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VASOMOTOR SYMPTOMS AS AN EARLY MARKER OF CARDIOMETABOLIC RISK IN MENOPAUSAL WOMEN

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Abstract

Vasomotor symptoms (VMS), including hot flashes and night sweats, are the most common manifestations of menopausal syndrome. Recent evidence suggests that VMS may be associated with an increased risk of cardiometabolic disorders. The aim of this study was to evaluate the clinical significance of vasomotor symptoms in the early detection of cardiometabolic risk in perimenopausal and postmenopausal women. A cross-sectional study was conducted involving 120 women aged 45–60 years. Participants were divided into groups based on the presence and severity of VMS. Cardiometabolic parameters, including body mass index (BMI), blood pressure, lipid profile, and fasting glucose levels, were assessed. The results showed a significant association between moderate-to-severe VMS and elevated cardiometabolic risk factors. Women with pronounced VMS had higher BMI, increased systolic blood pressure, and adverse lipid profiles. These findings suggest that VMS may serve as an early clinical marker of cardiometabolic risk, highlighting the importance of timely screening and preventive strategies.

Keywords

Menopause; vasomotor symptoms; hot flashes; cardiometabolic risk; hypertension; dyslipidemia.

Introduction. Menopause is a natural biological process characterized by the cessation of ovarian function and a progressive decline in estrogen levels, leading to a variety of physiological and metabolic changes in women's bodies [4,10]. This transitional period is often accompanied by a wide range of clinical manifestations, among which vasomotor symptoms (VMS), including hot flashes and night sweats, are the most common and distressing [2,5]. It is estimated that up to 70% of women experience VMS during the menopausal transition, with varying intensity and duration [5,6].

Traditionally, vasomotor symptoms have been considered primarily as a consequence of thermoregulatory dysfunction associated with estrogen deficiency.

However, recent studies suggest that VMS may reflect more complex pathophysiological mechanisms, including autonomic nervous system dysregulation, endothelial dysfunction, and inflammatory processes [3,7]. These mechanisms are closely linked to the development of cardiovascular and metabolic disorders.

Cardiovascular diseases remain the leading cause of morbidity and mortality among postmenopausal women worldwide [4]. The menopausal transition is associated with an unfavorable shift in cardiometabolic risk factors, including increased body mass index, insulin resistance, dyslipidemia, and elevated blood pressure [10,12]. Emerging evidence indicates that women experiencing early or severe vasomotor symptoms may have a higher risk of developing cardiovascular disease compared to those without such symptoms [8,9].

Several large-scale epidemiological studies have demonstrated a significant association between vasomotor symptoms and subclinical markers of cardiovascular disease, such as increased carotid intima-media thickness and impaired endothelial function [7,9]. Furthermore, longitudinal data suggest that the presence and severity of VMS may serve as an early clinical indicator of adverse cardiometabolic changes [3,11].

Despite growing evidence, the clinical significance of vasomotor symptoms as a potential early marker of cardiometabolic risk remains insufficiently explored, particularly in clinical practice settings. Early identification of high-risk individuals during the menopausal transition is crucial for timely preventive interventions and reduction of long-term cardiovascular complications.

Therefore, the aim of this study was to evaluate the clinical significance of vasomotor symptoms of menopausal syndrome in the early diagnosis of cardiometabolic risk in women.

Materials and methods. A cross-sectional observational study was conducted. The study included 120 women aged 45–60 years attending a gynecology clinic. Inclusion criteria were: Perimenopausal or postmenopausal status and Absence of severe chronic diseases. Exclusion criteria: Hormone replacement therapy, Known cardiovascular disease and Endocrine disorders (e.g., diabetes mellitus type 1). Participants were divided into three groups: 1) No VMS; 2) Mild VMS; 3) Moderate-to-severe VMS.

The following parameters were assessed: Body mass index (BMI), Blood pressure (BP), Fasting blood glucose, Lipid profile (total cholesterol, LDL, HDL, triglycerides).

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Statistical analysis was performed using SPSS software. Differences between groups were evaluated using ANOVA and chi-square tests. A p-value <0.05 was considered statistically significant.

Results. A total of 120 women aged 45–60 years were included in the study. The participants were divided into three groups: no vasomotor symptoms (Group 1, n=40), mild VMS (Group 2, n=40), and moderate-to-severe VMS (Group 3, n=40).

Women with moderate-to-severe VMS demonstrated significantly higher body mass index (BMI) and blood pressure compared to other groups.

Table 1. Baseline clinical characteristics of participants

Parameter	Group 1 (No VMS) n=40	Group 2 (Mild VMS) n=40	Group 3 (Moderate–Severe VMS) n=40	p-value
Age (years)	49.8±3.2	50.6±3.5	51.1±3.8	0.18
BMI (kg/m²)	24.6±2.8	26.1±3.1	28.4±3.6	**0.01**
Systolic BP (mmHg)	118.5±9.4	124.2±10.1	132.8±11.6	**0.001**
Diastolic BP (mmHg)	74.2±6.3	78.5±7.2	83.7±8.4	**0.002**

Significant differences were observed in lipid profile and glucose levels between the groups.

Table 2. Cardiometabolic parameters

Parameter	Group 1	Group 2	Group 3	p-value
Total cholesterol (mmol/L)	4.8±0.7	5.3±0.8	6.1±0.9	**0.003**
LDL (mmol/L)	2.7±0.6	3.1±0.7	3.8±0.8	**0.002**
HDL (mmol/L)	1.4±0.3	1.2±0.3	1.0±0.2	**0.01**
Triglycerides (mmol/L)	1.3±0.4	1.6±0.5	2.0±0.6	**0.004**
Fasting glucose (mmol/L)	4.9±0.5	5.3±0.6	5.8±0.7	**0.02**

Women with moderate-to-severe VMS had a significantly higher prevalence of cardiometabolic risk factors.

Table 3. Prevalence of risk factors (%)

Risk Factor	Group 1 (%)	Group 2 (%)	Group 3 (%)	p-value
Obesity (BMI ≥30)	10%	22.5%	40%	**0.01**
Hypertension	15%	30%	55%	**0.002**
Dyslipidemia	20%	37.5%	60%	**0.001**
Impaired glucose	12.5%	25%	42.5%	**0.01**

Correlation analysis revealed a significant positive association between the severity of vasomotor symptoms and cardiometabolic parameters: VMS severity

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and BMI: **r=0.42, p<0.01;** VMS severity and systolic BP: **r=0.48, p<0.001;** VMS severity and LDL: **r=0.39, p<0.01;** VMS severity and triglycerides: **r=0.41, p<0.01.** Additionally, a negative correlation was observed between VMS severity and HDL levels (**r=-0.36, p<0.01**).

Women with moderate-to-severe vasomotor symptoms exhibited significantly worse cardiometabolic profiles, including higher BMI, elevated blood pressure, adverse lipid levels, and impaired glucose metabolism. The severity of VMS was positively correlated with major cardiovascular risk factors, suggesting its potential role as an early clinical marker.

To further evaluate the independent association between vasomotor symptoms (VMS) and cardiometabolic risk, multivariate regression analysis was performed.

Moderate-to-severe VMS were used as an independent predictor, while cardiometabolic risk factors were considered dependent variables. The analysis was adjusted for age.

Table 4. Multivariate logistic regression analysis of cardiometabolic risk factors

Variable	Odds Ratio (OR)	95% CI	p-value
Obesity (BMI ≥30)	2.85	1.42–5.73	**0.003**
Hypertension	3.12	1.58–6.14	**0.001**
Dyslipidemia	2.67	1.34–5.29	**0.004**
Impaired glucose metabolism	2.21	1.10–4.42	**0.02**

Linear regression analysis demonstrated that the severity of VMS was significantly associated with continuous cardiometabolic parameters.

Table 5. Linear regression analysis (β-coefficients)

Dependent Variable	β-coefficient	Standard Error	p-value
BMI	0.38	0.09	**<0.001**
Systolic BP	0.44	0.11	**<0.001**
LDL cholesterol	0.36	0.08	**0.002**
Triglycerides	0.40	0.10	**0.001**
HDL cholesterol	-0.31	0.07	**0.004**

Multivariate logistic regression analysis showed that women with moderate-to-severe vasomotor symptoms had significantly higher odds of developing major cardiometabolic risk factors, particularly hypertension and obesity.

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Linear regression analysis further confirmed that the severity of VMS is independently associated with adverse cardiometabolic parameters. A positive relationship was observed with BMI, blood pressure, LDL cholesterol, and triglycerides, while HDL cholesterol demonstrated an inverse association.

After adjustment for age, vasomotor symptoms remained an independent predictor of cardiometabolic risk, suggesting their potential utility as an early clinical marker for cardiovascular and metabolic disorders in menopausal women.

Discussion.

The present study demonstrates a significant association between vasomotor symptoms (VMS) of menopausal syndrome and cardiometabolic risk factors. Women with moderate-to-severe VMS exhibited higher body mass index, elevated blood pressure, adverse lipid profiles, and impaired glucose metabolism compared to those without symptoms. Moreover, regression analysis confirmed that VMS are an independent predictor of cardiometabolic risk, even after adjustment for age.

These findings are consistent with previous studies suggesting that VMS are not merely a quality-of-life issue but may reflect underlying pathophysiological processes associated with cardiovascular risk [3,7]. In particular, the observed relationship between VMS severity and increased blood pressure may be explained by heightened sympathetic nervous system activity and vascular reactivity, which have been described in menopausal women experiencing frequent hot flashes [7].

In addition, the association between VMS and dyslipidemia observed in this study aligns with earlier reports indicating that estrogen deficiency contributes to unfavorable lipid metabolism, including increased LDL and triglyceride levels and decreased HDL cholesterol [4,10]. These metabolic alterations play a crucial role in the development of atherosclerosis and subsequent cardiovascular disease.

The positive correlation between VMS severity and body mass index also deserves attention. Obesity has been shown to exacerbate vasomotor symptoms through thermoregulatory dysfunction and inflammatory pathways, creating a bidirectional relationship between metabolic disturbances and menopausal symptoms [6,8]. This interaction may further amplify cardiometabolic risk in affected women.

Importantly, our results support the hypothesis that VMS may serve as an early clinical marker of subclinical cardiovascular disease. Previous longitudinal studies have demonstrated that women with early or severe VMS have a higher likelihood of developing cardiovascular events later in life [8,9]. Furthermore, subclinical markers such as endothelial dysfunction and increased carotid intima-media thickness have been reported in women with frequent vasomotor symptoms [7,9].

From a clinical perspective, the identification of VMS as a potential marker of cardiometabolic risk has important implications. Unlike many traditional risk factors, VMS are easily identifiable during routine clinical assessment and do not require specialized diagnostic tools. Therefore, they may provide a practical and cost-effective opportunity for early risk stratification and timely preventive interventions.

However, several limitations of this study should be acknowledged. First, the cross-sectional design does not allow for causal inference between vasomotor symptoms and cardiometabolic risk. Second, the relatively small sample size may limit the generalizability of the findings. Third, potential confounding factors such as lifestyle, diet, and physical activity were not fully assessed.

Despite these limitations, the study provides valuable evidence supporting the clinical significance of vasomotor symptoms in assessing cardiometabolic risk. Future large-scale prospective studies are needed to further clarify the causal mechanisms and evaluate the predictive value of VMS in cardiovascular outcomes.

Conclusion. The results of this study demonstrate that vasomotor symptoms of menopausal syndrome are significantly associated with adverse cardiometabolic profiles. Women with moderate-to-severe vasomotor symptoms exhibited higher body mass index, elevated blood pressure, unfavorable lipid levels, and impaired glucose metabolism compared to those without symptoms.

Importantly, vasomotor symptoms were identified as an independent predictor of cardiometabolic risk, even after adjustment for age. These findings suggest that VMS may serve not only as a clinical manifestation of menopause but also as an early indicator of underlying cardiovascular and metabolic disturbances.

From a clinical perspective, the assessment of vasomotor symptoms represents a simple, non-invasive, and cost-effective approach for early identification of women at increased cardiometabolic risk. Incorporating VMS evaluation into routine clinical practice may improve risk stratification and enable timely preventive interventions.

Further large-scale prospective studies are required to confirm these findings and to better understand the pathophysiological mechanisms linking vasomotor symptoms with cardiometabolic disorders. Early detection and targeted prevention strategies in this population may contribute to reducing the burden of cardiovascular disease in menopausal women.

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