 (100)	29 (60.42)	4 (50)
Slump test positive	-	19 (39.58)	4 (50)

**Figure 1:** Shown slump test positive.

positive in case with more VAS pain score so the inflammation of nerve root and dural sac are important cause which may be acute or acute on top chronic onset, and it compatible with previous studies explained the mechanism.

Lumbar disc herniation and facet joint hypertrophy may set off a cascade of inflammatory changes leading to sensitization of the affected nerve root and local nerve conduction abnormalities. Mechanical compression and deformation of a sensitized nerve root serve to continue propagation of radicular pain. Direct mechanical compression of the dorsal root ganglion may lead to pain without previous inflammatory sensitization. Its clinical symptoms vary but appear as a result of neurovascular mechanisms, nerve root excitation, or mechanical compression of the spinal canal. These mechanisms can occur simultaneously. Patients typically present either with low back pain and radicular leg pain or with neurogenic claudication. So this is why we found more case in lateral recess stenosis or combined stenosis more than in central stenosis alone in our study [14,15]. But when compare between accuracy, sensitivity and specificity between slump test in lumbar disc herniation in previous studies and spinal stenosis with sciatica pain in our study, slump test in spinal stenosis poor diagnostic value and less sensitivity and specificity than in lumbar disc herniation patient about 3-4 multiply. Chronic disease and constriction of the nerve roots by the foraminal ligaments, adhesion of the nerve roots and around dural sac and predominantly lateral recess and foraminal lumbar stenosis. Slump test and others

nerve root tension tests are less often positive in spinal stenosis may be explained why the frequency decreases with age, even when a consistent herniated disc is documented: in a series of 269 sciatica patients with a consistent MRI, the Lasègue test was positive in 100% of cases between 10 and 19 years, 87% of cases between 20 and 29 years, 82% of cases between 30 and 39 years, and the probability of a positive result in people over 60 was 5.4 times lower [16]. These results showed compatible with our study. Flaw of our study were no randomization, no blind technique, small patient numbers.

## Conclusions

Slump test is poor diagnostic value testing and low accuracy for diagnosis spinal stenosis with lumbar radicular pain. Slump test positive associate with more visual analog scale and severity of zone spinal stenosis in axial T2 MRI.

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