



## Risk Factors for Peripheral Vertigo

Yuni Retno Sekarwangi<sup>1</sup>, Dwi Marliyawati<sup>2</sup>, Kanti Yunika<sup>2</sup>, Zulfikar Naftali<sup>2</sup>

<sup>1</sup>Faculty of Medicine, Diponegoro University Semarang, Indonesia

<sup>2</sup>Departement Otorhinolaryngology, Faculty of Medicine, Diponegoro University Semarang, Indonesia

### Abstract

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**Author Affiliation:**

Department of Otorhinolaryngology,  
Faculty of Medicine, Diponegoro University  
Semarang, Indonesia

**Author Correspondence:**

Dwi Marliyawati  
Dr. Sutomo Street No. 16, Semarang,  
Central Java 50244, Indonesia

**E-mail:**

[dwimarliyawati@yahoo.com](mailto:dwimarliyawati@yahoo.com)

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**Background :** Several risk factors influence the occurrence of peripheral vertigo, including advanced age, gender, and chronic metabolic diseases. This disease is not widely recorded in primary care due to the need for detection with simple examinations. Research on the association of several risk factors has yet to be reported. The objectives of this study was to examine the relationship between age, gender, type 2 diabetes mellitus (DM2), and hypertension as risk factors for peripheral vertigo.

**Methods :** This study is a case-control study that used consecutive sampling. The study sample consisted of 39 people: 19 in the case group and 20 in the control group. Data were obtained from 2 health centers and Diponegoro National Hospital, Semarang City. The data were obtained from history taking and physical examinations such as the Gans Sensory Organization Performance Test (SOP), past pointing test, and dysdiadokokinesia test. DM2 disease and hypertension were gathered from medical records. Data analysis used univariate analysis, bivariate analysis with chi-square, and logistic regression multivariate analysis.

**Results :** Statistical test results concluded that hypertension is a risk factor for peripheral vertigo ( $p = 0.008$ ; OR = 6.964; 95%CI = 1.657 – 29.263). Whereas age, gender, and DM2 were not risk factors, with p-values of 0.187, 0.378, and 0.417, respectively.

**Conclusion :** The significant risk factor associated with the occurrence of peripheral vertigo was hypertension by 6.964 times.

**Keywords :** Peripheral vertigo, risk factors, hypertension

## INTRODUCTION

Vertigo is a symptom of dizziness with a spinning head as if there is a rotating motion of the patient towards the surroundings or the surrounding environment that rotates towards the patient.<sup>1</sup> Peripheral vertigo can occur due to disorders in the inner ear organs, including the vestibular nerve. The inner ear organs involved in the balance system can be the semicircular canal, utriculus, or saculus.<sup>2</sup>

Symptoms of vertigo significantly affect comfort, quality of life in the organ system, emotional stability, and social environment at work.<sup>3</sup> Patients with mild vertigo sometimes do not immediately seek health treatment. However, severe symptoms cause patients not to dare to move, causing patients to immediately seek treatment either at the hospital or the health center. This condition is an emergency because the risk of falling is more significant, especially in the elderly. Although it is only a symptom, the causative factors or risk factors need to be sought to optimize management to prevent recurrence.<sup>4</sup>

Symptoms of vertigo need to be sought in detail from the history to determine the type of vertigo involving the inner ear, which is then clarified by the results of physical examination both in general and localized to the ear. This is to rule out the possibility of differential diagnosis of central vertigo.<sup>5</sup> Evaluation of vestibular system function can be done with some simple balance physical examination in primary health facilities without special equipment.<sup>2</sup> The Gans Sensory Organization Performance Test (SOP) is a simple physical examination to assess the function of the body's balance system. It is a simple examination which is readily available, is safe for patients and can be done at primary health care.<sup>6</sup>

The incidence of peripheral vertigo is estimated from 3% to 10% of the population.<sup>7</sup> Research on the prevalence of vertigo in Indonesia has yet to be recorded accurately. This number may increase with age and is influenced by gender. Chronic metabolic diseases such as type 2 diabetes mellitus (DM2) and hypertension are suspected to affect the occurrence of peripheral vertigo.<sup>8</sup> The prevalence of vertigo among elderly ranges from 33–35%.<sup>3</sup> The elderly with hypertension experience more peripheral vertigo than those without hypertension (23.8%; 16%).<sup>1</sup> The incidence of BPPV with DM2 disease is more significant than BPPV alone.<sup>8</sup>

Age and female have been reported as risk factors for vertigo or dizziness.<sup>9</sup> Systemic metabolic disorders such as DM and hypertension are risk factors for the vestibular system.<sup>8,10</sup> Patients with thick blood and heart disease may experience dizziness triggered by head movement. This condition involves blood circulation disorders due to decreased oxygen concentration, which affects tissue perfusion, mainly in peripheral areas with tiny blood vessels, such as the ear's vestibular organs.<sup>3</sup>

## RESEARCH METHODS

This study is an observational analytic with a case-control design conducted from November 2021 to April 2022. The selection of research subjects was carried out using a

consecutive sampling method. The inclusion criteria of the case group were patients with peripheral vertigo aged  $\geq 26$  years and willing to participate.

Subjects were selected from patients of Ngesrep Health Center, Kagok Health Center, and Diponegoro National Hospital in Semarang City. Subjects were explained the study's purpose, objectives, benefits, and procedures and then filled out informed consent. Diagnosis of peripheral vertigo was done by taking anamnesis related to vertigo symptoms (description, duration, onset, and precipitating factors). Patients were examined using the Gans Sensory Organization Performance Test (SOP), as well as dysmetria and dysdiadokinesia examinations. The tools used were the respondent form and foam for the Gans Sensory Organization Performance Test.

The risk factor data of this study were age, gender, DM2, and hypertension. These variables were nominal scale. Age was categorized into  $\geq 50$  years and  $< 50$  years. Diagnoses of DM2 and hypertension were from medical records.

The collected data were analyzed using univariate, bivariate, and multivariate analyses using SPSS version 26 IBM statistical software. Bivariate analysis was performed using the Chi-Square test or Fisher's test to determine the relative risk by calculating the odds ratio. Multivariate analysis was performed with logistic regression using the backward stepwise method.

This study has obtained ethical permission from the Health Research Ethics Commission of the Faculty of Medicine, Diponegoro University Semarang.

## RESEARCH RESULTS

This study involved 39 subjects: 19 in the case group and 20 in the control group. The youngest of the study subjects was 40 in the control group, and the oldest was 83 in the case group. Subjects with DM2 and hypertension who experienced peripheral vertigo accounted for 62.5%. [Table 1](#) shows the characteristics of the study subjects.

In [Table 2](#), it was found that hypertension caused peripheral vertigo significantly and by 6.964 times ( $p = 0.015$ ; OR = 6.964; 95% CI = 1.657 - 29.263). Age was not a risk factor for peripheral vertigo ( $p = 0.187$ ). The female gender in the case group was more than male, with a percentage of 84.2% and 15.8% ( $p = 0.378$ ). In this study, DM2 was also not a risk factor for peripheral vertigo ( $p = 0.417$ ).

The results of multivariate logistic regression showed that hypertension was the most significant risk factor for peripheral vertigo ( $p = 0.008$ ). They caused peripheral vertigo by 6.964 times ([Table 3](#)).

## DISCUSSION

Statistical results prove that hypertension was a significant risk factor for peripheral vertigo. Subjects with hypertension had 6.964 times the risk of peripheral vertigo. The results of this study were in line with previous studies which stated that hypertension was a risk factor for peripheral vertigo. The frequency of vertigo in the elderly with hypertension was higher than in healthy elderly, 23.8% and 16%,

**TABLE 1**  
**Characteristics of Research Subjects**

Group		Case n (%)	Control n (%)	Total n (%)
Total	Male	19 (48.7)	20 (51.3)	39 (100)
Age	≥50 Years	18 (52.9)	16 (47.1)	34 (100)
	<50 Years	1 (20)	4 (80)	5 (100)
Gender	Female	16 (51.6)	15 (48.4)	31 (100)
	Male	3 (37.5)	5 (62.5)	8 (100)
DM2	DM2	7 (63.6)	4 (36.4)	11 (100)
	Not DM2	12 (42.9)	16 (57.1)	28 (100)
Hypertension	Hypertension	15 (68.2)	7 (31.8)	22 (100)
	Not Hypertension	4 (23.5)	13 (76.5)	17 (100)
DM2 and Hypertension		5 (62.5)	3 (37.5)	8 (100)

**TABLE 2**  
**Results of bivariate analysis**

Category		Case n (%), n=19	Control n (%), n=20	p-value	OR	95% CI	
						Lower	Upper
Age	≥50 years	18 (94.7)	16 (80)	0.187 <sup>a</sup>	4.5	0.455	44.546
	<50 years	1 (5.3)	4 (20)				
Gender	Female	16 (84.2)	15 (75)	0.378 <sup>a</sup>	1.778	0.361	8.764
	Male	3 (15.8)	5 (25)				
DM2	Yes	7 (36.8)	4 (20)	0.417 <sup>b</sup>	2.333	0.554	9.834
	No	12 (63.2)	16 (80)				
Hypertension	Yes	15 (78.9)	7 (35)	0.015 <sup>b*</sup>	6.964	1.657	29.263
	No	4 (21.1)	13 (65)				

Note: \*significant if *p-value* <0.05, <sup>a</sup> Fisher's exact test, <sup>b</sup> Chi-Square test

respectively.<sup>1</sup> Hypertensive patients had a risk of 1.51 times the recurrence of peripheral vertigo compared to people without hypertension.<sup>11</sup>

Hypertension as a chronic vascular disease can increase the incidence of atherosclerosis and thicken blood vessel walls, which leads to decreased oxygen and nutrient perfusion in the vestibular system both centrally and peripherally.<sup>1,12</sup> Decreased tissue perfusion will trigger impaired function of hair cell receptors in the peripheral vestibular system. Previous studies have shown that there was a significant difference in the prevalence of vestibular system function disorders in patients with hypertension.<sup>13</sup> Hypertension also increases the risk of otoconia fragment release in the endolymph fluid, which can cause BPPV.<sup>13,14</sup> The most common peripheral vertigo disease from all cases

was BPPV, so hypertension can be a risk factor for peripheral vertigo.<sup>3</sup>

The results of the analysis in this study concluded that age was not a risk factor for peripheral vertigo. Previous studies on peripheral vertigo patients were more about age more than 50 years (*p* ≤0.005) and estimated to have a risk of 1.8 times compared to respondents with younger age.<sup>7</sup> The age distribution in both groups was not balanced, so it was a weakness in this study because of the limited research time to find patients with peripheral vertigo. However, in this study, peripheral vertigo was more common in the elderly.

Comorbid diseases in the elderly can be a risk factor for peripheral vertigo, although, in some studies, it was still not proven. A study showed that people with DM2 with hypertension would be at risk of BPPV compared to people

TABLE 3  
Logistic regression test results

Variable	<i>p</i> -value	Exp(B)	95% CI		
			Lower	Upper	
Step 1	Age Category	0.482	2.439	0.455	44.546
	Hypertension	0.015	6.134		
Step 2	Hypertension	0.008*	6.964	0.361	8.764

Notes: \*significant if *p*-value <0.05

with DM2 without hypertension.<sup>8</sup> This was also supported by previous research with the results of all respondents who experienced recurrent BPPV. As many as 123 (22.3%) respondents had one comorbid disease, which increased to 255 (46.3%) respondents with more than one comorbid disease.<sup>14</sup> Physical activity and mobilization of respondents were allegedly able to affect balance ability, but the study was not analyzed. Physical activity was said to prevent BPPV in the elderly.<sup>15</sup> A decrease in physical activity and mobilization in the elderly will increase the risk of recurrent BPPV.<sup>16</sup>

Gender can be a risk factor for peripheral vertigo. Previous studies have shown that women were more at risk of peripheral vertigo than men, with a difference in the proportion of respondents, 768(71.3%) women and 309 (28.7%) men, and increased the risk by 4.4 times in women.<sup>7</sup> However, in this study, gender was not a statistical risk factor. Menopausal factors may influence the results of this analysis. Women who have menopause will experience a decrease in estradiol hormone, which plays a role in preventing microcirculation damage to the KSS and maintenance of otoconia. Damage to microcirculation in the KSS and decreased expression of proterin in otoconia can cause otoconia dislocation, which triggers BPPV. A study showed that BPPV patients had lower estradiol levels than non-BPPV patients ( $p < 0.001$ ).<sup>17</sup> Another study reported that although the proportion of women experiencing BPPV was higher than men, 62.7% to 37.3% of 1092 respondents, only 48.8% of women experienced BPPV recurrence, while 53.3% of men experienced a recurrence of all cases.<sup>14</sup>

DM2 was significantly associated with the incidence of BPPV.<sup>8</sup> Different results reported in a systematic review and meta-analysis journal suggested by twelve journals and 10,869 respondents showed DM disease did not cause the incidence of BPPV ( $p=0.71$ ).<sup>18</sup> But in this study, it was not proven significantly to be a risk factor for peripheral vertigo ( $p=0.4178$ ).

The duration of DM2 may affect the results of the analysis. The duration of DM affects the progression of microvascular complications, including vestibular system dysfunction. The results of multivariate analysis from previous studies showed that the duration of DM of more than ten years was a risk factor for several microvascular complications, with more than 50% experiencing microvascular complications after 12–14 years since first

diagnosed.<sup>19</sup>

The limitation of this study was that other factors were not examined in detail, such as other comorbid diseases experienced by respondents, physical activity levels, menopausal status, duration of DM, and objective measurement of risk factors. This study did not use a matching method to reduce research bias. This study only detected peripheral vertigo and has not been categorized.

## CONCLUSION

Hypertension was a risk factor for peripheral vertigo by 6.964 times. However, advanced age, female gender, and DM2 in this study were not proven to be risk factors for peripheral vertigo.

The researcher suggested further research that recorded risk factors for peripheral vertigo, such as other comorbid diseases, physical activity level, menopausal status, duration of diabetes, and objective measurement of risk factors. Further research with the same independent variables, a larger sample size, and matching in the respondent group was needed to reduce research bias. It is also necessary to conduct similar research on more specific types of peripheral vertigo.

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