

Association between diabetic neuropathy, fall risks and balance in diabetes type 2 patients

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Objective: To determine whether there is an impact of diabetic neuropathy on balance and fall risks in diabetes type 2 patients.

Methodology: It is a cross sectional study that involved diabetes type 2 patients aged between 40 to 60 years with neuropathy, confirmed by Michigan neuropathy screening scoring. Study excluded the patients with ongoing comorbidities and neuropathies of other cause. This study included 196 patients. Data were collected through non probability purposive sampling technique from 3 different hospitals in Lahore (Services Hospital, Jinnah Hospital and Surgimed Hospital). Three measures were used for each parameter of the study, Michigan neuropathy screening instrument for neuropathy, Timed up and Go Test for balance assessment and Fall Efficacy Scale International for fall risk assessment. Data were analyzed by

SPSS version 25.

Results: Out of 196 patients, only 16(8%) had no neuropathy and 180(92%) had considerable neuropathy with mean score of 17.8954 on Michigan neuropathy instrument. For TUG test, 148(75.5%) patients were labelled slow and 48(24.5%) as normal. For fall efficacy scale international, 80(41%) patients were completely independent and other 116(59%) were moderate to completely dependent, defining the fear of fall that each patient had.

Conclusion: There is a remarkable association between diabetic neuropathy, risk of falls and balance. The level of significance between neuropathy and balance impairments increased risk falls was high. (Rawal Med J 202;45:27-30).

Keywords: Diabetic neuropathy, balance impairments, fall risk, daily life activities.

INTRODUCTION

Diabetes Mellitus (DM) affects almost all the organ systems of a human body. Nearly 422 million adults were estimated to be diabetic according to the latest 2016 data from the World Health Organization (WHO).¹ It is globally but more so in Asians.² The disease involves carbohydrate, oil and polypeptide metabolism.³ Diabetic neuropathy is one of the complication of DM that has a huge impact on patients life style.⁴ It results in typical sign and symptoms.⁵ Almost 5 million patients die every year because of the complications of this disease and large number of these deaths (75%) occur in third world countries.⁶ By 2045 around 693 million adults will have diabetes that is almost double of the diabetic population today.⁷

Following 2013 diabetic atlas 36% of total diabetic population was living in Asia and Africa.⁸ In Myanmar, there was an increased diabetic rate, neuropathic pain and a progressive relationship with chronic diabetes, advancing age and smoking.⁹ In Malaysia, 17.7% of its total population is diabetic.¹⁰

The prevalence of DM is high in Pakistan, ranging from 7.6% (5.2 million of its total population) to 11% estimated in 2011 and expected to reach 15% (14 million) by 2030.¹¹

Diabetes affects particular segments of nervous system leading to neuropathies.¹² Patients with neuropathy are at a greater risk falls because it impacts the body's center of mass and center of pressure differences.¹³ This causes decreased central sway and defines that reduced local balance control is adjusted with a greater central balance control.¹⁴ The frequency of falls is even higher in patients with a poor control of diabetes, advancing age and in ambulant patients with concomitant stroke.¹⁵ In long term, these patients, develop hypertension and renal failure.¹⁶ Examining association between balance and neuropathy in diabetic and non diabetic patients, the former showed significantly deficient balance adaptations when compared to the other control group.¹⁷ Diabetic neuropathy can cause deteriorating affects on central nerves as well, resulting in subsequent vestibular system impair-

ments.¹⁸ Some of the diabetic patients are more prone to falls because of their reduced mobility, increased fear of falls and recurrent falls.¹⁹ These patients also have neurotrophic ulcers and cracked skin.²⁰ Neuropathy causes certain symptoms like burning, tingling and numbness during the process of walking and consequently patient modifies their feet into certain positions to overcome these symptoms.²¹

These impairments can be associated with certain type of abnormalities in motor (impairment of motor coordination), autonomic (presence of postural hypotension) and sensory (lack of associated sensory impulses) systems of the body. The goal of this study was to determine whether the occurrence and severity of neuropathy had an impact on risk of balance impairments and falls in type 2 DM patients.

METHODOLOGY

It was a cross sectional study and we used a non probability purposive sampling technique with a sample size of 196 patients selected on the basis of related studies on topic showing significant relationship between neuropathy balance and fall risk.⁴ The study was conducted in 6 months from January to June 2019. Patients were selected from outpatient unit of Jinnah, Services and Surgimed Hospitals, Lahore, Pakistan. Study included diabetes type 2 patients with age between 40 and 60 years, pre diagnosed type 2 diabetes from an endocrinologist with sign and symptoms of diabetic neuropathy. We excluded the patients who were unable provide accurate anamnestic medical history, had prior history of non-diabetic neuropathies, had some major cardiovascular events 3 months prior to screening and any other condition which, in the investigators opinion, could lead to biasness in the study results. The study was approved by all relevant authorities.

The presence and severity of neuropathy was assessed by Michigan Neuropathy Screening Instrument (MNSI). Those patients scoring above 7 in patients version of the scale and 2.5 or above in the physical examination part of the scale were labeled as having significant neuropathy. We determined the fear of falls and patients dependency

in performing daily life activities through Fall Efficacy Scale (FES-I). Patients scoring above 70 were considered highly dependent and those scoring below 30 were considered independent and had no fear of falls. For static and dynamic balance assessment we used Timed Up and Go (TUG) test. Patient must complete the given task in less than 12 seconds in order to have negative results. By neuropathy scale (MNSI), we estimated the level of peripheral dysfunction and then determined its association with fall risks (FES-I) and balance (TUG) with the results of respective tests.

Statistical Analysis: We used SPSS version 25 for data analysis and Chi-square test to determine the association between the provided categorical data.

RESULTS

Results for Michigan neuropathy instrument showed that only 8.1% of the patients had no neuropathy, and 91.9% scored had considerable neuropathy with mean score of 17.8954 (Table 1). For TUG test, 75.5% or 148 patients took more than 12 seconds to complete the task and 24.5% or 48 patients took less than 12 seconds to complete the task. Asymptomatic significance for neuropathy and fear of falls (measured by fall efficacy scale) showed a strong association between these two variables ($P=0.003$) (Table 2).

Table 1. Statistics for the scales.

	Mean	Median	Standard deviation
MNSI	17.8954	18.0000	3.53416
FES-I	35.5204	31.5000	20.05261

MNSI =Michigan neuropathy screening instrument. FES-I = Fall efficacy scale International.

Table 2. Chi-square test values.

MNSI	Pearson's chi-square (p)
TUG	0.000
FES-I	0.003

TUG = Timed up and Go test. MNSI =Michigan neuropathy screening instrument.

FES-I = Fall efficacy scale International. Numeric data defines the P values that were determined by applying Chi square test in SPSS version 25 on the required variables.

For fall efficacy scale international, 80 patients were completely independent and 116 patients were

moderate to completely dependent, defining the fear of fall that each patient assumed with a mean of 35.5204. Level of association between neuropathy, measured by MNSI and balance measured by timed up and go test was significant and strong ($P=0.0002$).

DISCUSSION

The present study shows a significant association between diabetic neuropathy and balance impairments. Study confirmed the presence of diabetic neuropathy related onset of balance impairments and greater risk of falls but also relates diabetic neuropathy advancements with activities like postural hypotension. We found that 68% of the patients complained of lightheadedness and other activities that changed the orthostatic blood pressure, regardless of the stage of neuropathy This explains that in addition to peripheral nerves, diabetic neuropathy also affects the central nerves of the body.²²

In addition to other multivariate models like (age, gender, co-morbid diseases), diabetic neuropathy acts as an independent variable for increased risk of falls. Neuropathy can be one of the factor other than those linked with chronic glucose fluctuations that can cause balance impairments and can be one of the main predictors of falls.²³

Study suggests that not only the internal effects of neuropathy but external influences on the sensitivity of feet like conduction of peripheral nerves, have effects on balance. The changes in foot sensitivity can cause imbalances as large number of subjects reported decreased sensitivity during the survey. Most of these subjects had poor balance. Because they were unable to accurately sense the ground surface and this factor had a negative impact on patients ability to balance and walk on different surfaces. Also, these patients took longer time to complete the above mentioned timed up and go test, we can assume because of the same reason.²⁴

It was expected that falls in neuropathic patients were largely related to foot ulcers, but foot ulcers caused falls occur only with the presence of co-morbid diseases. With the presence of a co-morbid disease like osteoporosis, diabetic patients did not

only show frequents fall but even more fractures related to falls.

CONCLUSION

There is significant association between diabetic neuropathy and balance impairments and between neuropathy and increased risk of falls. Patients having considerable neuropathy can be predicted to be at a greater risk of falls and encountering balance impairments as compared to the patients with no neuropathy.

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