Decreased Arterial Elasticity Assessed by Pulse Wave Velocity in Patients with Behçet's Disease

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ABSTRACT

Introduction: Behçet's disease (BD) is a rare chronic disorder. The predominant histopathological lesion is vasculitis. Pulse wave velocity (PWV) is a marker of aortic stiffness and inversely related to arterial distensibility, elasticity, or relative arterial compliance. The aim of the present study was to investigate the arterial elasticity using PWV in patients with BD.

Patients and Methods: A total of 25 patients with BD (21 male) and 21 healthy subjects (10 male) without known traditional cardiovascular risk factors, such as hypertension, diabetes mellitus, and hyperlipidemia, were studied. The mean time of disease duration was 3.6 ± 2.5 (1-10) years. Arterial elasticity was assessed by automatic carotid-femoral (aortic) PWV measurement by the Complior Colson (France) device. PWV is calculated by the following formula: Pulse wave velocity (m/s) = distance (m)/transit time (s).

Results: The carotid-femoral (aortic) PWV (10.66 ± 1.74 vs. 8.16 ± 0.84 m/s) and diastolic blood pressure (79.00 ± 10.10 vs. 73.33 ± 8.11 mmHg) were higher in patients with BD than in the control groups ($p< 0.001$ and $p= 0.03$, respectively). A significant correlation was found between PWV and age, diastolic blood pressure, and mean blood pressure in the studied group ($p< 0.001$, $r= 0.56$; $p= 0.02$, $r= 0.32$; and $p= 0.03$, $r= 0.31$, respectively).

Conclusion: Arterial elasticity assessed by carotid-femoral (aortic) PWV, an indicator of arterial stiffness and atherosclerosis, is lower in patients with BD than in healthy controls.

Key Words: Behçet's disease; pulse wave velocity

Behçet Hastalığında Nabız Dalga Hızı Aracılığı ile Değerlendirilen Azalmış Arteriyel Elastisite

ÖZET

Giriş: Behçet hastalığı, nadir görülen kronik bir hastalıktır. Başlıca histopatolojik lezyonu vaskülittir. Nabız dalga hızı aortik sertliğin göstergesi olup arteriyel distansibilite, elastisite ve göreceli arteriyel kompliyansla ters yönde ilişkilidir. Mevcut çalışmada; Behçet hastalığına sahip hastalarda nabız dalga hızı aracılığı ile ölçülen arteriyel elastisite araştırılmıştır.

Hastalar ve Yöntem: Daha önce bilinen hipertansiyon, diabetes mellitus, hiperlipidemi gibi geleneksel kardiyovasküler risk faktörü olmayan 25 (21 erkek) Behçet hastası ve 21 (10 erkek) sağlıklı birey çalışmaya alındı. Ortalama hastalık süresi 3.6 ± 2.5 (1-10) yıldı. Arteriyel elastisite, otomatik olarak karotis-femoral (aortik) nabız dalga hızı aracılığıyla Complior Colson (Fransa) cihazı ile değerlendirildi. Nabız dalga hızı; Nabız dalga hızı (m/s) = mesafe (m)/ilerleme zamanı (s) formülü ile hesaplandı.

Bulgular: Karotis-femoral (aortik) nabız dalga hızı (10.66 ± 1.74; 8.16 ± 0.84 m/s) ve diyastolik kan basıncı (79.00 ± 10.10; 73.33 ± 8.11 mmHg) kontrol grubuna göre Behçet hastalığında daha yüksek bulundu (sırası ile $p< 0.001$, $p= 0.03$). Sadece nabız dalga hızı ile yaş, diyastolik kan basıncı ve ortalama kan basıncı arasında anlamlı korelasyon saptandı (sırası ile $p< 0.001$, $r= 0.56$; $p= 0.02$, $r= 0.32$; $p= 0.03$, $r= 0.31$).

Sonuç: Arteriyel sertlik ve aterosklerozun bir belirteci olan karotis-femoral (aortik) nabız dalga hızı aracılığı ile değerlendirilen arteriyel elastisite sağlıklı kontrollere göre Behçet hastalığında azalmış olarak bulunmuştur.

Anahtar Kelimeler: Behçet hastalığı; nabız dalga hızı

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INTRODUCTION

Behçet's disease (BD) is a chronic, multisystem disorder producing ulcers that affect the mouth and genitals, skin lesions, and uveitis[1]. In some people, deep vein thrombosis, arterial thrombosis, arterial aneurysm, and increased arterial stiffness may be seen in clinical practice[2]. The predominant histopathological lesion is vasculitis where the vessel wall is infiltrated by neutrophils, lymphocytes, and monocytes in BD[3]. Vasculitis may involve the arteries and veins of all sizes.

Pulse wave velocity (PWV) is an index of arterial stiffness and inversely related to arterial distensibility, elasticity, or relative arterial compliance[4]. It is associated with inflammation and major cardiovascular risk factors, including hyperlipidemia, hypertension, and diabetes mellitus[4-6]. The measurement of PWV using carotid-femoral (aortic) artery is generally accepted as the gold standard method to determine aortic stiffness and arterial elasticity. The aim of the present study was to investigate the arterial elasticity in patients with BD by PWV.

PATIENTS and METHODS

Our cross-sectional study consisted of 25 patients with BD (21 male) who were diagnosed by the criteria of the Annual European Congress of Rheumatology and 21 healthy subjects (10 male)[7]. All of the patients were inactive during the investigation. If a patient has no any sign of mouth ulcer, genital ulcer, erythema nodosum, active neurologic involvement, and active gastrointestinal involvement, and so on, the patient was classified as inactive.

Exclusion criteria were a history of myocardial infarction, congestive heart failure, peripheral arterial disease, carotid artery disease, renal failure (plasma creatinine > 1.8 mg/dL), arterial hypertension, insulin-dependent diabetes mellitus, non-insulin-dependent diabetes mellitus, atrial fibrillation, hyperlipidemia, valvular heart disease, presence of anemia (hematocrit < 35%), obesity with body mass index > 35 kg/m^2, and waist-hip ratio > 1.

None of our patients were treated with beta-blockers, statins, calcium channel blockers, hormone replacement therapy, diuretics, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, and nitrates. The study was approved by the hospital ethical committee. Consent was obtained from all subjects for inclusion in the study. PWV and blood pressure (systolic, diastolic, pulse pressure, and mean blood pressure) were measured at the office, in compliance with the European Society of Cardiology (ESC) and the European Society of Hypertension guidelines, using a mercury sphygmomanometer with a cuff appropriate to the arm circumference, in patients at rest with a minimum of 20 min (Korotkoff I for systolic pressure and V for diastolic pressure)[8].

Pulse pressure = Blood pressure (Systolic–Diastolic); Mean blood pressure = Systolic blood pressure/3+2xDiastolic blood pressure/3.

Arterial elasticity is measured by automatic carotid-femoral (aortic) PWV. The technical specification of this device has been described[4]. PWV along the aorta can be measured with two ultrasound or strain-gauge transducers non-invasively using a TY-306 Fukuda pressure sensitive transducer (Fukuda, Tokyo, Japan) fixed transcutaneously over the course of a pair of arteries separated by a known distance: the right femoral and right common carotid arteries. Measurement was repeated over 10 different cardiac cycles, and the mean value was used for the final analysis.

PWV is calculated from measurements of pulse transit time and the distance (the distance between two recording sites includes right femoral and right common carotid arteries measured on the surface of the body in meters) traveled by the pulse between two recording sites according to the following formula: PWV (m/s) = distance (m)/transit time (ms).

Statistical Analysis

Statistical data were obtained using the SPSS version 8.0 program (Chicago, IL, USA). All values were expressed as mean ± standard deviation. The Spearman test was used to calculate correlations. The Mann Whitney U test was used to assess the obtained results. A p value < 0.05 was accepted as statistically significant.

RESULTS

The mean time of disease duration was 3.6 ± 2.5 (1-10) years. Patients with BD had higher carotid-femoral (aortic) PWV [10.66 (1.74) vs. 8.16 (0.84 m/s)] and diastolic blood pressure [79.00 (10.10) vs. 73.33 (8.11) mmHg] than those with the control groups (p< 0.001 and p= 0.03, respectively) (Table 1).

No significant difference was detected in age, height, weight, body mass index, waist, hip, waist/hip ratio, systolic blood pressure, mean blood pressure, pulse pressure, and heart rate between the two groups (p> 0.05) (Table 1). A significant correlation was found only between PWV and age, diastolic blood pressure, and mean blood pressure in the studied group (p< 0.001, r= 0.56; p= 0.02, r= 0.32; and p= 0.03, r= 0.31, respectively).

Table 1. Basic data and hemodynamic values in control subjects and patients with Behçet's disease

Parameters	Behçet's disease	Healthy controls	p
Age (years)	39.0 ± 10.5	35.3 ± 9.1	0.18
Weight (kg)	74.28 ± 10.24	70.09 ± 14.01	0.31
Height (cm)	170.80 ± 8.82	166.52 ± 9.06	0.10
BMI (kg/m^2)	25.42 ± 2.79	25.16 ± 4.17	0.60
Waist (cm)	85.80 ± 8.05	86.19 ± 11.03	0.68
Hip (cm)	97.04 ± 5.98	98.95 ± 6.69	0.13
Waist/hip	0.87 ± 0.01	0.87 ± 0.02	0.55
SBP (mmHg)	119.40 ± 14.01	114.04 ± 12.90	0.20
DBP (mmHg)	79.00 ± 10.10	73.33 ± 8.11	**0.03**
MBP (mmHg)	92.16 ± 11.11	86.66 ± 8.01	0.05
Pulse pressure (mmHg)	40.40 ± 6.75	39.76 ± 10.66	0.71
Heart rate (bpm)	76.00 ± 11.48	74.95 ± 10.53	0.93
PWV (m/s)	10.66 ± 1.74	8.16 ± 0.84	**< 0.001**

BMI: Body mass index, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, MBP: Mean blood pressure, PWV: Pulse wave velocity.

DISCUSSION

In the present study, arterial elasticity was assessed by carotid-femoral (aortic) PWV, an indicator of arterial stiffness. A noteworthy decline has been detected in patients with BD when compared with healthy controls. Although the underlying mechanisms of vascular disease in BD are unclear, the predominant histopathological lesion is vascular inflammation that is related with endothelial cell injury and increases the risk of thrombosis.

Increased arterial stiffness or decreased arterial elasticity is associated with inflammation that is related with vascular fibrosis and smooth muscle cell proliferation[9]. Decreased myocardial oxygen supply and increased left ventricular afterload are closely related to aortic pressure. Further progress in myocardial ischemia is a result of increased arterial stiffness that is related to increased carotid-femoral PWV or decreased arterial elasticity.

Atherosclerotic cardiovascular disease, which is still one of the leading causes of death in our country and worldwide, is a result of the complex pathological process of thickening of the vessel wall. This process could be defined in different levels in some non-invasive techniques, including carotid-femoral (aortic) PWV, which is defined as the arterial pulse's velocity of moving along the vessel wall, as an indicator of arterial stiffness, plays an important clinical role in describing patients under high cardiovascular risk, including hypertension, chronic renal disease, hyperlipidemia, peripheral arterial disease, and diabetes mellitus[4,9]. PWV is negatively correlated with arterial elasticity and relative arterial compliance[4].

Age is the most important factor that contributes to increased aortic PWV in our study. At the same time, many studies have investigated the effects of different factors, such as sex, weight, height, blood pressure, heart rate, inflammatory markers, such as C-reactive protein, and also age on PWV[4,10-12]. Since the most important factor is age, decrease arterial elasticity caused by decrease in elastin fiber and increase in collagenous material are related with advanced age[4]. Normally, the total elastin and collagen protein levels are almost the same in all parts of the aortic wall.

As age progresses, endothelial dysfunction and increased arterial media calcification lead to alteration of the extracellular matrix. In this process, smooth muscle cell proliferation and synthesis of structural proteins, including collagen, increase[4]. Another important factor is blood pressure, especially systolic blood pressure level by age. PWV also depends on that becomes increased at high blood pressure and decreased at low blood pressure.

In our study, positive correlations were found between PWV and diastolic and mean blood pressure[4,10-13]. Reduced arterial elasticity in increased blood pressure appears to be caused by structural changes, including smooth muscle hypertrophy, changes of extracellular matrix, and increased collagen levels of the vessel wall[14].

In conclusion, arterial elasticity assessed by carotid-femoral (aortic) PWV, a marker of atherosclerosis, is lower in patients with BD than in healthy controls.

Study Limitations

Our study has limitations. First, patients with active BD and known atherosclerotic cardiovascular disease or risk factors, such as a hyperlipidemia, heart valve disease, aortic aneurysm, choric renal disease, peripheral arterial disease, cerebrovascular disease, previous myocardial infarction, and diabetes mellitus, were excluded from the study. Second, the number of cases in the present study is relatively small. Therefore, the study should be confirmed by a large sample size.

CONFLICT of INTEREST

The authors reported no conflict of interest related to this article.

AUTHORSHIP CONTRIBUTIONS

Concept/Design: MB

Analysis/Interpretation: UA

Data Acquisition: UA

Writting: MB

Critical Revision: MB

Final Approval: All of authors.

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