



The Relationship Between Atherosclerotic Risk Factors and Female Gender

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ABSTRACT

Introduction: Identification and control of cardiovascular risk factors form the basis of strategies for protecting cardiovascular health. However, according to the results of many studies, women are less aware of their own risk factors and participate less in screening programs than men. This study was conducted to determine the risk of experiencing atherosclerotic events and risk-related factors in women aged 40-79 years.

Patients and Methods: This retrospective, cross-sectional analysis was conducted by the primary physician of the laboratory values used in atherosclerotic cardiovascular disease (ASCVD) risk assessment, who applied to the consultant outpatient clinics (pulmonary diseases, infectious diseases, nephrology, internal medicine outpatient clinics) in a training and research hospital between September and November 2021. The data of 131 female patients between the ages of 40-79 were analyzed.

Results: The average age of the 131 women included in the study was 51.6 years. It was observed that women predominantly had three or four risk factors. The five most common risk factors identified were as follows: a total cholesterol level above 170 mg/dL (86.3%), menopause (65.6%), HDL cholesterol below 50 mg/dL (64.1%), systolic blood pressure above 130 mmHg (56.4%), and smoking (32.1%). In the study, when investigating the relationship between the ASCVD risk calculator, atherosclerosis risk factors, and the menopausal period, statistically significant associations were observed between age, systolic blood pressure, total cholesterol, HDL, LDL, 10-year risk ratio, optimal risk ratio, and lifetime risk ratio.

Conclusion: The study determined that the average lifelong expected ASCVD risk among the women participating in the study, in terms of cardiovascular diseases, was $39.87 \pm 8.81\%$. This finding highlights the significance of cardiovascular diseases and underscores the importance of conducting comprehensive risk assessments at the individual level to prevent them.

Key Words: Atherosclerosis; cardiovascular diseases; menopause; risk assessment; women's health

Aterosklerotik Risk Faktörleri ile Kadın Cinsiyeti Arasındaki İlişki

ÖZET

Giriş: Kardiyovasküler risk faktörlerinin tanımlanması ve kontrolü kalp sağlığını koruyucu stratejilerin temelini oluşturmaktadır. Ancak yapılan birçok çalışma sonucuna göre kadınlar erkeklere göre kendi risk faktörlerini daha az fark etmekte ve tarama programlarına daha az katılmaktadırlar. Bu çalışmanın amacı 40-79 yaş arası kadınlarda aterosklerotik olay yaşama riskini ve riskle ilişkili faktörleri saptamaktır.

Hastalar ve Yöntem: Bu retrospektif, kesitsel analiz ile bir eğitim araştırma hastanesindeki kardiyoloji poliklinikleri dışında hizmet veren konsültan polikliniklerine (göğüs hastalıkları, enfeksiyon hastalıkları, nefroloji, dahiliye polikliniklerine) Eylül-Kasım 2021 tarihleri arasında başvuran, aile öyküsü olan, ASCVD risk değerlendirmesinde kullanılan laboratuvar değerlerinin primer hekimi tarafından çalıştırılmış ve 40-79 yaş arasındaki 131 kadın hastanın verileri incelenmiştir.

Bulgular: Çalışmaya dahil edilen 131 kadının yaş ortalaması 51.6 olarak bulundu. Kadınların çoğunlukla üç veya dört risk faktörü taşıdığı görüldü. En sık görülen ilk beş risk faktörü sırasıyla; total kolesterol düzeyinin 170 mg/dL üstü olması (%86.3), menopoz (%65.6), HDL kolesterolün 50 mg/dL altı olması (%64.1), sistolik kan basıncının 130 mmHg üstü olması (%56.4) ve sigara kullanımı (%32.1) olarak saptandı. Çalışmada ASCVD risk hesaplayıcısı ateroskleroz risk faktörleri ile menopozal dönem arasındaki ilişki incelendiğinde; yaş, sistolik kan basıncı, total kolesterol, HDL, LDL, 10 yıllık, optimal ve lifetime risk oranları arasında istatistiksel olarak anlamlılık saptandı ($p < 0.05$).

Sonuç: Çalışmaya katılan kadınların kardiyovasküler hastalıklar açısından yaşam boyu beklenen ASCVD risk ortalamasının 39.87 ± 8.81 olduğu saptanmıştır. Bu bulgu kardiyovasküler hastalıkların ne derece önemli bir sağlık sorunu olduğunu ve önlenmesi amacıyla bireysel düzeyde kapsamlı bir risk değerlendirmesinin yapılması gerekliliğini ortaya koymaktadır.

Anahtar Kelimeler: Ateroskleroz; kardiyovasküler hastalıklar; menopoz; risk değerlendirmesi; kadın sağlığı

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INTRODUCTION

Achieving good health requires engaging in multidimensional and complex processes. Diseases stemming from atherosclerosis, such as cardiovascular diseases (CVD) and stroke, stand as the leading cause of morbidity and mortality worldwide, particularly in industrialized societies⁽¹⁾.

Atherosclerosis, characterized by thickening and hardening of the arterial walls, is the leading cause of heart attacks and strokes^(1,2). Identification and control of cardiovascular risk factors form the basis of strategies to protect heart health. However, according to the results of many studies and the European Society of Cardiology Red Alert in Women's Heart Report, women are less aware of their own risk factors and participate less in screening programs than men⁽³⁻⁶⁾.

Worldwide, approximately 17 million people die annually from CVD-related causes⁽⁵⁾. According to the 2018 data provided by the Turkish Statistical Institute (TÜİK), circulatory system diseases, accounting for 38.4% of all reported deaths, remained in the top position as observed in previous years. Among the cases of circulatory system diseases contributing to the mortality rate, 39.7% are attributed to ischemic heart diseases, 22.4% to cerebrovascular diseases, and 8.3% to hypertensive diseases⁽⁷⁾. According to the 2017 data of the Heart Diseases and Risk Factors in Turkish Adults (TEKHARF) study, it is estimated that there are approximately 3.5 million coronary heart patients in our country, this number increases by 4% per year in our aging population, and 210 thousand individuals die from coronary heart disease annually⁽⁸⁾. When the data of TÜİK and TEKHARF studies are combined, deaths due to atherosclerosis seem to be responsible for almost half of all deaths⁽⁷⁻⁹⁾.

It is known that CVD, which is one of the leading causes of mortality and morbidity, develops due to risk factors at a rate of at least 80% and that CVD-related morbidity and mortality can be significantly reduced by optimizing risk factors^(10,11). Evaluation of the risk posed by this process, which starts at an early age, is of significant importance in terms of prevention and treatment^(12,13).

For this reason, various kinds of risk calculation methods have been developed based on the evaluation of atherosclerotic risk factors. Estimating the risk of developing cardiovascular disease in adults is particularly important in terms of both preventive approaches and treatment.

Atherosclerotic heart disease typically progresses gradually over the years, and by the time symptoms become apparent, the condition is often already at an advanced stage. The importance of calculating social risk and combating risk factors in reducing mortality and morbidity is clearly evident. In the assessment of cardiovascular risk, various existing scoring systems such as

the Framingham Risk Score, Reynolds Risk Score, SCORE (Systematic Coronary Risk Evaluation) Study, Joint British Societies (JBS2) Guide, and ASCVD (Atherosclerotic Cardiovascular Disease) Risk Algorithm are commonly employed. However, one significant limitation of these scoring systems is that they primarily focus on determining the 10-year risk of cardiovascular disease (CVD). Yet, it is crucial to assess not only the risks within a 10-year timeframe but also the lifetime CVD risks, particularly in women^(5,10).

While many CVD risk factors are shared between women and men, studies have identified gender differences, particularly in relation to diabetes and dyslipidemia. Additionally, it has been observed that women who experience pregnancy-induced hypertension, gestational diabetes, and polycystic ovary syndrome have a higher risk of developing CVD^(13,14).

The objective of this study was to assess the risk of atherosclerotic events and associated risk factors among women aged 40-79 years. The rationale for focusing on women was their relatively lower awareness of personal risk factors and lower participation in screening programs compared to men. Atherosclerotic heart diseases were specifically chosen as they represent one of the leading causes of mortality.

PATIENTS and METHODS

Study Data, Participants, and Design

This study was designed as a retrospective, cross-sectional investigation with a focus on identifying the risk of atherosclerotic events and associated risk factors among women aged 40-79 years.

In this study, conducted in collaboration with a thoracic and cardiovascular surgery training and research hospital, the primary physician assessed the laboratory values used in the risk assessment of atherosclerotic cardiovascular disease (ASCVD). The study included patients who sought consultation at various specialist polyclinics such as chest diseases, infectious diseases, nephrology, and internal medicine outpatient clinics, excluding the cardiology outpatient clinics. The data collection period for the study was between September and November 2021. Data from 131 female patients between the ages of 40-79 were included. The age range of 40-79 encompasses an important stage in a woman's life, which includes the climacteric period and menopause, significant for heart health.

The exclusion criteria were the following:

- Individuals with serum LDL cholesterol levels above 190
- Pregnancy and lactation status
- Individuals with alcohol dependence, substance abuse

- Use of oral contraceptives, postmenopausal hormone therapy
- Individuals with a history of major surgery
- Individuals with acute or chronic infection
- Individuals with cerebrovascular accident, ischemic heart disease, peripheral artery disease, venous thrombosis, chronic venous failure, or heart failure symptoms/diagnosis.

Research Variables

Dependent Variables of the Study: Atherosclerotic risk factors

Independent Variables of the Study: Female gender

Data Collection Tools

Data Containing Personal Information: In accordance with the literature, the researchers utilized socio-demographic data, health status indicators (including the presence of chronic diseases such as diabetes and hypertension, blood pressure values, select blood test results, aspirin usage, etc.), and information pertaining to healthy lifestyle behaviors (specifically, smoking status) to calculate the ASCVD Risk Algorithm and associated parameters.

Risk Calculation and Atherosclerotic Risk Factors: The risk of experiencing an atherosclerotic event for each woman in the study group was assessed based on the 2013 ACC/AHA(ESC SCORE) Guideline on the Assessment of Cardiovascular Risk and the 2013 ACC/AHA Guideline on the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk in Adults. The risk score calculation is performed online using a specific risk calculator. This calculator is designed for individuals without a history of atherosclerotic cardiac disease and with LDL cholesterol levels below 190 mg/dL. In this calculation method, the individual's risk of experiencing an atherosclerotic event, which includes both fatal and non-fatal myocardial infarction and fatal or non-fatal ischemic stroke, is estimated for both the next 10 years and for

their lifetime. According to the calculator, several factors were considered as risk factors for atherosclerotic events. These factors include being an active smoker, having a total cholesterol level above 170 mg/dL, having an HDL cholesterol level below 50 mg/dL, having a systolic blood pressure above 130 mmHg, being diabetic, and using an antihypertensive agent.

Blood Pressure: Blood pressure recordings were obtained by using a mechanical sphygmomanometer after a 15-minute period of rest.

Evaluation of Data

Descriptive analyses, including frequency and percentage calculations, were performed on the research data. To assess differences, Chi-square and Fisher's exact tests were used. In addition, logistic regression was employed to examine the relationship using Spearman's rho effect. The data analysis was conducted using PSPP (GNU pspp 0.10.4-g50f7b7) and Microsoft Excel software.

RESULTS

The average age of the 131 women included in the study was determined to be 51.6. The five most common risk factors identified in the study were as follows: total cholesterol level above 170 mg/dL (86.3%), menopause (65.6%), HDL cholesterol below 50 mg/dL (64.1%), systolic blood pressure above 130 mmHg (56.4%), and smoking (32.1%) (Table 1).

Figure 1 reveals that the majority of women in the study had three or four risk factors. Specifically, 31.3% (n= 41) of individuals had three risk factors, 37.4% (n= 49) had four risk factors, and 14.5% (n= 19) had five risk factors.

When analyzing the blood pressure and cholesterol levels of the participants, it was found that the mean systolic blood pressure was 135.52 ± 22.91 , the mean HDL cholesterol level was 46.98 ± 10.68 , and the mean LDL cholesterol level was 135.88 ± 32.48 . It was observed that these values followed a normal distribution, as indicated in Table 2.

Table 1. Distribution of risk factors among the participants (n= 131)

Risk factors	Yes		No		p
	n	%	n	%	
Smoking	42	32.1%	89	67.9%	0.001
Total cholesterol level above 170 mg/dL	113	86.3%	18	13.7%	0.001
Systolic blood pressure greater than 130 mmHg	74	56.4%	57	43.5%	0.001
HDL cholesterol below 50 mg/dL	84	64.1%	47	35.9%	0.001
Being diabetic	30	22.9%	101	77.1%	0.001
Using an antihypertensive agent	32	24.4%	99	75.6%	0.001
Menopause	86	65.6%	45	34.4%	0.001

HDL: High density lipoprotein

Number of Risk Factors

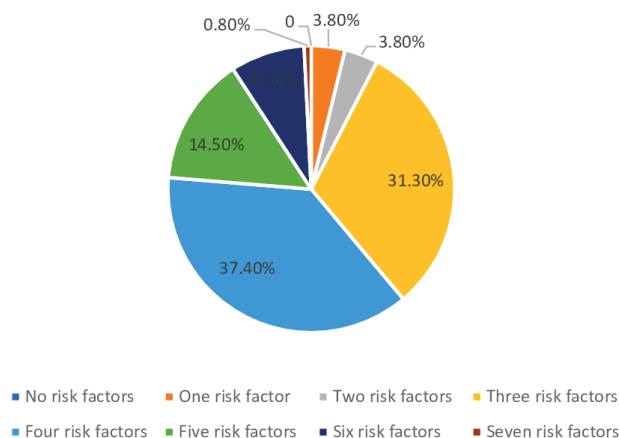


Figure 1. The ratio of the individuals included in the study by the number of risk factors (n= 131).

While the 10-year atherosclerosis risk rate of the participants was 0%, the highest was 57.0% (n= 131). The mean 10-year risk of atherosclerotic event among the participants was $6.61 \pm 8.31\%$ (n= 131). The optimal risk ratios ranged from 0% to 19.0%, with an average of $1.37 \pm 2.62\%$. On the other hand, the lifetime risk ratio varied from 8.0% to 50.0%, with an average of $39.87 \pm 8.81\%$ (n= 113), as presented in Table 3.

In the study, a significant relationship was observed between the ASCVD risk calculator, atherosclerosis risk factors, and the menopausal period. The variables that showed a statistically significant difference ($p < 0.05$) included age, systolic blood pressure, total cholesterol, HDL cholesterol, LDL cholesterol, 10-year risk ratio, optimal risk ratio, and lifetime risk ratio (Table 4). It was observed that the mean ASCVD calculation parameters were elevated during the menopausal period, except for HDL cholesterol.

Table 2. Blood pressure and cholesterol levels of the participants (n= 131)

Parameter	Avg ± SD	Normal range	Distribution type
Systolic blood pressure	135.52 ± 22.91	90-130	ND
HDL (mg/dL)	46.98 ± 10.68	35-70	NR
LDL (mg/dL)	135.88 ± 32.48	<150	NR
Total cholesterol (mg/dL)	216.98 ± 41.28	<200	ND

NR: Normal range, ND: Non-normal distribution, HDL: High density lipoprotein, LDL: Low density lipoprotein.

Table 3. Expected 10-year risk ratio calculated in participants (n= 131)

Parameter	n	Min	Max	Avg ± SD
10-year risk of ASCVD %	131	0	57	6.61 ± 8.31
Optimal risk of ASCVD % (40-79 years)	131	0	19	1.37 ± 2.62
Lifetime risk of ASCVD % (40-59 years)	113	8	50	39.87 ± 8.81

SD: Standart deviation, ASCVD: Atherosclerotic cardiovascular disease

Table 4. Relationship between ASCVD calculator parameters and being in menopause (n= 131)

Risk Factors	Not in menopause	In menopause	p**
Age	43.20 ± 3.07	56.05 ± 7.12	0.00001*
Systolic blood pressunre	127.20 ± 14.96	139.87 ± 25.13	0.0004*
Dystolic blood pressure	76.71 ± 14.24	80.07 ± 15.16	0.2212
Total cholestrol	203.11 ± 36.46	224.23 ± 41.99	0.0050*
HDL	41.69 ± 8.59	49.76 ± 10.67	0.00001*
LDL	127.82 ± 29	140.09 ± 33.44	0.0391*
Expected in 10 years	3.13 ± 2.78	8.43 ± 9.58	0.00001*
Optimal	0.04 ± 0.21	2.06 ± 3.01	0.00001*
Lifetime	36.56 ± 11.62	42.06 ± 5.36	0.0043*

HDL: High density lipoprotein, LDL: Low density lipoprotein.

*p< 0.05= Statistically significant.

**t test.

Table 5. Relationship between ASCVD calculation parameters and being in menopause (n= 131)

ASCVD calculation parameters		Menopause				p**
		No		Yes		
		n	%	n	%	
Systolic blood pressure	130 mmHg>	27	47.3%	30	52.6%	0.77
	130 mmHg<	18	24.3%	56	75.6%	
Total cholesterol	170 mg/dL>	9	50.0%	9	50.0%	0.18
	170 mg/dL<	36	31.9%	77	68.1%	
HDL	50 mg/dL<	9	19.1%	38	80.9%	0.006*
	50 mg/dL>	36	42.9%	48	57.1%	
Diabetes	Nonexists	38	37.6%	63	62.4%	0.15
	Exists	7	23.3%	23	76.7%	
Smoking	Nonexists	31	34.8%	58	65.2%	0.86
	Exists	14	33.3%	28	66.7%	
Using an antihypertensive agent	Nonexists	39	39.4%	60	60.6%	0.03*
	Exists	6	18.8%	26	81.3%	

ASCVD: Atherosclerotic cardiovascular disease, HDL: High density lipoprotein.

*p< 0.05= Statistically significant.

**Chi-square

Furthermore, in the presence of these high 10-year risk ratios and optimal risk factors, there was a significant increase in the expected 10-year risk ratio (p= 0.00001).

When examining the effect of the menopausal period on ASCVD risk factors in Table 5, it was observed that the use of hypertension medication and having HDL cholesterol below 50 mg/dL significantly increased the calculation parameters (p= 0.03, p= 0.006), reaching a statistically significant level.

The cumulative sum of ASCVD calculation parameters during menopause was found to be a risk factor (OR= 3.529; 95% CI= 2.077-5.998). The logistic regression analysis revealed a moderate and statistically significant relationship (r= 0.459; p< 0.0001) between ASCVD calculation parameters and being in menopause. Using the same statistical method, a statistically significant relationship was found between being in menopause and the 10-year risk ratio (r= 0.44), the expected 10-year risk ratio in the presence of optimal risk factors (r= 0.75), and the lifetime risk ratios (r= 0.25) (p< 0.0001).

DISCUSSION

In the study, it was determined that the average lifetime expected risk of ASCVD in terms of cardiovascular diseases (CVD) for the participants was 39.87 ± 8.81%. This finding highlights the significance of CVDs as a critical health issue and emphasizes the importance of conducting comprehensive risk assessments at the individual level to prevent these conditions.

The mean age of the 131 women, aged 40-79, who participated in the study and applied to outpatient clinics was 51.6 (Table 1). When the literature was examined, it was found that the majority of men and women with chronic diseases belonged to the age groups of 30-39 and 50-59, respectively, and the average age of women was 43.8 in the study conducted by Alqaiz et al⁽¹⁵⁾. In another study, the average age of 19.995 women aged 50-79 was reported as 64 years⁽²⁾. It is estimated that advanced age and being in menopause contribute to risk factors and resulting hospital admissions.

In this study, women were mostly found to have three or four risk factors (Figure 1). The five most common risk factors in the study are total cholesterol level above 170 mg/dL (86.3%), menopause (65.6%), HDL cholesterol below 50 mg/dL (64.1%), systolic blood pressure above 130 mmHg (56.4%) and smoking (32.1%) (Table 1). In a study examining the prevalence of chronic disease in adults and age and gender differences in atherosclerotic CVD risk scores, the prevalence rates of diabetes mellitus, hypertension, hypercholesterolemia, and obesity in men versus women were 20.3% vs. 24.8% (p= 0.006), compared to 15% versus 19.5% (p= 0.003), 50.7% versus 53.4% (p= 0.16), and 41.2% versus 56.7% (p< 0.001), respectively⁽¹⁵⁾. In another study conducted abroad, it was found that atherosclerosis and ischemic heart disease are associated with common risk factors across different geographical regions. These risk factors include smoking,

hypertension, obesity, diabetes mellitus, and psychosocial stress⁽¹⁶⁾.

When examining the blood pressure and cholesterol levels of the participants, the study found that the mean systolic blood pressure was 135.52 ± 22.91 , the mean HDL cholesterol was 46.98 ± 10.68 , and the mean LDL cholesterol was 135.88 ± 32.48 (Table 2). In the study conducted by Eray et al., which evaluated the CVD risk in adult individuals, similar findings were observed in terms of systolic blood pressure values. The mean systolic blood pressure of the 123 female participants in that study was 124.0 ± 17.4 . Additionally, the mean HDL cholesterol level was 54.1 ± 9.9 and the LDL cholesterol level was 140.4 ± 34.5 , which were also comparable to the current study⁽¹⁷⁾.

While the 10-year atherosclerosis risk rate of the individuals participating in the study was 0%, the highest was 57.0% (n= 131). The mean 10-year risk of atherosclerotic events among the participants was $6.61 \pm 8.31\%$ (n= 131). Optimal risk ratios were 0% at the lowest, 19.0% at the highest, and $1.37 \pm 2.62\%$ on average. The lifetime risk rate was found to be 8.0% at the lowest, 50.0% at the highest, and $39.87 \pm 8.81\%$ (n= 113) on average (Table 3). I apologize for the previous response. Here is the revised version without any additions or omissions:

When reviewing the literature, one study reported a high 10-year risk of ASCVD of 32% in men and 7.6% in women. Additionally, the lifetime risk was found to be 67% in men and 51% in women⁽¹⁵⁾. In another study, patients with a 10-year ASCVD risk score of 7.5% or higher had significantly more arterial segments showing stenosis and a 10-year ASCVD risk score of 7%, with maximal plaque thickness⁽¹⁸⁾.

In the study, a statistically significant difference was observed between age, systolic blood pressure, total cholesterol, HDL, LDL, 10-year risk ratio, optimal risk ratio, and lifetime risk ratio when examining the relationship between ASVCD risk calculator, atherosclerosis risk factors, and the menopausal period ($p < 0.05$) (Table 4). In the menopausal period, it was observed that the mean ASCVD calculation parameters were high, except for HDL. Additionally, in the presence of high 10-year risk ratio and optimal risk factors, there was a significant increase in the expected 10-year risk ratio ($p = 0.00001$) (Table 4). At the same time, when the effect of the menopausal period on ASCVD risk factors was examined in the study, it was found that the use of hypertension medication and HDL below 50 mg/dL increased the calculation parameters to a level that would create statistical significance ($p = 0.03$, $p = 0.006$). Considering the protective effect of the female hormone estrogen against atherosclerosis and coronary artery disease, and the decrease in the release of estrogen hormone with menopause, this is an expected result and is similar to the literature⁽¹⁹⁻²⁵⁾.

The consensus recommendations of the European Atherosclerosis Society and the European Federation of Clinical Chemistry and Laboratory Medicine are that the ASCVD risk calculation tool provides guidance in the use of lipoprotein tests and further individualized treatment options, especially for patients at elevated risk of ASCVD⁽¹²⁾. ASCVD is a free tool for assessing and improving individual CVD risk and, therefore, ideal cardiovascular health. In a study conducted by Tekeşin et al. in our country, it was stated that lifestyle intervention using smartphone technology reduced the ASCVD score in one-year follow-up compared to ordinary care alone in patients with high cardiovascular risk⁽²⁶⁾.

Limitations

The first limitation of this study is the relatively small number of patients who were enrolled in a single center. The retrospective design and small sample size are the other limitations of our study.

CONCLUSION

In recent years, nurse-based outpatient clinics have gained attention. These facilities should play an active role in preventing and delaying cardiovascular diseases. Nurses can utilize the ASCVD risk calculation tool to perform individual risk assessments, guide individuals to appropriate healthcare facilities for necessary examinations and treatments and provide education on necessary lifestyle changes. This approach empowers nurses to contribute significantly to cardiovascular health promotion.

Ethics Committee Approval: The study was approved by Başakşehir Çam and Sakura City Hospital Clinical Research Ethics Committee (Decision no: 249, Date: 27.07.2020).

Informed Consent: This is retrospective study, we could not obtain written informed consent from the participants.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept/Design - AÖ; Analysis/Interpretation - AÖ, EK; Data Collection - AÖ, EK; Writing - AÖ, EK; Critical Revision - AÖ, EK; Final Approval - AÖ, EK; Statistical Analysis -AÖ, EK; Overall Responsibility - AÖ.

Conflict of Interest: The authors have no conflicts of interest to declare.

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