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Original Article

Orthostatic Hypotension among Vietnamese Older Adults with Type 2 Diabetes And Its Predictors

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Abstract

Objective: Orthostatic hypertension (OH) is one of the most common symptoms of autonomic nervous system disorder in patients with type 2 diabetes. This study aimed to determine the percentage of OH among Vietnamese older adults with type 2 diabetes and its influencing factors.

Methods: A cross-sectional descriptive study was conducted using convenience sampling to recruit 96 older adults with type 2 diabetes who received care at a large hospital in central Vietnam between November 2020 and June 2021. Data were collected using a demographic and health-related questionnaire and Omron electronic sphygmomanometers for blood pressure (BP) measurement. OH was diagnosed according to the 1996 diagnosis criteria of the American Autonomic Society and the American Academy of Neurology. Descriptive statistics, independent *t*-test, chi-square, and univariable and multivariable logistic regression were used for analysis, with p-value ≤ 0.05 considered significant.

Results: The relative frequency of orthostatic hypotension (OH) among older adults with type 2 diabetes was 46.9%. Multivariable logistic regression identified gender, HbA1C level, and duration of diabetes as significant predictors of OH. Specifically, females had 5.44-fold higher odds of developing OH compared to males (OR = 5.44; 95% CI: 1.94–15.25; $P = 0.001$). Each one-unit increase in HbA1C was associated with a 1.33-fold increase in the odds of OH (OR = 1.33; 95% CI: 1.002–1.77; $P = 0.049$). Additionally, longer diabetes duration was linked to higher odds of OH, with an 8.3% increase in odds for each additional year of diabetes (OR = 1.08; 95% CI: 1.01–1.16; $P = 0.018$). Although stroke history and kidney failure showed elevated odds ratios, their associations with OH were not statistically significant ($P > 0.05$).

Conclusion: Orthostatic hypotension (OH) is highly prevalent among older adults with type 2 diabetes, particularly in females with prolonged disease duration and poor glycemic control (high HbA1C). Clinically, these findings highlight the need for healthcare providers to prioritize routine screening and tailored management strategies for this high-risk group, aiming to prevent complications such as falls, cardiovascular events, and decreased quality of life.

Keywords: Aged, Hemoglobin A, Glycosylated, Hypotension, Orthostatic, Diabetes mellitus, Type 2, Disease duration

Introduction

Orthostatic hypotension (OH) is associated with increased mortality from unexpected sudden death due to falls, syncope, and cardiovascular disease (1). It is one of the common clinical manifestations of diabetes. However, it mostly occurs without symptoms or with non-specific symptoms such as headache, dizziness in the standing position, fainting, vomiting, and nausea, so it is easy to overlook or confuse with other conditions (1). According to the consensus of the American Autonomic Society Committee and the American Academy of Neurology (2), it is defined as a postural drop in systolic blood pressure (SBP) of at least 20 mm Hg and/or diastolic blood pressure (DBP) of at least 10 mm Hg from the supine position to the standing position within 3 minutes of standing. With diabetic patients, OH significantly affects quality of life and has been linked to increased cardiovascular complications and overall mortality (3). Furthermore, the presence of OH is associated with a 30% to 100% higher risk of death related to parasympathetic neuropathy (4).

The prevalence of OH among older adults with type 2 diabetes has been reported to range from approximately 6% to 32%, depending on the study population and diagnostic criteria applied (5). Based on the analysis of 21 studies involving 13,772 participants, the pooled prevalence of orthostatic hypotension among individuals with diabetes was 24% (95% CI: 19–28%) (6). This finding highlights that OH is a relatively common complication in diabetic populations and warrants greater clinical attention. This wide variation reflects differences in study design, measurement protocols, and population characteristics.

Previous studies have identified multiple factors associated with OH in diabetic patients, including advanced age, female gender, the presence of comorbidities (such as cardiovascular disease or autonomic neuropathy), the use of antihypertensive medications, poor glycemic control (elevated HbA1c), and longer duration of diabetes (6). An observational cross-sectional study, conducted as part of the Brazilian Diabetes Study, showed that OH among diabetic patients was not associated with age (7). A retrospective cross-sectional study conducted at a single center involving 200 patients with diabetic sensorimotor polyneuropathy found a significant association between orthostatic hypotension and the duration of diabetes (8). Despite these findings, the results across studies remain inconsistent, and no definitive set of predictors has been universally established.

Moreover, based on our literature review, although there is a growing body of research focusing on diabetes and its complications among the older adult population in Vietnam, studies specifically examining the prevalence and determinants of orthostatic hypotension in this group are virtually nonexistent. To the best of our knowledge, the present study is among the first to explore both the prevalence and associated factors of OH among older Vietnamese adults living with type 2 diabetes. This research may provide important baseline data for clinicians and health policymakers in designing appropriate screening and intervention strategies for this underrecognized yet clinically significant condition.

Methods

This was a descriptive, cross-sectional study conducted among older adults with diabetes at Danang C Hospital, a tertiary hospital in central Vietnam. Participants were conveniently recruited from all patients receiving treatment at the hospital's Endocrinology Department between November 2020 and June 2021. Only those who met the inclusion criteria and provided informed consent were enrolled in the study. The sample size was calculated using G*Power version 3.1.9.4 (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany; http://www.gpower.hhu.de/). A one-tailed logistic regression analysis was used with an α error probability of 0.05 and a statistical power of 0.80. Based on prior assumptions, the expected probabilities of orthostatic hypotension (OH) in the comparison groups were 0.45 and 0.30, respectively. Under these parameters, the minimum required sample size was estimated to be 81 participants. However, in order to enhance the generalizability of the findings, the researchers increased the sample size by about 20%. The final sample size was 96. The inclusion criteria were individuals sixty years old or older, diagnosed with type 2 diabetes for more than twelve months, no cognitive impairment (MMSE Vietnamese version ≥ 23 (9)), health status adequate for participating for the duration of the study, and fluency in communication in Vietnamese. This study was approved by the Medical Ethics Councils of Da Nang University of Medical Technology and Pharmacy (01/QD-HDDD) and Da Nang C Hospital. The participants were clearly informed about the study before signing the informed consent form for their participation.

Blood pressure (BP) was measured according to the Vietnam National Heart Association recommendations. Participants rested in the supine position for at least 15 minutes, after which BP was measured using calibrated automatic electronic sphygmomanometers (model HEM 7130, OMRON Corp, Kyoto, Japan). An appropriately sized cuff was selected based on upper arm circumference, ensuring the bladder encircled at least 80% of the arm. The cuff was placed on the right arm, which was positioned at heart level and supported on a flat surface during the measurement. Standing BP was measured after 3 minutes of standing upright, following the same protocol.

Demographic characteristics were collected through a structured interview questionnaire developed by the research team. The questionnaire covered variables such as age, gender, education level, occupation, and marital status. It was reviewed for content validity by five experts, including endocrinologists and nurses holding doctoral or master's degrees. Clinical information – including BMI, medication use, comorbidities, history of diabetes, and glycated hemoglobin A (HbA1c) – was obtained from patients' medical records.

Data were analyzed using the Statistical Package for the Social Sciences version 22.0 (SPSS Inc., Chicago, Illinois, US), with an α level of 0.05. Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to describe the participants' characteristics. *t*-test and chi-square were used to compare variables, and Fisher's exact tests were applied when the percentage of cells was less than 5%. Univariate logistic regression was conducted to identify factors associated with orthostatic hypotension (OH). Variables with a p-values < 0.05 in the univariate analysis were included in the multivariate logistic regression model. A stepwise backward elimination method was used to select the final model. The Hosmer-Lemeshow goodness-of-fit test was applied to assess model fit, and multicollinearity was checked using the variance inflation factor (VIF). Odds ratios (OR) and 95% confidence intervals (95% CI) were reported for each predictor.

Results

The mean age of the participants was 71.5 (SD = 7.52). The BMI of the sample was between 18.7 and 31.4, with an average of 23.9 (SD = 2.64). About three-fifths (60.4%) of the participants were male. Nearly half (46.9%) of the sample had graduated from high school. The majority of the sample (96.9%) were in retirement, and a solid majority of them (71.9%) were married. (Table 1)

Table 2 shows the data about OH among older adults with type 2 diabetes. Nearly half (46.9%) of participants had OH.

Univariable regression results showed that gender, age, diabetic duration, HbA1C, and stroke history were related to OH among older adults with type 2 diabetes (*P* value < 0.05). (Table 3)

Table 4 revealed that older female adults (OR = 5.44; 95% CI: 1.941–15.249), had a higher HbA1C (OR = 1.33; 95% CI: 1.002–1.765), and had a longer diabetic duration (OR = 1.083; 95% CI: 1.014–1.158) had a higher risk of OH.

Discussion

The results of this study showed that the prevalence of orthostatic hypotension among Vietnamese older adults with type 2 diabetes was relatively high, at 46.9%. Several rationales could explain this. The participants in this study had a high average age (M = 71.5; SD = 7.52) and a long duration of diabetes. Furthermore, in our study, 82.3% of the patients used one or more antihypertensive medications, which is one of the possible causes of postural hypotension (10).

This result is lower than that of the study on OH among Brazilian older adults with diabetes, which was 69.8%. The rationale for this difference could be the difference between the characteristics of participants. In the study of Bezerra, the average age of older adults was 73.2 (SD = 6.3), higher than that of our participants. In addition, the subjects in their study had an average duration of diabetes of over 10 years, leading to greater complications of diabetes. The study also showed that the presence of some chronic complications of diabetes, such as peripheral neuropathy, amputation, and arterial disease of the lower extremities, in Brazilian patients was more common than in our study (11).

However, the result of our study is higher than that of Zhou et al with an OH rate of 24.0%. This difference is explained by the fact that Zhou's study used a systematic review research method; the subjects in the study did not have high agreement on anthropometric characteristics, as well as measurement methods, which were not consistent with the AAN criteria (6). For example, Bouhanick et al defined OH as a decrease in SBP of at least 20 mmHg and a decrease in DBP of at least 10 mmHg at any measurement while standing (12), and several other studies, such as that of Wijkman et al reported blood pressure as measured

Table 1. Characteristics of participants

Characteristic	N	%
Age		
Mean = 71.5; SD = 7.52; Min = 60; Max = 89		
BMI		
Mean = 23.91; SD = 2.64; Min = 18.7; Max = 31.4		
Gender		
Male	58	60.4
Female	38	39.6
Education level		
Primary school	3	3.1
Secondary school	20	20.8
High school	28	29.2
Higher than high school	45	46.9
Working status		
Retirement	93	96.9
Working	3	3.1
Marital status		
Married	69	71.9
Widowed/Single	27	28.1

SD: standard deviation.

Table 2. Relative frequency of OH among older adults with type 2 diabetes

Blood pressure		Mean	SD
Supine BP	Systolic BP	133.6	10.8
	Diastolic BP	73.1	7
Standing BP after 3 minutes	Systolic BP	124.5	15.3
	Diastolic BP	72.2	7.7
Orthostatic hypotension	*n* = 45	Percentage: 46.9%	

SD: standard deviation.

Table 3. Prevalence of OH from characteristics of participants

Factors		Orthostatic hypotension		*P*-value
		Yes	No	
Gender				
Male		19	39	<0.01
Female		26	12	
Age (Mean, SD)		72.98 (7.54)	70.20 (7.32)	0.07
BMI (Mean, SD)		24.16 (2.71)	23.69 (2.59)	0.39
Diabetic duration				
<5 years		6	11	
5–10 years		8	23	<0.01
>10 years		31	23	
HbA1C (Mean, SD)		9.23 (1.96)	8.15(1.61)	<0.01
Comorbidity				
Stroke	Yes	6	1	0.03
	No	39	50	
Hypertension	Yes	38	41	0.60
	No	7	10	
Coronary artery disease	Yes	15	15	0.68
	No	30	36	
Kidney failure	Yes	6	1	0.03
	No	39	50	
Lipid disorder	Yes	13	12	0.55
	No	32	39	

BMI: body mass index; SD: standard deviation.

Table 4. Multiple regression analyses for predicting OH among older people with type 2 diabetes

Predicting factors	B	SE	Wald	*P*-value	OR	95% CI	
						Lower	Upper
Gender	1.694	0.526	10.375	0.001	5.44	1.941	15.249
HbA1C	0.285	0.145	3.885	0.049	1.33	1.002	1.765
Diabetic duration	0.08	0.034	5.573	0.018	1.083	1.014	1.158
Stroke history	2.103	1.222	2.962	0.085	8.187	0.747	89.748
Kidney failure	2.107	1.172	3.234	0.072	8.224	0.827	81.744

CI: confidence interval; OR: odds ratio.

while sitting instead of standing (13).

In the current study, multivariable logistic regression was used to identify the predictors of OH among older adults with type 2 diabetes. The findings showed that gender, HbA1C, and diabetic duration were significantly predictive of OH among older adults with type 2 diabetes.

Notably, the result in this study showed that female older adults were likely at high risk of OH (OR = 5.44, 95% CI: 1.941–15.249). There are various possible explanations for this. First, older women often have higher central pulse pressure and have stiffer large arteries than men of the same age (14). Furthermore, increased carotid aorta stiffness and less baroreflex sensitivity of women compared to men can reduce blood pressure cushioning during postural changes (14,15). In addition, women's center of gravity is lower, their estrogen levels are higher, and their parasympathetic nervous system is more active. Consequently, women have a reduced ability to adapt to changes in positional shifts in blood pressure (16).

The research results showed that the duration of diabetes was a significant predictor of OH. This study recorded the highest rate of OH in the group of participants with diabetes duration > 10 years and the lowest in the group of subjects with diabetes duration of 5–10 years. This result was similar to the studies of Rios (8) and Bavaria et al in 2022 (17). Previous studies have demonstrated that the duration of diabetes is related to prolonged hyperglycemia and disease complications such as diabetic neuropathy (18). This can explain why patients with a long period of diabetes often have OH.

The results of this study indicated that HbA1C was a predictor of OH among older adults with diabetes. This was consistent with previous studies of Gaspar et al (19) and Bavaria et al (17). HbA1c values can indicate the overall state of blood sugar over the past two to three months. High levels of HbA1c indicate poor glycaemic management, which can impair vascular elasticity and lower extravascular volume as a result of osmotic diuresis, ultimately leading to OH (20). Furthermore, by lowering the myo-inositol concentration, poor glycemic management can result in impaired vasodilatation and decreased blood flow in nerve fibers. Nephropathy-induced volume depletion, endothelial dysfunction, decreased neuropeptide responses, and osmotic diuresis – all of which can result in OH – are produced by autonomic denervation (21,22).

There are some limitations to the current study. First, data were collected at only one hospital in central Vietnam; thus, the sample might not be representative of the entire older adults with diabetes in the whole country. Second, the head-up tilt test was not used to evaluate OH. Nonetheless, we employed the most well-recognized diagnostic approach of OH as well as the approach most frequently utilized in clinical practice.

Conclusion

OH is one of the most common health concerns among older adults with type 2 diabetes and has some negative impacts. The results of this study shed light on OH among older Vietnamese diabetes patients, providing valuable information for clinical nurses and other healthcare providers. First off, the prevalence of OH among older people with type 2 diabetes is relatively high. This is crucial information for healthcare professionals to know since they should be able to identify and prevent OH in older adults early on. Secondly, this study also discovered some predictors of OH, such as gender, HbA1C, and diabetic duration. In daily care, nurses should use these factors to better detect older adults who are at risk of OH. Moreover, in order to prevent OH, healthcare staff should try to control the level of HbA1C among diabetic patients. Lastly, the findings of this study broaden our understanding of OH and its clinical manifestations among diabetic patients and should facilitate the process of identifying and improving the existing information regarding the most effective interventions. Given the seriousness of OH, it is hard to argue against its prevention and reduction in older adults with type 2 diabetes. Future research should focus on longitudinal studies to clarify causal relationships between risk factors and orthostatic hypotension in older adults with diabetes. Additionally, exploring other potential predictors such as autonomic neuropathy, medication use, and lifestyle factors will deepen our understanding of the subject. Evaluating targeted interventions, including optimized glycemic control and physical activity programs, across diverse populations will further support effective prevention and management strategies.

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Authors' Contribution
Conceptualization: Nguyen Thi Thanh Tuyen and Tran Thi Hoang Oanh.
Data curation: Nguyen Thi Thanh Tuyen.
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Software: Nguyen Thi Thanh Tuyen.
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Visualization: Tran Thi Hoang Oanh and Luu Thi Thuy.
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Competing Interests
None.

Ethical Approval
This study obtained Ethical approval from the Medical Ethics Council of Da Nang University of Medical Technology and Pharmacy (01/QĐ-HĐĐĐ). Informed consent was obtained from all the participants before data collection. The questionnaires were anonymously filled out and kept confidential.

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