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Original Research Article

TO COMPARE THE FUNCTIONAL BALANCE BETWEEN NORMAL ELDERLY, ELDERLY WITH DIABETES, ELDERLY WITH DIABETIC POLYNEUROPATHY

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ABSTRACT

Background: We aimed in this study to compare functional balance using berg balance scale amongst three groups namely elderly without diabetes, elderly with diabetes and elderly with diabetic polyneuropathy. There were total 108 patients included in the study.

Purpose: The main objective of the study was to compare functional balance by using berg balance scale among the three groups namely elderly without diabetes, elderly with diabetes and elderly with diabetic polyneuropathy.

Methodology: A total of 108 patients were taken for the study, were divided into three groups namely:

Group A- Elderly without diabetes,

Group B- Elderly with diabetes and

Group C- Elderly with diabetic polyneuropathy.

Berg balance scale was administered in the above mentioned three groups.

Results: The mean of age, gender and duration since diabetes was calculated in all groups. Berg balance scale scores were calculated and in that high fall risk there were 20(55.56%) participants in elderly with diabetic polyneuropathy. In medium fall risk there was 1(2.78%) participant in elderly with diabetes and 16(44.44%) participants in elderly with diabetic polyneuropathy. While in low fall risk there were 36 (100%) participants in normal elderly, 35(97.22%) participants in elderly with diabetes and 0(0%) in elderly with diabetic polyneuropathy. One way Anova was done and all the three groups were having significant difference in their BBS scores.

Conclusion: this study concluded that elderly with diabetic polyneuropathy were at high risk of fall than the other two groups; however elderly with diabetics were also at low risk of fall compared to elderly without diabetes though the result was not significant.

KEY WORDS: Diabetes mellitus, Berg balance scale, Diabetic polyneuropathy, Elderly population.

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INTRODUCTION

Diabetes is a clinical syndrome characterized mainly by polyuria, polydipsia and polyphagia due to absolute deficiency of insulin or diminished biologic effectiveness of it or both [1].

The DM increases as the age of an individual

increases. In 2000, the prevalence of DM was estimated to be 0.19% in people d”20 years old and 8.6% in people e”20 years old [2]. The most frequently-occurring micro vascular complication in diabetes is diabetic neuropathy (DN). Diabetic polyneuropathy is characterized by severe pain, loss of ambulation, balance problems, risk of fall and increased risk of foot ulceration and amputation [2]. Although DPN may be present in up to 10% of patients with type 2 DM at diagnosis, the prevalence of neuropathic symptom increases with duration of disease, with the highest rate of neuropathy found among patients who have had DM for at least 25 years [3,5].

Falls present a substantial health problem among the elderly population. Approximately one-third of community-dwelling people over 65 years of age will experience one or more falls each year (Stelmach and Worringham, 1985; Tinetti et al., 1988; Powell and Myers, 1995; Spirduso, 1995; Hausdorff et al., 1997; Shumway-Cook et al., 1997a). Subsequently, the frequency increases to nearly 40% for those individuals over 80 years of age and affects women more than men (Nickens, 1985; Powell and Myers, 1995) [5]. Shumway-cook and colleagues (1997) reported that the BBS was the best single predictor of fall status in community dwelling older adults without neurologic pathology. This test uses 14 different items, which are rated 0 to 4. Declining BBS scores were associated with increased fall risk [6]. Some studies have trace of evidence that functional balance is impaired in patients with diabetic polyneuropathy [7]. As these patients have distal symmetrical polyneuropathy there are neurological deficits and characterized by loss of position sense, vibration, light touch and sensory ataxia with loss of ankle reflexes. Balance and postural control clearly rely upon the integrity of peripheral sensory information, and patients with diabetic distal neuropathy, because of their altered lower limb proprioception, may be at a higher risk of falling than non-neuropathic subjects [8].

In patients with diabetes, the chance of falling may be increased due to lower extremity neuropathy. Balance is affected by hyperglycaemia which may cause dizziness; on the other hand, there is increase in risk of fall with hypoglycaemic episodes that are linked to tight glycemic control. The consequences of falls are expected to be more severe among elderly with diabetes.[8] In India there are dearth of studies where comparison is being done among elderly without Diabetes, Elderly with Diabetes and elderly with diabetic polyneuropathy on balance issues, so here a need arises to compare balance scores amongst these three groups.

Objective of the study: To compare functional balance using Berg Balance Scale among three groups namely elderly without diabetes, elderly with diabetes and elderly with diabetic polyneuropathy.

METHODOLOGY

This study is a cross sectional study comprising of 108 patients and was divided into three equal groups. Ethical Clearance was obtained from the Ethical committee of S.D.M. college of Medical Science And Hospital. All the patients whose diabetes type-2 and diabetic polyneuropathy confirmed by Medicine department and Neurophysicians of S.D.M. College of Medical science and hospital, Dharwad, were included as per inclusion and exclusion criteria. Age matched elderly patients without diabetes visiting medicine opd were also included in the study. Patient willing to participate were briefed about the study and their written consent was taken.

Procedure: Patients were divided into 3 groups namely:

Group A- Elderly without diabetes,

Group B- Elderly with diabetes and

Group C- Elderly with diabetic polyneuropathy.

Berg balance scale was administered in the above mentioned three groups. The study was briefly explained to the participants. If one item cannot be assessed in one time then therapist can take three trials of that item and amongst three trials the best one is taken.

Berg balance scale consists of 14 functional tests of which 6 are static balance items and 8 are dynamic balance items. This scale requires minimal equipments: 2 standard chairs (1 with arms and 1 without), stepper/steps, ruler, stopwatch and space. BBS completion needs 10–20

min and its score represents the participant's ability to control postural balance. BBS is a 5 point likert type of scale. Each test was scored by the therapist from 0–4 (0 – inability to complete the task; 4 – independent task fulfillment). The overall score is the sum of the obtained scores for each test. Thus, the maximal overall score is 56, and the minimal is zero. The higher score indicates a better functional balance. Scores of 0 to 20 represent balance impairment (high risk of fall), 21 to 40 represent acceptable balance (medium risk of fall), and 41 to 56 represent good balance (low risk of fall). In the majority items, the subject is asked to sustain a given position for a definite time.

Data analysis: In this study, statistical analysis was done using SPSS (Statistical Package for the Social Sciences) version 20.0. Comparison of gender, diagnosis of fall risk in all three groups according to BBS was done by using chi-square test.

Comparison of three groups with respect to Berg balance scale scores was done by one way ANOVA Pair wise comparison of three groups amongst each other was done by Tukeys multiple post hoc procedures P value < 0.05 was considered as statistically significant.

RESULTS

Table 1: Distribution of samples according to age groups in three groups.

Age groups	Normal	%	Elderly with diabetes	%	Elderly with diabetic polyneuropathy	%	Total	%
60-69yrs	17	47.22	13	36.11	4	11.11	34	31.48
70-79yrs	15	41.67	18	50	18	50	51	47.22
80+yrs	4	11.11	5	13.89	14	38.89	23	21.3
Total	36	100	36	100	36	100	108	100
Mean age	70.39		71.92		75.36		72.56	
SD age	6.99		7.94		7.01		7.55	

Table 2: Distribution of samples according to gender in three groups.

Gender	Normal	%	Elderly with diabetes	%	Elderly with diabetic polyneuropathy	%	Total	%
Male	15	41.67	14	38.89	16	44.44	45	41.67
Female	21	58.33	22	61.11	20	55.56	63	58.33
Total	36	100	36	100	36	100	108	100

Table 3: Distribution of samples according to scores of BBS and three groups.

Scores of BBS	Normal	%	Elderly with diabetes	%	Elderly with diabetic polyneuropathy	%	Total	%
High fall risk	0	0	0	0	20	55.56	20	18.52
Medium fall risk	0	0	1	2.78	16	44.44	17	15.74
Low fall risk	36	100	35	97.22	0	0	71	65.74
Total	36	100	36	100	36	100	108	100
Chi-square=103.8744, p=0.00001*								

Table 4: Comparison of three groups with respect to Berg balance scale scores by one way ANOVA.

*p<0.05

Groups	Mean	SD	SE
Normal	52.11	2.49	0.42
Elderly with diabetes	48.72	3.67	0.61
Elderly with diabetic polyneuropathy	24.47	11.36	1.89
Total	41.77	14.2	1.37
F-value	165.1323		
P-value	0.00001*		
Pair wise comparison of three groups by Tukeys multiple post hoc procedures			
Normal vs Elderly with diabetes	P=0.1072		
Normal vs Elderly with diabetic polyneuropathy	P=0.0001*		
Elderly with diabetes vs Elderly with diabetic polyneuropathy	P=0.0001*		

Table 5: Comparison of three groups with respect to Berg balance scale scores in male samples by Kruskal Wallis ANOVA.

Groups	Mean	SD	SE
Normal	51.87	2.85	0.74
Elderly with diabetes	49.36	3.69	0.99
Elderly with diabetic polyneuropathy	28.25	11.1	2.78
Total	42.69	12.93	1.93
H-value	51.2422		
P-value	0.00001*		
Pair wise comparison of three groups by Tukeys multiple post hoc procedures			
Normal vs Elderly with diabetes	P=0.6146		
Normal vs Elderly with diabetic polyneuropathy	P=0.0001*		
Elderly with diabetes vs Elderly with diabetic polyneuropathy	P=0.0001*		

*p<0.05

Table 6: Comparison of three groups with respect to Berg balance scale scores in male samples by Kruskal Wallis ANOVA.

Groups	Mean	SD	SE
Normal	51.87	2.85	0.74
Elderly with diabetes	49.36	3.69	0.99
Elderly with diabetic polyneuropathy	28.25	11.1	2.78
Total	42.69	12.93	1.93
H-value	51.2422		
P-value	0.00001*		
Pair wise comparison of three groups by			
Normal vs Elderly with diabetes	P=0.6146		
Normal vs Elderly with diabetic polyneuropathy	P=0.0001*		
Elderly with diabetes vs Elderly with diabetic polyneuropathy	P=0.0001*		

*p<0.05

Table 7: Comparison of three groups with respect to Berg balance scale scores in female samples by one way ANOVA.

Groups	Mean	SD	SE
Normal	52.29	2.26	0.49
Elderly with diabetes	48.32	3.68	0.79
Elderly with diabetic polyneuropathy	21.45	10.89	2.43
Total	41.11	15.1	1.9
F-value	130.6384		
P-value	0.00001*		
Pair wise comparison of three groups by Tukeys multiple post hoc			
Normal vs Elderly with diabetes	P=0.1310		
Normal vs Elderly with diabetic polyneuropathy	P=0.0001*		
Elderly with diabetes vs Elderly with diabetic polyneuropathy	P=0.0001*		

*p<0.05

DISCUSSION

The purpose of this study was to compare the functional balance using berg balance scale among elderly without diabetes, elderly with diabetes and elderly with diabetic polyneuropathy. Total 108 patients referred by medicine department and by Neurophysicians of Shri Dharmasthala Manjunatheshwara College of Medical Sciences and Hospital were included in the study. The berg balance scale was administered in all the three groups namely elderly without diabetes, elderly with diabetes and elderly with diabetic polyneuropathy. The duration of data collection was 1 year.

As shown in table 1, in our study participants were of age group ranging from 60-80+ years of age. In the age range between 60-69 years there were 17 (47.22%) participants in normal elderly, 13 (36.11%) in Elderly with diabetes, 4 (11.11%) in Elderly with diabetic polyneuropathy. In the age range between 70-79 years there were 15 (41.67%) participants in normal elderly, 18 (50.00%) in Elderly with diabetes, 18 (50.00%) in Elderly with diabetic polyneuropathy. In 80yrs and above age group there were 4 (11.11%) participants in normal elderly, 5 (13.89%) in elderly with diabetes, 14 (38.89%) in elderly with diabetic polyneuropathy. The prevalence of diabetes mellitus increases with age, mainly it was reported to be prevalent in age group more than 50 years.[10]The factors contributing to diabetes in elderly are 25% of older persons have impaired glucose tolerance (IGT), rises in glucose levels, especially post prandial blood glucose levels that directly correlate with age.

As shown in table 2, out of 108 participants there were 45(41.67%) male and 63(58.33%) female. Group A (normal elderly) consisted of 15 males (41.67%) and 21females (58.33%) female. Group B (Elderly with diabetes) consisted of 14 males (38.89%) and 22 females (61.11%). Group C (Elderly with diabetic polyneuropathy) consisted of 16 males (44.44%) and 20 females (55.56%). Total number of females in our study was greater than males. Nearly half (47%) the women with diabetes have a body mass index greater than 30 kg/m2 compared with 25% of all women and gestational diabetes. Increased waist circumference is also closely associated with an increased risk of diabetes.

The severity and complications of diabetes increases with duration of diabetes. Diabetic polyneuropathy is one of the most common complications of diabetes. The risk of polyneuropathy is increased by about nine times if the subject has poor diabetic control.[4] Also in the present study out of 36 individuals in the group of elderly with diabetic polyneuropathy all the

participants are suffering from diabetes more than 10 years of age.

Table no.4 shows distribution of samples according to scores of BBS namely - high fall risk, medium fall risk and low fall risk. Our results shows that elderly diabetic polyneuropathy have high risk of fall than the other two groups which is consistent with the previous study done by Tabassom Ghanavati et al where they have reported that elderly with diabetic polyneuropathy are at high risk of fall compared to elderly without diabetes [7]. In the BBS score range of 54 to 56, a 1-point change in the berg balance score was associated with a 6 to 8% increase in fall risk. Below the score of 36, fall risk was close to 100 % [6]. The type 2 diabetic group with neuropathy was at greater risk of falls, and confirming the view that major risk factors for falling are, previous falls history, increasing age, presence of diabetes and increased postural sway [11].

As shown in table 5, when all three groups were compared with respect to BBS by using one way Anova, the p-value was found to be significant. The mean score of BBS was more in normal elderly than elderly with diabetes and elderly with diabetic polyneuropathy. Also the mean score of BBS was more in elderly with diabetes than in elderly with diabetic polyneuropathy. This indicated that the berg balance score is much lowered in elderly with diabetic polyneuropathy than other two groups. The contributing factors for high risk of fall in elderly with diabetic polyneuropathy could be because of poor postural control, affection in somatosensory system, lack of appropriate proprioceptive information from lower extremity, use of hip strategy instead of ankle strategy [5]. One of the study done by Mathew S suggested that DM is an independent fall risk factor among elderly nursing home residents. The reasons for falls were hypoglycemia from inappropriate glycemic control; visual impairments contribute to increased risk of falls.

There are numerous studies which explain why there is high risk of falls in elderly with diabetic polyneuropathy. In one of the previous study done by James K. Richardson on “diabetic peripheral neuropathy impairs weight transfer and unipedal balance in the elderly”; they found that Unipedal balance is known to be sensitive to aging effects and exhibits significant decrements already by the fifth decade [9].

This study demonstrated that elderly with diabetic polyneuropathy are at high risk of fall compared to other two groups. Also elderly with diabetes are at risk of falls compared to normal elderly without diabetes and the factors contributing to it could be use of hypoglycemic medication, use of insulin, cognitive defects and poor muscle function.

CONCLUSION

In this study it can be concluded that elderly with diabetic polyneuropathy were at high risk of fall than the other two groups; however elderly with diabetics were also at low risk of fall compared to elderly without diabetes though the result was not significant.

ABBREVEIATIONS

DM – Diabetes Mellitus

DPN- Diabetes Polyneuropathy

PN – Polyneuropathy

BBS- Berg Balance scale

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Conflicts of interest: None

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