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A Comparative Study to Analyze the 5 Times Sit-To-Stand Test Performance in Healthy Individual vs. Diabetic Neuropathy Patient

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Abstract

Purpose: To obtain the normal time period for 5 time sit-to-stand in diabetic neuropathy patients.

Objectives: To study the performance of 5 time sit-to-stand test in healthy individual and diabetic neuropathy patient and compare the 5 time sit-to-stand test performance in healthy individual and diabetic neuropathy patient.

Methods: Cross Sectional Study design assigned by convenient sampling with 30 Subjects in each group.

Outcome measure: Five times sit to stand test.

Results: The average time of 5 time sit to stand test taken by healthy individual was 14.36 seconds and diabetic neuropathy patients was 21.06 seconds.

Conclusion: The aim of the study is to compare the time taken by healthy individual and diabetic neuropathy with the help of 5 time sit-to-stand test. We conclude that diabetic neuropathic patients take more time compare to healthy individual to complete 5 time sit-to-stand test.

Keywords: Sit to stand; Five times sit to stand test; Diabetic neuropathy; Healthy individual

Introduction

Diabetes mellitus is a metabolic disease that is characterized by elevated levels of blood glucose. Already 2000 years ago, the ancient Greek physician Arateus of Cappadocia gave the first complete description of diabetes and concluded that "life with diabetes is short, disgusting and painful" [1]. India has earned the dubious distinction of being termed the "Diabetes capital of the world" with number of patients expected to cross 79.4 million by year 2030 [2].

There are two distinct types of diabetes mellitus: type 1 (DM1) and type 2 diabetes mellitus (DM2).

Ten percent of all patients with diabetes have DM1 which in most (but not all) cases develops during childhood or adolescence. This type of diabetes is the result of an autoimmune destruction of the insulin producing beta cells in the pancreas. The vast majority of the patients with diabetes mellitus suffer from DM2. This metabolic disorder is characterized by high blood glucose levels.

(Hyperglycaemia) due to insulin resistance and relative lack of insulin.

There are several risk factors in the development of DM2, such as family history (genetic

predisposition), intrauterine environment, obesity, diet and physical inactivity.

Edward Horton concluded in 1983 in his review that "Environmental factors such as excessive caloric intake altered dietary composition, physical inactivity and the process of aging, may contribute to the development of noninsulin-dependent diabetes mellitus in the genetically predisposed subject" [3].

Diabetic neuropathy (DN) is a nerve damaging disorder associated with diabetes. This condition is thought to be result from micro ascular injury involving small blood vessels that supply to the nerve (vas nervorum) in addition to macro vascular condition that can culminate in diabetic neuropathy. Neuropathy frequently results in significant morbidities such as a pain, loss of sensation, foot ulcers, gangrene and amputations which is much feared sequel that results in hospitalizations [4]. Postural instability in diabetic sensory neuropathy (DSN) patients is usually attributed to the lack of accurate proprioceptive feedback (sensory ataxia) from the lower limbs [5].

Diabetes is highly prevalent in older people, and its prevalence is expected to increase substantially in the next decades [6]. About 79% live in low- and middle-income countries. The number of people with diabetes increases to 451 million if the age is expanded to 18-99 years. If these trends continue, by 2045, 693 million people 18-99 years, or 629 million of people 20-79 years, will have diabetes [7].

Recent studies have shown that more than half of community-dwelling elderly people over the age of 62 years report a fear of falling. Developing a fear of falling is more prevalent with increasing age and fall history but is not limited to individuals with a history of falls. The impact of fear of falling is far-reaching because it can lead to activity restriction and diminished mobility, with as many as 56% of elderly

people curtailing activities due to this fear [8]. According to Volpato et al. a total of 53% of the sample reported mobility disability, 31.6% had ADL disability, and 26.8% had severe walking limitation [9]. According to Danik Lafond et al. DSN showed larger sway area, larger speed of sway larger COP range, higher RMS values of the COP-COM variable, and an increase in the power of medium-high frequency band of a power spectral analysis. According to Lindsey M Tilling et al. Falls occurred more frequently in patients with poor diabetic control [risk ratio (RR)=7.83 (2.948-20.799), χ^2 value=6.422]; patients requiring assistance with mobility: for those mobile with a stick [RR=1.839 (1.048-3.227), χ^2=4.619]. Poorly controlled diabetes and conditions associated with complications of diabetes are associated with an increased risk of falling in older people [10].

It is commonly used to measure mobility and function in older adults. Sit-to-stand is a mechanically demanding task performed frequently each day, yet many older adults have difficulty performing this task, for example, people with neurological impairment. The five-repetition sit-to-stand may be used as an individual measure or as part of a standardized battery to assess physical function. The five-repetition sit-to-stand requires the individual to stand up and sit down five times as fast as possible without using their hands to push up from the chair. The time taken to perform the task is measured using a handheld stopwatch; increased time reflects poorer performance. A standard armless chair is used, usually 43-47 cm in height. The back of the chair should be stabilized against a wall to ensure safety and stability. The individual is instructed to fold his/her arms across his/her chest to avoid using the hands. The test commences upon the assessor instructing the individual to begin and ceases when the individual sits back fully in the chair after the fifth repetition with his/her back coming to rest against the back of the chair. The five-repetition sit-to-stand is a simple to use, reliable and valid measure of physical function in older people, including those with musculoskeletal or neurological conditions. Poor performance on this test highlights mobility problems and is associated with subsequent disability [11].

Reliability, validity and responsiveness

The five-repetition sit-to-stand is highly reliable (intraclass correlation coefficients [ICCs] 0.76-0.99 for test-retest reliability and ICCs 0.97-1.00 for inter-rater reliability) in older adults. The associated measurement error is also small (0.6-1.4 seconds). Validity of the five-repetition sit-to-stand has been reported in these populations, although the correlations with gait (r=0.4-0.7), balance (r=0.3-0.7) and knee extensor strength (r=0.3-0.5) are variable [12].

Michigan neuropathy screening instrument

It consists of a questionnaire and physical examination. History (questionnaire) components- 15 Yes or No questions [13].

Five times sit to stand mainly use for balance ability.

We hypothesized the diabetic neuropathy patients have balance problem so might be influence on five time sit to test performance.

Materials and Methodology

Study design

Cross Sectional Study

Study setting

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Sample size

30 subjects in each group

Subjects

Male and Female

Inclusion criteria (Table 1)

Healthy Individual	Diabetic Neuropathy Patient
1. Age group 50 to 80,	1.Age group 50 to 80,
2. Individuals with no musculoskeletal or neurological problems.	2.Patients with no musculoskeletal or cardiac problems,
	3.Patients with MNSI SCORE: ≥ 7,
	4.Patient who were able to stand up from the chair without any external support,
	5.Patient diagnosed by Physician or Neurophysician

Table 1: Inclusion criteria.

Exclusion criteria

1. Who are unable to follow commands properly,
2. Suffering from other neurological or musculoskeletal this could affect sit to stand performance.

Materials used in study

1. Measure tape
2. Pencil
3. Papers

Apparatus used in study

1. Height adjustable chair
2. Digital stopwatch

Outcome measures

1. 5 time sit-to-stand test (FTSTS),
2. Michigan Neuropathy Screening Instrument (for diabetic neuropathy patient).

Procedure

Subjects will be selected on the basis of inclusion and exclusion criteria. All subjects will be provided written informed consent. A standard armless chair is used, usually 43-47 cm in height. The back of the chair should be stabilized against a wall to ensure safety and stability. The individual is instructed to fold his/her arms across his/her

chest to avoid using the hands. The test commences upon the assessor instructing the individual to begin and ceases when the individual sits back fully in the chair after the fifth repetition with his/her back coming to rest against the back of the chair. The individual is asked to stand up and sit down five times as fast as possible without using their hands to push up from the chair and the time is been noted.

Statistical Analysis

Unpaired t-test was used for analysis.

Null hypothesis will be rejected if <0.05. All the statistical analysis was conducted with the help of version 16.0 of the SPSS.

Results

Healthy Individual		Diabetic Neuropathy Patient		DF	t value	p value
Mean	SD	Mean	SD			
14.36 ± 0.7884	1.81	21.06 ± 6.700	3.92	58	8.498	<0.0001

Table 2: Mean for healthy individual 14.36 ± 0.7884 and for diabetic neuropathy 21.06 ± 6.700.

Graph:

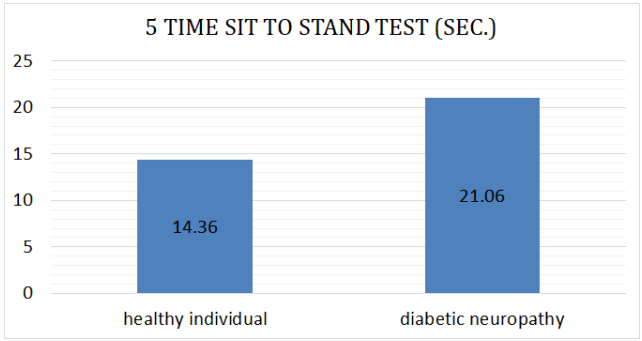

Figure 1: Comparison between neuropathy patients and healthy individuals.

We have taken 60 patients (30 in each group) out of 100. They were select as per our inclusion and exclusion criteria. After the study we got mean for healthy individual 14.36 ± 0.7884 and for diabetic neuropathy 21.06 ± 6.700 (Table 2). From the graph we learned that the diabetic neuropathy patients took more time as compare to healthy individuals (Figure 1).

Discussion

Diabetic nephropathy is a dreaded complication of DM and early detection is of paramount importance. The study was investigated to compare the 5 Time Sit-to Stand Test performances in healthy individual and diabetic neuropathy patient [14].

The task of FTSTS involves changing the base of support between the buttocks and feet repeatedly and places high demands on vision, proprioception, coordination, and especially lower limb strength [15]. A longer FTSTS time has been observed in people with balance problems, both young and older, and found to predict falls and disability in older adults [16].

At the end of study, we got average time taken by healthy individual is 14.36 seconds. According to Richard et al. they have categories the individuals according to their age. The average time taken was 60 to 69 years -11.4 seconds, 70 to 79 years -12.6 seconds and 80 to 89 years -14.8 seconds. According to Bohannon and Richard et al. they got mean 7.6 seconds. There are various factors which affect the studies. Factors like age group, gender, life style, etc. [17-20].

As per our study time taken by diabetic neuropathy patient is 21.06 seconds [21-24]. According to Lee et al. the mean baseline was 17 seconds [25,26]. According to Vaz et al. DN performed the test in 15.1 ± 2.7 seconds [27]. The values obtain from the present is higher than those of Lee et al. and Vaz et al. respectively. The difference in time variation taken can be due to following factors age group, gender, community, vision, sensory and motor affection and reduced muscle strength.

The results show that the diabetic neuropathy patients took more time as compare to healthy individuals. The diabetic neuropathy patient took 21.06 seconds to complete FTSTS and healthy individual took 14.36 seconds.

From the result we obtain that Diabetic neuropathy patient take longer period of time to complete five time sit-to-stand compare to healthy individual.

Conclusion

The aim of the study is to compare the time taken by healthy individual and diabetic neuropathy with the help of 5 time sit-to-stand test. We conclude that diabetic neuropathic patients take more time compare to healthy individual to complete 5 time sit-to-stand.

Clinical Implication

Diabetic neuropathy patient has lower limb weakness and balance problem. Five time sit-to-stand is used to measure lower limb functional strength.

According to our study the diabetes neuropathic patients take 21.06 seconds for 5 time sit to stand. So, we can say that this estimated value is normal for diabetic neuropathic patients in India.

If diabetic neuropathic patients take more than 21.06 seconds for 5 times sit to stand that means he or she might have more severity.

We can use sit to stand as diagnostic purpose in clinics for diabetic neuropathic patients and bring then to normal timing.

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