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Falls in Older Adults with Type II Diabetes

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Abstract

Aim: There are a number of mechanisms by which diabetes may contribute to falls and diabetic patients have 2 times more falls than non-diabetic fallers. The aim of the study is to study differences between patients who fall with and without type II diabetes.

Methods: Community-dwelling adults of 65 years of age and older were evaluated in a Fall Outpatient Clinic of a University Hospital and a prospective, observational study was run out during two years. Assessment included demographic and clinical data about relevant co-morbidities, medication, functional, cognitive and social evaluation, Mini Nutritional Assessment (MNA) and anthropometric measures, bio-electrical impedance analysis and physical performance by gait speed, Time-Up and Go test and grip strength.

Results: One hundred patients with falls were evaluated, 38% had Type II diabetes (84.2% women, p=0.023) and mean ± SD age was 83.3 ± 5.3. Patients with type II diabetes had more medications (p=0.0001) and there were differences in terms of cognitive and functional evaluation with no differences in nutritional assessment. Frailty syndrome was present in 84.2% of type II diabetic patients and 58.1% of non-diabetic ones (OR: 3.852 (1.407-10.548) p=0.009), and cognitive impairment was a new diagnosis in 44.7% of diabetic patients (OR: 2.776 (1.159-6.649) p=0.022).

Conclusion: The results highlight the value of medication, frailty and cognitive evaluation in type II diabetic patients who fall.

Keywords: Falls; Diabetes; Frailty; Cognitive impairment; Malnutrition

Introduction

Diabetes is one of the most prevalent chronic illnesses in the elderly; more than 25% of the U.S. population aged 65 years has diabetes mellitus and aging of global population and obesity in developed countries are significant drivers of type II diabetes [1]. Diabetes is associated with a variety of geriatric syndromes in older adults; depression, pain, cognitive impairment, falls, and urinary incontinence and these conditions frequently lead to functional impairment and disability [2]. The incidence of falls among diabetic individuals rises to a 39% [3], while in non-diabetic ones is estimated in nearly 30% [4].

The etiology of falls is complex and they are the expression of multiple predisposing and precipitating factors like neurodegenerative disorders, gait and balance problems, polymedication, psychotropic drugs, sensory deficits, and cardiovascular problems [4,5]. Also, frailty syndrome [6] and sarcopenia [7] have been recently reported to be involved in the genesis of falls.

There are a number of mechanisms by which type II diabetes may contribute to falls: cognitive impairment, visual deficit, neuropathic pain or decreased sensorimotor function, feet problems, frailty, sarcopenia or hypoglycemia linked to antidiabetics or insulin among others [8,9]. However, these risk factors are similar to those described for falls in general population [4,5]. In fact, little is known about differences in risk factors for falls between patients with and without diabetes, so the objective of this study is to describe differences in risk factors between older adults with and without type II diabetes.

Research Methodology

Community-dwelling adults of 65 years of age and older were evaluated in a Fall Outpatient Clinic of a University Hospital of Madrid and a prospective, observational study was run out between March 2014 and December 2016.

Study protocol was approved by the Research Committee of the Infanta Sofia University Hospital of San Sebastian de los Reyes (Madrid, Spain) and all participants gave informed consent to participate.

Inclusion criteria consisted in ≥ 65-year-old patients, who had fallen down in the last year with any fall consequences that required medical assistance or had fallen two or more times in the past year. These criteria were based on recommendations of the American and British Geriatric Guideline for Prevention of Falls in Older Persons [10].

Patients with no mobility (patients scored 0 or 1 according to the Functional Ambulatory Classification) [11], severe dementia (GDS 7), severe sensory impairment or any other patients with terminal disease and life expectancy less than three months were excluded.

Assessment

The assessment was done in one single evaluation in the Geriatric Outpatient Clinic, carried out by a geriatrician and a geriatric nurse and it included five steps:

First step: Demographic and clinical data about relevant co-morbidities (hypertension, type II diabetes, dementia, Parkinson

Disease, depression or sensory impairments) and current medication (total number and number of psychotropic drugs)

Second step: Comprehensive geriatric assessment including functional evaluation for basic and instrumental activities (using Barthel Index [12] and Lawton and Brody Index [13], respectively), and screening for cognitive problems using the Standardized Mini-Mental State Examination, MMSE [14].

Third step: Nutritional screening was made by using long version of Mini Nutritional Assessment (MNA) and considering a cut-off point of 24 for nutritional risk [15]. Anthropometric measurements were: body mass index (BMI), being cut-off points 22 and 30 kg/m^2 and mid-upper arm circumference and calf circumference, being cut-off points 21 cm and 31 cm, respectively. Fat Free Mass was assessed with bio-electrical impedance analysis with TANITTA BC-601 and then the Fat Free Mass Index (FFMI) was obtained by dividing FFM, by the square of height (kg/m^2).

Fourth step: Muscle mass strength was measured by hand grip strength using a standard adjustable handle dynamometer KERN & SOHN GmbH Balingen (Model; Elect WOC11007248). Hand grip strength test was performed with the dominant hand following a standard protocol and repeated for three times. Patients were classified according to the best result of three trials. Hand grip strength measurements <21 kg in women and <31 kg in men were considered as cut-off points for dynapenia [16].

Fifth step: Physical performance assessment included Time up and Go Test (TUG) using the best of two trials and being cut-off point 15 seconds [17], and 4 meters walking speed, using the best of three trials and the standard cut-off of ≤ 0.8 m/s for slow gait speed [18].

Additional information was serum 25-hydroxyvitamin D levels that were measured by competitive enzyme immunoassay technique (ADVIA Centaur, Siemens Healthcare Diagnostics). Hemoglobin A1c (HbAc1) was measured with High Performance Liquid Chromatography (HPLC) in type II diabetic adults. The diagnosis of Frailty was made by using Fried criteria [6] and ESPEN consensus statement was used to define malnutrition [19].

Statistical Analysis

Descriptive statistics were calculated for the main variables. Categorical variables were expressed as relative and absolute frequencies and the quantitative variables as medians with interquartile range [IQR] for non-normally distributed data or as a mean ± standard deviation (SD) when data was normally distributed. Differences between groups were compared using Fisher's Exact test for categorical data, Student's T-test for normally distributed data and Mann-Whitney U test for non-normally distributed data. An univariate logistic regression analysis was performed to identify independent variables associated with diabetes. The statistical analysis was performed using SPSS, v. 21.0 (IBM Corp; Armonk, NY; USA), with p<0.05 considered significant for all analyses. Venn diagrams were used to show the distribution of the diagnostics among diabetic and non-diabetic patients [20].

Results

One hundred patients were evaluated during the two-year period and 38% had type II diabetes. Diabetic patients were mainly women (84.2% women, p=0.023) and mean ± SD age was 83.3 ± 5.3. There was a high prevalence of chronic diseases (dementia, Parkinson,

hypertension and depression) and sensory impairments with no significant differences between diabetic and non-diabetic patients.

Table 1 summarizes the results of fall assessment in both groups. Although patients with type II diabetes had more number of prescriptions (p=0.0001), there were no statistical difference in the number of psychopharmacological drugs used between both of them (Table 1). Fall assessment showed differences between the two groups in terms of cognitive evaluation and physical function. On the other hand, results of the nutritional assessment did not differ between groups of study (Table 1). Mean ± SD HbA1c in diabetic group was 6.7 ± 1.6 and HbA1c was below 7% in 47.2%.

In relation to main diagnosis after fall assessment; frailty syndrome was present in 84.2% of diabetic patients and in 58.1% of non-diabetic ones (OR: 3.852 (1.407-10.548) p=0.009), and cognitive impairment was a new diagnosis in 44.7% of diabetic patients and in 22.6% of non-diabetic ones (OR 2.776 (1.159-6.649) p=0.022) (Table 2).

Venn diagram illustrates the overlap between frailty syndrome, malnutrition and cognitive impairment diagnosis after fall assessment in diabetic and non-diabetic patients (Figure 1).
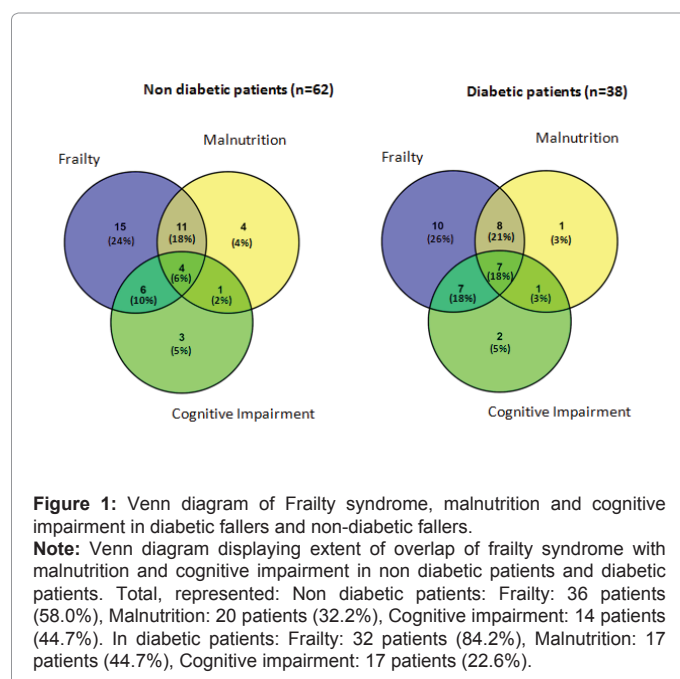
Variables	Diabetes (n=38)	No diabetes (n=62)	p-value*
Medications mean ± SD	10.3 ± 3.3	7.1 ± 3.3	0.000
> 4 Medications per patient, n (%)	38 (100)	54 (87.1)	0.023
Psychotropic medication mean ± SD	1.9 ± 1.5	1.6 ± 1.3	0.371
Barthel Index mean ± SD	82.5 ± 17.3	89.1 ± 13.1	0.037
Lawton Index mean ± SD	1.2 ± 1.9	2.3 ± 2.8	0.133
MMSE, mean ± SD	20.1 ± 4.3	22.7 ± 5.3	0.003
MMSE <24, n (%)	28 (75.7)	24 (45.4)	0.004
MNA ≤ 24, n (%)	29 (80.5)	45 (72.5)	0.376
Body Mass Index mean ± SD	27.7 ± 3.9	27.0 ± 4.6	0.448
Calf circumference<31, n (%)	11 (32.3)	14 (23.7)	0.366
Mid-upper arm circumference<21, n (%)	1 (3.2)	4 (10.5)	0.370
Fat Free Mass Index mean ± SD	16.7 ± 2,3	16.9 ± 2,1	0.669
Vitamin D mean ± SD	23.4 ± 9.9	25.6 ± 15.5	0.934
Time up and go Test>15 sec, n (%)	26 (74.3)	33 (55.9)	0.075
Time up and go Test, mean ± SD	21.2 ± 9.1	17.6 ± 6.8	0.036
Gait speed ≤ 0.8 m/sec, n (%)	30 (78.9)	46 (75.4)	0.685
Gait speed mean ± SD	0.6 ± 2.6	0.7 ± 2.4	0.074
Grip strength mean ± SD	13.2 ± 6.5	15.4 ± 5.8	0.026
Grip Strength<20 kg females <30 kg males	33 (89.1)	57 (95.0)	0.422

*p-value of the Fisher's Exact test (for categorical data) or Student's T-test (for continuous data)

Table 1: Results of fall assessment in elderly diabetic and non-diabetic patients.

Diagnosis: Frailty		n (%)	OR	p-value
Diabetes	No (n=62)	36 (58.1)	3.852 (1.407 - 10.548)	0.009
	Yes (n=38)	32 (84.2)		
Diagnosis: Cognitive Impairment		**n (%)**	**OR**	**p-value**
Diabetes	No (n=62)	14 (22.6)	2.776 (1.159 - 6.649)	0.002
	Yes (n=38)	17 (44.7)		

Table 2: Adjusted odds ratios for frailty syndrome and cognitive impairment in diabetic patients.

Figure 1: Venn diagram of Frailty syndrome, malnutrition and cognitive impairment in diabetic fallers and non-diabetic fallers.
Note: Venn diagram displaying extent of overlap of frailty syndrome with malnutrition and cognitive impairment in non diabetic patients and diabetic patients. Total, represented: Non diabetic patients: Frailty: 36 patients (58.0%), Malnutrition: 20 patients (32.2%), Cognitive impairment: 14 patients (44.7%). In diabetic patients: Frailty: 32 patients (84.2%), Malnutrition: 17 patients (44.7%), Cognitive impairment: 17 patients (22.6%).

Discussion

This study describes differences in a group of fallers with and without type II diabetes and we find higher rates of polymedication, cognitive impairment and frailty syndrome among diabetic fallers. Previous studies in diabetic patients describe incidence of falls in this group and mechanisms by which diabetic individuals have more falls, especially insulin treatment or sulfonylureas, hypoglycemic events or diabetes control [21,22]. Regarding diabetes control, Nelson describes HbA1c <7% as a risk factor [23] and Yau Rebeca et al. found that poor diabetes control with HbA1c >8% was a risk factor for falls and injured falls that required hospitalization [24]. In our study we see that polymedication was more frequent among diabetic people comparing with no diabetic ones, regardless other confounding factors. We also found a high prevalence of diabetic patients under strict control with HbA1c<7%, in line with Nelson results. Nevertheless, other risk factors related to falls like frailty, malnutrition, cognitive impairment, dementia or vitamin D deficit are especially of interest because can be effectively treated to reduce falls, although there is less information about theme in previous studies.

Gait speed and grip strength are part of frailty assessment and they measure functional performance and muscle strength; low performances are related to frailty syndrome and sarcopenia. Volpato describes poor lower-physical performance as a risk factor for falls in elderly women [25]. Pereira found that diabetic patients have worse Time up and go test scores as part of functional performance [26]. Our results show that frailty syndrome was more prevalent among diabetic people and they have more difficulties in functional tests.

Diabetes has previously been suggested to be a model of frailty, and significantly increases the risk of this syndrome [27]. Although frailty syndrome increases the risk of falls and then it is prevalent among fallers, the results of this study describe higher prevalence in the group of diabetics, being consistent with previous results of diabetes and frailty [6].

Our results suggest that cognitive impairment could be a key factor for falls in type II diabetes. This aspect has not been thoroughly examined in previous studies and this finding deserves further study. It has been described that memory impairment, reduced attention or executive dysfunction result in variability in gait speed or gait and balance dysfunction and this is the reason why some screening tests for dementia incorporate complex activities as walking while doing another task [28-30]. Diabetes is a risk factor for cognitive impairment or dementia like Alzheimer disease, vascular dementia or delirium [31] and these disorders increase the risk for falls [32,33], nevertheless it hasn´t been explored the relation between cognitive dysfunction and falls in diabetes.

Conclusion

We found that type II diabetic individuals who fall have higher rates of polymedication, cognitive impairment and frailty syndrome than non-diabetic fallers. This study's findings should be interpreted in the context of its limitations; it has been made in a small sample from a single center as it is part of a longer follow up study, we have only included fallers and it could be interesting to see differences between patients with a single fall and those with multiple events. But in the other hand we give a deep and comprehensive falls assessment that allows us to improve in the future. The results highlight the value of medication, frailty and cognitive evaluation in fall assessment of type II diabetic patients as critical risk factors in this group.

Conflict of Interest

The authors declare that they have no conflicts of interest concerning this article.

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