



RESEARCH

Assessment of duration of menopause and risk of cardiovascular events in postmenopausal women

Postmenopozal kadınlarda menopoz süresi ile kardiyovasküler olay geçirme riskinin değerlendirilmesi

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Abstract

Purpose: Menopause is a significant transitional phase in a woman's life, characterized by physiological and biochemical changes that may increase the risk of cardiovascular diseases. This study aims to evaluate the relationship between menopause duration, age at menopause, and cardiovascular risk using the Systematic Coronary Risk Evaluation (SCORE) system in postmenopausal women.

Materials and Methods: In this retrospective study, menopausal women (n=135) who applied to Bahçeşehir Family Health Centre were included. Age at menopause and duration of menopause were recorded; age, smoking status, blood pressure, total cholesterol and laboratory results were retrospectively analyzed to calculate the 10-year risk of fatal cardiovascular events.

Results: The mean age of participants was 57.92 ± 5.95 years, and the mean menopause duration was 10.76 ± 6.09 years. No statistically significant correlation was found between age at menopause and SCORE values. However, a significant positive correlation was observed between menopause duration and cardiovascular risk score, indicating that a longer duration of menopause is associated with an increased cardiovascular risk.

Conclusion: This study shows that duration of menopause may be associated with cardiovascular events in postmenopausal women. This highlights the importance of early cardiovascular risk assessment and preventive strategies in health services. Longitudinal studies with larger sample sizes are needed to better understand the effects of menopause-related hormonal changes on cardiovascular health.

Keywords: Menopause, post menopause, heart disease risk factors, cardiometabolic risk factors

Öz

Amaç: Menopoz, kadınların yaşamında önemli bir geçiş dönemidir ve bu süreçte meydana gelen fizyolojik ve biyokimyasal değişiklikler, kardiyovasküler hastalık riskini artırabilir. Bu çalışmada, postmenopozal kadınlarda menopoz süresi ve menopoz yaşı ile kardiyovasküler risk arasındaki ilişkinin Sistematik Koroner Risk Değerlendirme (SCORE) sistemi kullanılarak değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: Retrospektif olarak planlanan çalışmaya Bahçeşehir Aile Sağlığı Merkezine başvuran menopoz dönemindeki (n=135) kadınlar dahil edilmiştir. Hastaların menopoz yaşları ve menopozda geçen süreleri kaydedilmiş; yaşları, sigara kullanım durumları, kan basıncı değerleri, total kolesterol değerleri, ve laboratuvar sonuçları retrospektif olarak incelenerek 10 yıllık ölümcül kardiyovasküler olay geçirme riskleri hesaplanmıştır.

Bulgular: Katılımcıların yaş ortalaması $57,92 \pm 5,95$ yıl, menopoz süresi ortalaması ise $10,76 \pm 6,09$ yıl olarak bulunmuştur. Menopoz yaşı ile SCORE değerleri arasında istatistiksel olarak anlamlı bir ilişki saptanmamıştır. Ancak, menopoz süresi ile kardiyovasküler risk skoru arasında pozitif yönde anlamlı bir ilişki tespit edilmiştir. Bu bulgu, menopoz süresi uzadıkça kardiyovasküler riskin arttığını göstermektedir.

Sonuç: Bu çalışma postmenopozal kadınlarda menopoz süresinin kardiyovasküler olaylarla ilişkili olabileceğini göstermektedir. Bu durum, sağlık hizmetlerinde erken kardiyovasküler risk değerlendirmesi ve önleyici stratejilerin önemini vurgulamaktadır. Menopozla ilişkili hormonal değişimlerin kardiyovasküler sağlık üzerindeki etkisini daha iyi anlamak için daha geniş örneklem gruplarıyla yapılacak uzunlamasına çalışmalara ihtiyaç duyulmaktadır.

Anahtar kelimeler: Menopoz, postmenopoz, kalp hastalığı risk faktörleri, kardiyometabolik risk faktörleri

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INTRODUCTION

Menopause is a term derived from the Greek words 'meno' (month) and 'pausis' (pause). It refers to the permanent cessation of menstruation and the end of fertility because of reduced ovarian activity. Women usually spend the last third of their lives in the menopause after the end of their reproductive period¹⁻⁴. Several structural, physiological and biochemical changes occur in the body during the menopause. These changes include sleep disturbances, hot flushes, sweating, heart palpitations, headaches, depression, muscle and bone pain, vaginal atrophy and dryness. Long-term effects include an increase in musculoskeletal disorders, cancer and cardiovascular disease^{1,5-7}.

The menopause leads to significant physiological changes in the female body. There are significant fluctuations in sex hormone levels and an increase in body fat accumulation, particularly around the trunk. There are also adverse changes in lipid and lipoprotein levels, and remodeling of the vascular structure begins^{4,8}. During the reproductive years, women benefit from the protective effects of endogenous estrogen on the cardiovascular system. Studies show that estrogen provides important protection against cardiovascular disease by supporting vascular health⁸. However, there is a significant decline in estrogen levels during the menopause. This decline leads to a loss of the protective effects of estrogen on the vasculature and endothelial dysfunction⁹. Vasomotor symptoms, which are common during menopause, are also caused by a decrease in estrogen levels. The decrease in estrogen causes a physiological imbalance by reducing the function of the hypothalamic thermoregulatory system, which regulates body temperature. This leads to symptoms such as hot flushes, night sweats and sudden temperature changes. Although vasomotor symptoms are generally considered to be benign, severe and long-term cases have been associated with an increased risk of cardiovascular disease^{1,9}.

Good management of the physiological changes that occur during menopause is important for the long-term protection of women's health. A multidisciplinary approach should be taken to prevent these cardiovascular diseases, which increase with the menopause, and to reduce risk factors. Early assessment of cardiovascular disease risk, especially

in primary care, can help prevent these diseases and reduce health care costs.

Therefore, reliable assessment methods should be used for early diagnosis and prevention of cardiovascular disease. In this study, we aim to evaluate the association of cardiovascular risk with age and duration of menopause using the Systematic Coronary Risk Estimation (SCORE) in postmenopausal women. The SCORE system is an important scoring method that helps to determine an individual's ten-year risk of cardiovascular disease and can guide the health management of postmenopausal women. This assessment will help to better understand the impact of the menopause on the risk of cardiovascular events and will help to strengthen risk assessment approaches, especially in primary care. The data will be used to develop strategies for the prevention of cardiovascular disease and to support more effective implementation of early intervention and preventive health policies.

MATERIALS AND METHODS

Study design and sample

Patients registered at Bahçeşehir Family Health Centre were included in this retrospective study. Family Health Centers are institutions where people receive primary health care services and where patients are followed up annually. Each person registered in the units has a file in the system. These files contain demographic data, laboratory data, vaccination status, diseases, medication and examination results.

The total population of women over 18 years of age registered at the Family Health Centre where the study was conducted was 905, including 202 women aged 45-55 years and 152 women over 55 years. It is stated that 95% of women aged 45-55 years and 5% of women over 55 years are expected to enter the menopause¹⁰. According to this calculation, 192 women aged 45-55 years and 8 women over 55 years were expected to enter the menopause. In the power analysis, if 200 people from the total population of the Family Health Centre were menopausal, the sample size was calculated to be 132 with a confidence level of 95% and a margin of error of 5%.

The study sample consisted of 150 postmenopausal women who registered at the Family Health Centre between January 2023 and January 2024. Initially 150

postmenopausal women were evaluated for this study. However, 15 participants were excluded because they could not clearly remember their age at menopause or had undergone surgical menopause. As a result, 135 women who experienced natural menopause and had complete data were included. In addition, individuals with a history of cardiovascular disease, diabetes mellitus, chronic renal failure, use of antihyperlipidemic drugs, hormone replacement therapy or treatment for malignancy were excluded. Thus, the inclusion and exclusion criteria of the study were rigorously applied.

Procedure

Patients' age, smoking status, blood pressure, total cholesterol, age at menopause, and duration of menopause were recorded in their files, and laboratory results were retrospectively analyzed by the physician in charge of the study unit. Age at menopause was recorded as reported by the patients. Patients with incomplete information because they could not clearly remember their age at menopause or who had surgically induced menopause were excluded from the study ($n=15$). The study continued with 135 participants who reported a natural menopause. Patients with cardiovascular disease, diabetes mellitus, chronic renal insufficiency, and those taking antihyperlipidemic drugs were excluded from the study because they are at high risk of cardiovascular disease, and those taking hormone replacement therapy and drugs for malignancy were excluded because they may affect the duration of menopause.

Ethical committee approval for our study was obtained from the Scientific Research Evaluation Committee of Turkey-Adana Municipal Training and Research Hospital with decision dated 18.01.2024 and number 3113. In addition, permission to use local data was obtained from Adana Provincial Health Directorate (permission number: E-11289099-050.04-237990249 - 29.02.2024).

This study used the SCORE Turkey form, which is the preferred form used by the Ministry of Health in the Patient Management Panel system that is being implemented in primary care physicians. The Systematic Coronary Risk Evaluation (SCORE) system is a widely validated cardiovascular risk assessment tool developed by the European Society of Cardiology (ESC). It estimates the 10-year risk of fatal cardiovascular disease based on key risk factors, including age, sex, systolic blood pressure, total

cholesterol levels, and smoking status^{11,12}. The SCORE Turkey model is an adaptation specifically designed for the Turkish population, incorporating country-specific cardiovascular mortality data to enhance risk estimation accuracy. Unlike the general SCORE model, which provides separate risk assessments for low- and high-risk European populations, the SCORE Turkey version accounts for regional epidemiological characteristics, genetic predispositions, and lifestyle factors¹². This localization enhances its predictive validity in assessing cardiovascular risk in postmenopausal Turkish women. Previous studies have demonstrated the reliability and predictive accuracy of the SCORE system in various populations, including Turkish cohorts, confirming its strong correlation with observed cardiovascular event rates^{13,14}. The Turkish adaptation follows the standardized calibration methods recommended by ESC, ensuring consistency in cardiovascular risk estimation. The tool is widely used in primary healthcare settings to identify high-risk individuals and guide preventive strategies¹².

Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics for Windows, version 23 (IBM Corp., Armonk, NY, USA). In this study, independent variables included age at menopause, duration of menopause, blood pressure (systolic and diastolic), total cholesterol levels, and smoking status, while the dependent variable was the SCORE cardiovascular risk value. To determine statistical significance, appropriate tests were applied based on the distribution of independent variables. Independent sample t-tests were used for parametric data, whereas the Mann-Whitney U test was applied for non-parametric data. Differences among multiple groups were assessed using ANOVA for parametric variables and the Kruskal-Wallis test for non-parametric variables. The chi-square test was employed for categorical variables. Correlation analyses were conducted using Pearson or Spearman correlation coefficients, depending on the normality of the data distribution.

RESULTS

The study included 135 women with a mean age of 57.92 ± 5.95 years (min:42; max:69). Of the participants, 38 (28.1%) were smokers and 97 (71.9%) were non-smokers. Age at menopause,

number of years since menopause, blood pressure and cholesterol measurements of the participants are shown in Table 1. As the score was calculated based

on blood pressure and cholesterol levels, the statistical relationship between them was not investigated.

Table 1. Mean measured vital and laboratory values of the participants

	Mean±Standard Deviation	Min-max
Age at menopause	47.17±3.94	36-55
Duration of menopause	10.76±6.09	1-24
Systolic Blood Pressure	126.26±9.23	94-156
Diastolic Blood Pressure	79.43±7.28	60-96
Cholesterol	212.69±35.81	125-293
Score Value	2.90±2.32	0-14

Min: Minimum, max: maximum.

According to the results of the correlation analysis, the relationship between the calculated scores of the individuals and menopausal age was not statistically

significant ($p=0.135$). This result shows that there is no significant correlation between the variables (Table 2).

Table 2. The relationship between Score score and age at menopause

	Mean±Standard Deviation	Test Statistic	p*
Age at menopause	47.17±3.94	-1.49	0.135
Duration of menopause	10.76±6.09	-2.71	0.007

*Mann Whitney U test

The duration of menopause and the score value was found to be statistically significantly correlated ($p=0.007$). These two variables showed a significant positive link (correlation coefficient $r=0.519$). This suggests that the longer the time elapsed following

menopause, the greater the tendency for the score value to climb. Put another way, the score value rises in proportion to the length of the menopause, indicating a possible cumulative effect of the menopause duration on the score (Figure 1).

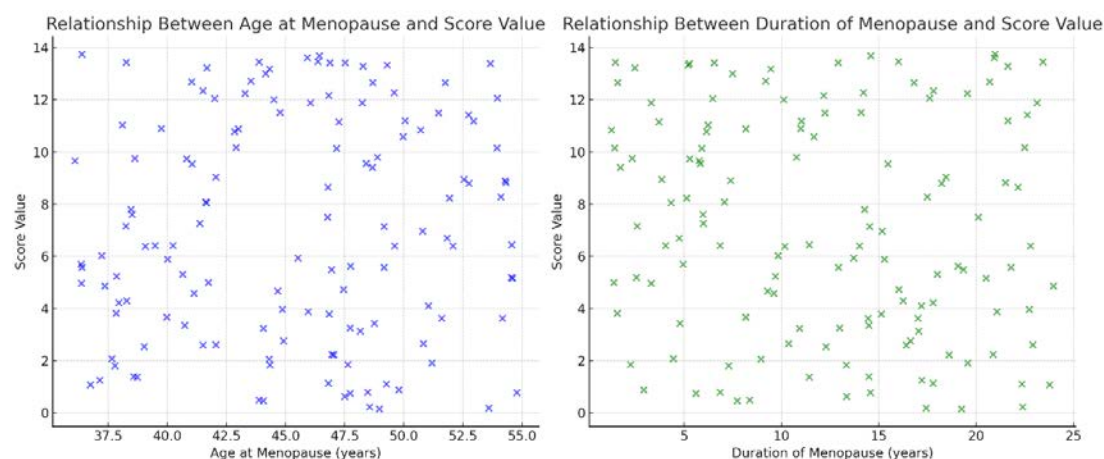


Figure 1. The scatter plot shows the relationships between age and duration of menopause and score value.

DISCUSSION

This study analyzed the effects of menopausal age and duration on the risk of cardiovascular events in postmenopausal women. The results suggest that cardiovascular risk may increase with prolonged menopause.

Epidemiological data have shown that the menopausal transition is associated with a higher prevalence of cardiovascular risk factors such as central obesity, atherogenic dyslipidemia, glucose intolerance, arterial hypertension and non-alcoholic fatty liver disease compared with the premenopausal state¹⁵. Changes in the lipid profile during the menopausal transition stand out as a critical factor in the pathogenesis of cardiovascular disease¹⁵. Women with a normal menstrual cycle have been observed to have a more protective lipid profile than postmenopausal women, which may be explained by the beneficial effects of estrogen on lipid metabolism¹⁶. Therefore, it is likely that the longer the duration of the menopause, the more pronounced the changes in the atherogenic lipid profile and thus the higher the cardiovascular risk.

The effect of early menopause on the risk of cardiovascular disease has been widely reported in the literature¹⁵⁻¹⁸. Early menopause brings with it the longer-term effects of hormonal imbalances resulting from a combination of genetic predisposition, environmental factors and lifestyle. Although our study did not reach statistical significance, the presence of an increased cardiovascular risk associated with early menopause in the literature suggests that this group of women should be monitored more closely.

The effect of menopause duration on cardiovascular health is also important. There is some evidence in the literature that the longer duration of menopause is associated with an increase in cardiovascular risk factors^{15,17,19}. Studies confirm that longer duration of menopause is associated with cardiovascular events. Therefore, a more comprehensive cardiovascular assessment of women with prolonged menopause is important for early detection and management of risk.

The SCORE scale has many advantages over other methods of detecting cardiovascular disease and considers the multifactorial etiology of cardiovascular disease. Score values calculate risk factors and

provide an overall clinical overview. In addition, identification of individuals at risk can guide lifestyle changes and interventions to prevent both fatal and non-fatal events. We suggest that screening postmenopausal women with high-risk score values for cardiovascular disease and implementing professional guidelines and therapeutic targets for primary prevention can significantly reduce the risk of coronary heart disease in this patient group^{7,11,13}. Customized risk maps that can provide reliable national mortality data for specific countries can now be generated using SCORE.

Diet and exercise have been shown to significantly delay the occurrence of cardiovascular events in both postmenopausal and premenopausal women. It has been reported that the risk of cardiovascular disease can be reduced by lifestyle changes such as healthy diet, exercise and smoking cessation^{14,20-28}. Implementing these strategies can play a crucial role in the prevention of cardiovascular disease, especially in postmenopausal women, who are at high risk.

The limitations of this study should also be considered. Due to the retrospective and cross-sectional design of our study, we could not establish a causal relationship. In addition, the fact that our study population was limited to a specific geographical region, that it was single-center and that the number of participants was small may limit the generalizability of our results. The lack of a control group may also reduce the reliability of the study. Future studies may need to be longer and more comprehensive prospective studies to better understand these associations.

In conclusion, the data suggest that the duration of menopause may increase the risk of cardiovascular events in postmenopausal women. This finding suggests that individuals at risk should undergo more rigorous and comprehensive cardiovascular assessment, especially during prolonged post menopause. The impact of genetic, biomarker and hormonal changes on cardiovascular risk should be further analyzed and innovative treatment approaches and targeted strategies should be developed. Incorporating these findings into clinical practice and public health policy will both increase the effectiveness of primary health care services and enable the development of more personalized and targeted intervention strategies in the light of advanced studies. Thus, significant gains in the

prevention of cardiovascular events can be achieved through individual patient assessment and early intervention strategies.

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