Nabız Dalga Hızının Avrupa Kardiyoloji Derneği Koroner Risk Skorlaması ile İlişkisinin Belirlenmesi

Pulse Wave Velocity and ESC SCORE (European Society of Cardiology Systematic Coronary Risk Evaluation)

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ÖZ

GİRİŞ ve AMAÇ: *Nabız dalga hızı kalp damar hastalıklarını ve aterosklerozu önleme açısından klinik kullanımda giderek önem kazanmaktadır. Bu çalışmada nabız dalga hızı ile Avrupa Kardiyoloji Derneği risk skorlaması (ESC SCORE) arasındaki ilişkiler araştırılmış ve kardiyovasküler hastalıkları öngörmedeki rolleri tartışılmıştır.*

YÖNTEM ve GEREÇLER: *Çalışma grubumuza nabız dalga hızı belirlenmiş toplam 713 birey dahil edilmiştir. Çalışmaya alınan bireylerin yaş, cinsiyet, sigara kullanımı, koroner arter hastalığı ve eşdeğeri hastalık mevcudiyeti, hipertansiyon varlığı, kullandığı ilaçlar, ek hastalıklar incelendi. Avrupa Kardiyoloji Derneği Heart-SCORE hesaplayıcısına girilerek hastaların total kardiyovasküler hastalık risk değeri belirlendi. Bu belirteçler ile nabız dalga hızı arasındaki ilişkiler araştırıldı.*

BULGULAR: *713 hastalık tüm grupta nabız dalga basıncı ortalaması 8,86 m/s iken en küçük değer 5,30 m/s, en yüksek değer 17,70 m/s idi. ESC Score açısından ortalama skor 2,55; en küçük değer 0 ve en büyük değer 24 idi. Çalışmaya katılan hastaların nabız dalga hızları ve Avrupa Kardiyoloji Derneği koroner risk skorları arasındaki korelasyon düşük düzey olarak saptandı (r=0,288). KAH / eşdeğeri hastalığı olan ve olmayan gruplar arasındaki ilişki incelendiğinde hem nabız dalga hızı ve hem ESC skorları, hastalığı olanlarda yüksek idi (p<0,001).*

TARTIŞMA ve SONUÇ: *Nabız dalga hızı ve ESC skoru arasında düşük düzey anlamlı korelasyon mevcuttu. Çalışmamız, kardiyovasküler hastalık öngördürücüsü olarak arteryel sertlik parametrelerinin rolüne dair yeni kanıtlar ortaya koymuştur..*

Anahtar Kelimeler: : *vasküler sertlik, nabız dalga hızı, kardiyovasküler hastalık*

ABSTRACT

INTRODUCTION: *Pulse wave velocity has become increasingly important in clinical use for the prevention of cardiovascular disease and atherosclerosis. In this study, we have investigated the relationship between pulse wave velocity with European Society of Cardiology Systematic Coronary Risk Evaluation (ESC Score) and discussed their roles for cardiovascular diseases (CVD).*

METHODS: *713 individuals followed at our outpatient clinic were included in this study. The patients' age, gender, smoking, history of coronary artery disease and equivalent disease, hypertension, drug regimens, additional diseases were recorded. Pulse wave velocities were measured using an arteriograph (Tensiomed). Online ESC-Score calculator was used to determine total cardiovascular disease risk. The relationship between scores and pulse wave velocity were investigated.*

RESULTS: *The mean of pulse wave velocity was 8.86 m/s of whole group, while the minimum and maximum values were 5.30 m/s and 17.70 m/s, respectively. Mean ESC Score was 2.55; as the minimum value 0 and the maximum value 24. Correlation between pulse wave velocity and the ESC Score was found to be low (r=0.288). In comparison between the groups with and without CVD, pulse wave velocity and the ESC scores were higher in patients with the disease (p<0.001).*

DISCUSSION AND CONCLUSION: *Pulse wave velocity and ESC score has significant but low correlation. Our study supports that pulse wave velocity may be determined as an indication for subclinical atherosclerotic disease.*

Keywords: *vascular stiffness, pulse wave analysis, cardiovascular disease*

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INTRODUCTION

Cardiovascular diseases (CVD) are already one of the major causes of mortality and morbidity among the world. According to World Health Organization, 17.7 million people die due to cardiovascular diseases every year, as 31% of all deaths (1). According to 2030 projections; estimated mortality due to CVD will be 23.3 million people and still the number one cause of death (2). In a study from Turkey, CVD mortality rates were reported as 44% in males, 52% for females and 48% for total population (3).

A remarkable rate of cardiovascular disease-related mortality and morbidity can be reduced with community-based, accessible, cost-effective methods (4-6). In this context, it is convenient to ensure protection and recommendations for cardiovascular disease with the evaluation of risk factors. A number of methods have been developed for total cardiovascular disease risk prediction; all with advantages and limitations. One of the most commonly used risk score is European Society of Cardiology SCORE (Systematic Coronary Risk Evaluation).

SCORE is based on 12 prospective studies in 11 European countries with a population of 205.000 individuals with 2.1 million person-years follow-up (7). SCORE charts are available for high and low-risk countries for Europe. This scheme predicts 10 year cardiovascular (not just coronary) risk of death due to CVD. Also, the scheme can be calibrated for the each country that has mortality statistics and the prevalence of CVD.

Arterial stiffness defines the viscoelastic properties of the vessel wall. Increase in aortic stiffness that commonly occur in the vascular system is a sign of atherosclerotic involvement (8,9). In many studies arterial stiffness has been shown to be an indicator of coronary artery disease (CAD), cerebro-vascular disease and peripheral arterial disease (9-11).

New researches for the development of early diagnostic methods are ongoing for the prevention of cardiovascular disease and atherosclerosis. Among them; arteriyel stiffness measurement provided some new parameters for early detection of cardiovascular diseases. Thus, pulse wave velocity is considered the most powerful parameter for arterial stiffness period (12). In this study, we aimed to investigate the relationship between pulse wave velocity and ESC SCORE.

MATERIAL AND METHODS

Local Ethics Committee of Gulhane Training and Research Hospital approved the present study with the date of 02.01.2013 and number 1491-38-13/1648.4-69. There was no informed consent due to retrospective nature of the study.

Study group selection and evaluation

This retrospective study included 713 patients followed as outpatient or inpatient between January 2013 - January 2014 in Gulhane Training and Research Hospital. Exclusion criteria of the study were: individuals younger than 18 years old and older than 85 years old, patients with previously known malignant disease, hypo/hyperthyroidism, systemic vasculitis (systemic lupus erythematosus, Behçet's disease, Churg-Strauss syndrome, giant cell arteritis/temporal arteritis, Wegener's granulomatosis, Henoch-Schönlein purpura, microscopic polyangiitis, polyarteritis nodosa, Takayasu arteritis, Buerger's disease etc.), and systemic rheumatological diseases (rheumatoid arthritis, spondyloarthropathies, Sjogren's syndrome, scleroderma etc).

Patients were evaluated for age, gender, smoking, presence of CAD and equivalent disease, hypertension, drug regimens, and additional diseases. Laboratory tests which are necessary for the calculation of ESC score; LDL cholesterol, HDL and total cholesterol extracted from the recorded data.

Blood pressure measurement

Blood pressure measurement performed with a mercury manometer in a sitting position on the right arm after resting of at least 10 minutes. It was done twice at an interval of two minutes. If significant differences between the first two measurements formed, additional measurements were performed.

Arterial Stiffness Measurement

In the measurement of arterial stiffness Tensiomed arteriography was used. The measurement performed resting after at least 5 minutes and no smoking or caffein in the last 30 minutes, in a quiet room without outside stimuli and in a sitting position. Systolic pressure, diastolic pressure, mean blood pressure, pulse rate, pulse

pressure, pulse wave velocity, augmentation index (AIx) and central aortic pressure was measured.

Determining ESC SCORE

The data collected from the date of birth / age, sex, systolic blood pressure, cholesterol, HDL cholesterol, smoking status were entered to online ESC-SCORE calculator and determined total cardiovascular disease risk of patients.

Statistical Analysis

For statistical evaluation of the data; microprocessor commercial statistical software (SPSS ver.15.0, SPSS Inc, Chicago, Illinois, USA) was used. P value of <0.05 was considered statistically significant.

Descriptive statistics were performed for the group. Independent samples t test, Mann-Whitney U test and chi-square test were used for the comparisons. Normality of distributions were assessed by Kolmogorov-Smirnov test. Pearson correlation analysis was used for correlation analysis due to large number of patients. Low level correlation was referred to r <0.25, moderate correlation was referred to 0.25 <r <0.75, high level of correlation was defined to r> 0.75 for correlation values (r) which were significant (p <0.05).

Individuals with and without CVD are investigated for the relationships with ESC SCORE and pulse wave velocity. Parameters of ESC SCORE were separately analyzed for the correlation with pulse wave velocity.

RESULTS

General characteristics of patients participating in the study and descriptive results

The present study included 713 patients referred to our clinic between the ages of 18-85. 61.9% of the group (n=441) had hypertension, 18% (n=128) patients had diabetes, 12.1% (n=86) had impaired fasting glucose, 2.5% (n=18) had impaired glucose tolerance, 1.1% (n=8) had impaired fasting glucose plus impaired glucose tolerance; and 66.3% (n=473) were healthy. The other diseases were as; 13.5% (n=96) coronary artery disease, 0.3% (n=2) previous history of stroke, 1.8% (n=13) peripheral artery disease and 3.2% (n=23) kidney disease. General characteristics of patients participating in the study are presented in Table 1.

Table 1. General characteristics of individuals participating in the study.

General Features	Men (n = 342)	Women (n =371)	All group (n=713)	P
Pulse wave velocity (m/s)	8.78 ± 1.78	8.94 ± 1.84	8.86 ± 1.81	0,148
ESC Score	3.86 ± 4.12	1.36 ± 1.85	2.55 ± 3, 38	<0,001*
Age (years)	51.15 ± 12.78	52.68 ± 11.616	51.95 ± 12.20	0,072
Systolic blood pressure	135.07 ± 18.42	139.33 ± 22.05	137.29 ± 20.48	0.01*
Non-smoker	45.6% (n=156)	20.2% (n=75)	32.4% (n = 231)	<0,001*
LDL-cholesterol	126.51 ± 39.33	131.72 ± 37.352	12 9.23 ± 38.37	0,047*
HDL-cholesterol	44.31 ± 10.26	53.63 ± 12.81	49.16 ± 12.54	<0,001*
Total cholesterol	202.12 ± 45.34	213.67 ± 44.68	208.18 ± 45.33	<0,001*

Significant difference between men and women
ESC Score European Society of Cardiology Systematic Coronary Risk Evaluation, HDL High Density Lipoprotein LDL Low Density Lipoprotein m/s meter/second

There was not significant difference between males and females for age and pulse wave velocity. Smoking rate of males was significantly higher (p<0.001) compared to females. Systolic blood pressure values, LDL cholesterol, HDL cholesterol and total cholesterol levels were significantly higher in females than in male patients. Mean of ESC scores of males was higher than females (p<0.001). In the entire group of 713 individuals; pulse wave velocity's mean value was 8.86 m/s, while the minimum value 5.30 m/s, the maximum value 17.70 m/s, median 8.60 m/s, respectively. ESC Score's mean was 2.55; the minimum value was 0, the maximum value was 24 and the median value was 1.

The relationship between pulse wave velocity and ESC score for the patients without CVD

The correlation analysis between ESC Score and pulse wave velocity pointed out moderate low correlation (r=0.257) after extraction of CVD diagnosed patients (Table 2). Within the ESC Score parameters; age and systolic blood pressure had higher correlation; while cholesterol parameters was found to have lower correlation. There was no significant correlation between pulse wave velocity with HDL cholesterol (p=0.900).

Table 2. *The relationship between pulse wave velocity and ESC score for the patients without CVD.*

Correlation table (in patients without CVD)		PWVao (M/S) MEN	PWVao (M/S) WOMEN	PWVao (M/S) ALL PATIENTS
ESC Score	r	0,348	0,310	0,257
	p	<0,001	<0,001	<0,001
	n	211	292	503
Age	r	0.279	0.452	0,390
	p	<0,001	<0,001	<0,001
	n	212	292	504
LDL	r	-0.015	0,224	0,125
	p	0.833	<0,001	0,005
	n	209	290	499
HDL	r	-0.056	-0.031	-0.006
	p	0,422	0.599	0,900
	n	211	291	502
TC	r	0,012	0.246	0.155
	p	0.863	<0,001	<0,001
	n	211	291	502
Systolic Blood Pressure	r	0.296	0.443	0.393
	p	<0,001	<0,001	<0,001
	n	212	292	504

ESC Score European Society of Cardiology Systematic Coronary Risk Evaluation, HDL High Density Lipoprotein LDL Low Density Lipoprotein m/s meter/second, PWVao Pulse wave velocity, TC total cholesterol.

DISCUSSION

ESC SCORE aims to predict CVD risk for apparently healthy individuals. If an individual had a cardiovascular event or had already diagnosed with CVD, strict follow up and treatment would have been administrated.

There are studies in the literature reporting the relationship between pulse wave velocity and atherosclerotic disease. In a study conducted by Pereira et al. in Portugal population, pulse wave velocity appeared to be an independent parameter and by adding this as a risk factor to SCORE will improve predicting CVD risk (13). Sehesdedt et al. demonstrated that pulse wave velocity over 12m/s increases CVD risk independently of the SCORE and addition this to SCORE would increase the risk prediction (14). A comprehensive meta-analysis including 16 studies with 17,635 patients, determined that pulse wave velocity was an additional risk factor for cardiovascular risk; and they showed that the efficiency increases with medium risk patients and young individuals in particular (15). For our correlation results; our study supports that pulse wave velocity may be determined as an indication for subclinical atherosclerotic disease rather than an independent risk factor.

In patients without CVD, the correlations were found significantly but low. Thus, our study also has shown that we can not use pulse wave velocity to estimate ESC scores for healthy individuals. Also we demonstrated that hypertension increases both ESC score and PWVao. This effect of hypertension is proved by numerous studies in the literature. Meanwhile, the risk of hypertension for cardiovascular diseases as pulse wave velocity and ESC score has been shown in our present study.

Previously studies pointed out pulse wave velocity, augmentation index and central aortic pressure's prognostic importance for evaluation of hypertension, diabetes, end-stage renal failure and aging. Will Hansen et al.'s epidemiological study of general population designated that the increase in pulse wave velocity increase the risk of CVD and associated with increased mortality (16). Framingham Heart Study showed higher pulse wave velocity results not only as more risk, but also higher mortality in patients with ischemic heart disease (17). Wilson et al. noticed that, arterial stiffness is predictor of all-cause mortality related to CVD in patients with hypertension (18). Vlachopoulos et al. reported that, with a 1m/s increase or one standard deviation increase in pulse wave velocity, 10% and a 40% increase occurred for CVD mortality (19). In a recent study by Kim et al, arterial stiffness is shown as an independent predictor for risk of mortality in patients with type 2 diabetes mellitus (20). After all, this current study presented that pulse wave velocity may be determined as an indication for subclinical atherosclerotic disease rather than an independent risk factor in Turkish population.

In the literature, there are studies with different scoring systems showing correlation with the pulse wave velocity. G. F. Mitchell et al.'s Framingham heart study consisting of 2,232 patients with 7.8 years follow-up concluded that high pulse wave velocity increases the risk of cardiovascular disease by 48%, and also increases the mortality rate due to cardiovascular events (21).

There are some limitations in our study. The first could be that filling patient information form/taking history from patients were made by different doctors and CVD diagnosis recorded into form with patient history only. The second may be that the drugs which might have effects on arterial stiffness and pulse wave velocity have not been taken into account.

In conclusion; our study revealed that pulse wave velocity may be determined as an indication for

subclinical atherosclerotic disease rather than an independent risk factor. In this regard prospective cohort studies with CVD end-point and longer follow-up time are needed in particular in the population of Turkey.

The clinical use of arterial stiffness parameters may increase with prospective new studies by taking into consideration of the differences in measurement techniques and the drug effect on pulse wave velocity and arterial stiffness.

Conflicts of interest: The authors declare that there are no conficts of interest.

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