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PROSPECTIVE STUDY

Study on Single Leg Stance Test as an Outpatient Assessment Tool in Spine Examination

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ABSTRACT

Study design: A prospective study

Objective: Sciatica is one of the most prevalent clinical conditions seen in spine outpatient clinics. The levels commonly involved are L4-L5 and L5-S1 levels. Examination of L5 nerve root involves motor power of extensor Hallucis Longus (EHL), extensor digitorum, hip abductors and sensation over dorsal aspect of foot. When it comes to the routine out patient clinical examination, the usage of Hip abductor examination is not generally practiced. There is a need to assess the usage of Hip abductor examination as single leg stance test (SLST) in patients presenting with Sciatica in spine outpatient clinics.

Materials and methods: This study is a prospective study involving a total of fifty four patients. Patients presenting with sciatica are made to stand on one leg without support in a firm surface with the other knee flexed to 90° and eyes opened. Interpretations are made. We analyzed our results with motor EHL power and sensory findings.

Results: In our study involving 54 patients, 37% of cases with EHL power 5 had difficulty in performing single leg stance. 100% of cases with EHL power 4 had difficulty. 100% cases with EHL power 3 or less than 3 had difficulty in performing, with 35% among those even not possible to perform SLST.

Conclusion: This study shows Single Leg Stance Test (SLST) as an excellent clinical assessment tool for L5 nerve root examination in patients presenting with sciatica. It is easily reproducible, less inter/intra observer bias, more accurate in predicting deficit, useful in acute painful cases and in people with hallux valgus deformities. Single Leg Stance Test (SLST) may be considered as an assessment tool for patients in spine examination in outpatient clinics.

Keywords: L5 nerve root examination, Single leg stance test, Spine outpatient assessment.

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INTRODUCTION

Sciatica is one of the most prevalent clinical conditions seen in spine outpatient clinics. The levels commonly involved are L4-L5 and L5-S1 levels. In conditions producing nerve root compression there occurs a weakness of the muscles innervated by the nerve root.[1] Examination of the motor and sensory levels is mandatory in these patients. Examination of L5 nerve root involves motor power of extensor hallucis longus, extensor digitorum and hip abductors and sensation over the dorsal aspect of foot.[2] When it comes to routine outpatient clinical examination, the usage of Hip abductor examination is not generally practiced. The hip joint is a three-point lever system with the abductors acting as the power arm. When the patient stands on a single leg, the abductors on that side pulls the pelvis from swaying down and maintains the center of gravity.[3] In patients with affected hip abductor (glutei) power, when the patient stands on one leg, there is difficulty in maintaining the center of gravity due to dipping of the contralateral pelvis and will have difficulty in single leg stance (SLS).[4] There is a need to assess the use of Hip abductor examination as SLS test (SLST) in patients presenting with Sciatica in spine outpatient clinics. This study aims to assess the SLST as an outpatient assessment tool in Spine examination.

MATERIALS AND METHODS

This is a prospective study conducted at our institute from April 2017 to May 2018 involving a total of 54 patients. We included patients with sciatica, leg pain, and numbness. Patients with spinal infection, Traumatic fractures, bedridden, bilateral sciatica and patients with associated hip and knee pathologies were excluded from the study. A detailed consent was obtained from all patients involved in the study. Patients presenting with sciatica are explained about the study. A detailed clinical examination was done. For L5 nerve root, examination of motor power of

Fig. 1: Clinical method of SLS test

extensor hallucis longus, extensor digitorum, and hip abductors was assessed. Medical research council (MRC) grading of power was done with grade 0–no visible contraction to grade 5–active range of movement against full resistance. Sensation over the dorsal aspect of the foot was documented. In this study, hip abductor power is examined using SLST. The method of SLS was explained and demonstrated to patients. Patients were made to stand on one leg without support on a firm surface with the other knee flexed to 90 and eyes opened (Fig. 1). First, the patient was made to stand on the unaffected side followed by the affected leg.

Observations were made with SLS time of 10 seconds. All tests were performed by two trained surgeons. Each examiner was unaware of the patient's other results. Interpretations of the study are made as follows (Table 1).

- *Possible:* if the patient can single leg stand without support for more than 10 seconds.
- *Difficult:* if the patient can single leg stand without support for more than 5 seconds but less than 10 seconds.

Table 1: SLST grading

Interpretation (SLST grade)	*Finding*
SLST A–Possible	Able to stand without support >10s
SLST B–Difficult	Able to stand without support >5 s but < 10 s
SLST C–Not possible	Not able to stand without support for at least 5 s

- *Not possible:* If cannot stand on one leg without support for at least 5 seconds.

All patients underwent magnetic resonance imaging of the whole spine to confirm the disease pathology. We analyzed our results with motor power and sensory findings with SLS results.

RESULTS

Out of the 54 patients, 29 patients were male, and 25 patients were females. 41% of the cases involved the left side. Most common level affected in our study was L4-L5 level 34 (63%) (Table 2).

Patients age range from 15 to 78 with a mean age of 52 years. 37% of cases with EHL power 5 had difficulty (SLST B) in performing single leg stance (Table 3).

One hundred percent of cases with EHL power 4 had difficulty (SLST B); 100% of cases with EHL power less than 4 had difficulty in performing (SLST B and C), with 35% among those even not possible to perform SLST C. When there is a decrease in sensation, 89% of cases had difficulty in performing SLST B and C) (Table 4).

DISCUSSION

Single leg stance (SLS) is a more sensitive and easily reproducible test with less inter- and intra-observer bias. It is more accurate in predicting the L5 nerve root deficit in comparison to motor power examination of EHL.[5] SLST also referred to as unipedal stance test, SLS test and one

Table 2: Data showing study results

	SLS	*Possible (SLST A)*	*Difficult (SLST B)*	*Not possible (SLST C)*	*Total*
Age	<30	3	4		7 (13%)
	30-50	7	13	1	21 (39%)
	>50	8	14	4	26 (48%)
Side	Right	7	12	1	20 (37%)
	Left	5	15	2	22 (41%)
	Bilateral	6	4	2	12 (22%)
Sex	Male	11	14	4	29 (54%)
	Female	7	17	1	25 (46%)
Pathology	IVDP L4-L5	10	22	2	34 (63%)
	IVDP L4-L5, L5-S1	2	3		5 (10%)
	L4-L5	1	3	2	6 (10%)
Spondylolisthesis	L4-L5 stenosis	5	2	1	8 (15%)
	Others		1		1 (2%)

Table 3: Single leg stance test (SLST) results analyzed with extensor hallucis longus (EHL) motor power

SLS		*Possible (SLST A)*	*Difficult (SLST B)*	*Not possible (SLST C)*	*Total*
EHL/ EDL Power	5	18	11	–	29 (54%)
	4	–	11	–	11 (20%)
	<3	–	9	5	14 (26%)

Table 4: Single leg stance test (SLST) results analyzed with L5 sensory finding

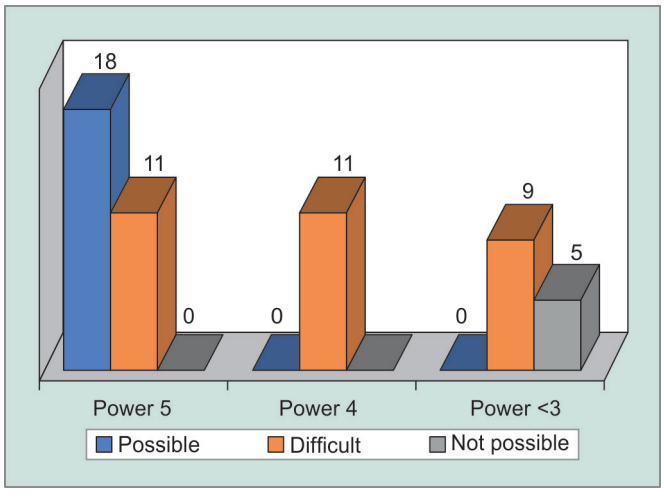
SLS		*Possible (SLST A)*	*Difficult (SLST B)*	*Not possible (SLST C)*	*Total*
Sensory	Intact	14	5	_	19 (35%)
	Decreased	4	26	5	35 (65%)

leg standing test in literature. Single leg stance is often used to test the static postural and balance control in the elderly population. The Hip joint allows movement in three axes. The mechanics of the hip joint during standing and walking is mainly governed by the powerful muscles around the joint. During standing in both legs, the body is perfectly balanced, and abductors are relaxed.[6] During the single leg stance, the force produced by gravity and body weight pulls the body to lean; this is counteracted by the abductor on the stance side. The abductor muscle force on the stance leg depends on the body weight, body weight moment arm, and abductor moment arm.[7] When standing on a single leg, the body weight moment arm increases, greater abductor muscle power is needed to maintain the stability.[8] When there is abductor muscle weakness, the body fails to counteract the downward pull of gravity and body weight and loses balance.[9] This is the first study to compare the EHL power with the hip abductor power as SLS to assess L5 nerve root weakness. Assessment of EHL power is often overlooked, because of the lack of accurate method. Hara et al.,[10] in their study on EHL power assessment, found greater variability in between observers with different position of the great toe. They suggested measuring the power of the EHL over the Meta Tarso Phalangeal (MTP) joint.

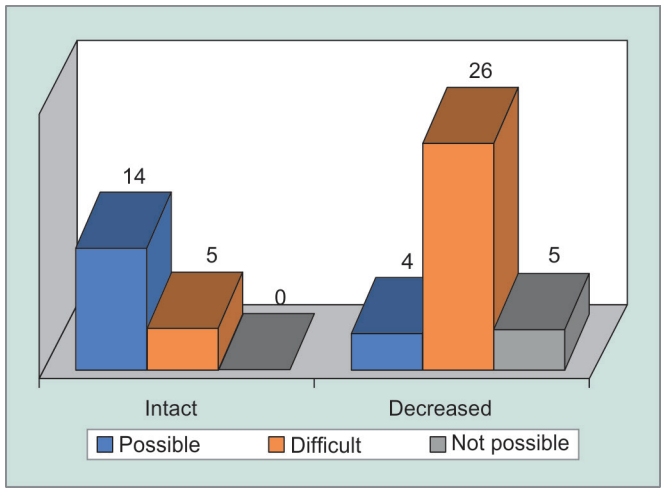
In this study, patients above 50 years formed the majority (48%). When the EHL power is 5, 37% of cases had difficulty (SLST B) in performing the test, which suggests that SLST could be used as a predictor or early detection of L5 nerve root motor dysfunction in comparison with EHL power (Graph 1).

When the EHL power is 4 or less than 4, all 25 cases (100%) had difficulty (SLST B and C), suggesting that SLST has high sensitivity. When the EHL power is 3 or less than 3, 35% of cases could not perform SLST C. This suggests that the tests interpretations are in accordance with motor power. 89% of cases with sensory dulling had difficulty (SLST B and C) in performing the test, suggesting a good correlation with the sensory examination as well (Graph 2).

Kwo et al.,[11] in their study in thirteen low back pain patients and thirteen volunteers found that older adults with chronic Low back pain performed significantly worse in clinical balance tests and this may be a potential risk factor for falls. They suggest that older adults with chronic low back pain, clinicians may also need to examine their balance performance and spinal steadiness during balance challenging tests. Timothy Sells et al.,[12] conducted his study on 256 special forces operators in the military who had the previous history of low back pain or sciatica. Their results indicated that operators who had previously reported low back pain had significantly worse SLS under both the eyes open and eyes closed conditions. They also recommend SLS in all military special forces personnel with a history of low back pain. Springer et al.,[13] in the study involving 567 participants to find the normative values for SLS found a significant age-dependent decrease in SLS time.



Graph 1: Correlation between extensor hallucis longus motor power and results of single leg Stance test



Graph 2: Correlation between L5 Sensory findings and results of Single Leg Stance Test

Inter-rater reliability for the best of 3 trials was determined to be excellent with eyes open and for eyes closed. They concluded that the unipedal stance test (eyes open and eyes closed) a reliable, readily available and easy to perform 'bedside' examination tool for balance testing. Jacobs et al.,[14] recommended including SLS for patients with Parkinson disease to evaluate postural stability since it correlated with balance confidence and a history of falls. El-Kashlan et al.,[15] recommended using SLS as an outcome measure of static equilibrium of vestibular treatment. Potvin and Tourtellotte et al.,[16] recommended SLS with the eyes closed in conjunction with a battery of tests to evaluate motor function during the 'clinical quantitative neurological examination,' and Brinkman et al.,[17] included the SLS with eyes open in their recommended battery of tests for balance assessment in a routine neurological examination. Curb et al.,[18] also recommended Single Leg Stance (SLS) to quickly assess the global functional level. Vellas et al.[9,19] found that subjects who were unable to balance on one limb for 5 seconds had 2.1 times the risk of incurring an injurious fall as individuals who could balance for more than 5 seconds. Gehlsen and Whaley et al.,[20] were able to distinguish between fallers and nonfallers using the SLS with eyes open and eyes closed in an elderly population and suggested that impaired SLS is a marker of frailty in elderly persons. Bohannon et al.,[21] obtained normative values for age group from 20 to 79 years of age.

In the third and fourth decade, subjects were able to perform a single leg stance for an average of 28 to 29 seconds. Their study showed a decrease in SLS time at age 60. Springer et al.,[3,13] study shows that unipedal stance test (UPST) time decreases dramatically by the 7th decade. Hurvitz et al.,[22] suggest using a 45 second time limit for a more normal distribution. Springer et al.,[13] studies shows the mean UPST time for different age groups. For the age group from 18 to 39 the meantime is 45 seconds, for age group 60 to 69 meantime is 30 seconds and for 80 to 99 meantime is 10 seconds. In our study, we used a time trial of 5 seconds and 10 seconds to make the test universally applicable in all age groups.

CONCLUSION

This study shows SLST as an excellent clinical assessment tool for L5 nerve root examination in patients presenting with sciatica. SLST is a more sensitive test than EHL motor power examination. It is easily reproducible, less inter/intraobserver bias, more accurate in predicting deficit, useful in acute painful cases and people with hallux valgus deformities. SLS may be considered as an assessment tool for patients in spine examination in outpatient clinics.

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