



Araştırma/Research

Is there any association between ABO blood types and slow coronary flow?

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Abstract

Aim: Slow coronary flow (SCF) is defined as a microvascular disorder characterized by slow advance of the contrast material administered during angiography, despite absence of epicardial coronary artery occlusion and delayed opacification of distal vascular structures. Genetically inherited ABO blood types are presumed to play role in coronary artery disease. In this study, the relationship between SCF and ABO blood types was investigated.

Methods: The study was designed as a retrospective study, and included 250 cases that underwent coronary angiography procedure in our center between 2016 January and 2018 December (one hundred and twenty five cases of SCF and 125 cases of normal coronary angiogram). ABO blood types were determined using standard agglutination techniques in both study groups. Blood types were compared between both subject groups.

Results: The frequency of blood type A was increased among patients with SCF in comparison with control subjects ($p<0.001$). High density lipoprotein cholesterol was increased in SCF group ($p<0.001$). Triglyceride, total cholesterol and low density lipoprotein cholesterol levels were increased in the SCF group when compared to controls ($p=0.003$, $p<0.001$, and $p<0.001$, respectively).

Conclusion: This study demonstrated that blood group A may be an increased risk for SCF.

Keywords: ABO blood types, slow coronary flow.

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Kan grupları ve koroner yavaş akım arasında herhangi bir ilişki var mı?

ÖZET

Amaç: Yavaş koroner akım (YKA), epikardiyal koroner arter tıkanıklığı olmamasına rağmen, anjiyografi sırasında uygulanan kontrast maddenin yavaş ilerlemesi ve distal vasküler yapıların gecikmeli opaklaşması ile karakterize bir mikrovasküler bozukluk olarak tanımlanmaktadır. Genetik olarak taşınan ABO kan gruplarının koroner arter hastalığında rol oynadığı varsayılmaktadır. Bu çalışmada YKA ve ABO kan grupları arasındaki ilişki araştırıldı.

Gereç ve yöntemler: Çalışma retrospektif bir çalışma olarak tasarlandı ve merkezimizde Ocak 2016 - Aralık 2018 tarihleri arasında koroner anjiyografi prosedürü uygulanan 250 vaka (125 YKA hastası ve 125 normal koroner anjiyogram vakası) çalışmaya dahil edildi. Her iki çalışma grubunda da ABO kan tipleri standart aglutinasyon teknikleri kullanılarak belirlendi. Her iki grup arasında kan tipleri karşılaştırıldı.

Bulgular: YKA hastalarında A kan grubu sıklığı kontrol grubuna kıyasla artmıştı ($p<0.001$). Kontrol grubunda yüksek dansiteli lipoprotein kolesterol artmıştı ($p<0.001$). Kontrol grubuna kıyasla trigliserit, total kolesterol ve düşük dansiteli lipoprotein kolesterol düzeyleri YKA grubunda artmıştı ($p=0.003$, $p<0.001$, $p<0.001$, sırasıyla).

Sonuç: Bu çalışma, A kan grubunun YKA için artmış bir risk olabileceğini ortaya koydu.

Anahtar sözcükler: ABO kan grupları, yavaş koroner akım

INTRODUCTION

SCF is a clinical condition categorized by slow advance of the administered contrast material within epicardial arteries without any angiographic sign of arterial occlusion (1). SCF has been shown to cause chest pain during exercise or at rest and the pathophysiology of SCF is still not clear. Currently, endothelial dysfunction, microvascular and vasomotor dysfunction, and increased thrombotic and inflammatory activities are believed to be possible contributors to this condition (2-4). Several studies have documented the presence of myocardial ischemia with non-invasive tests in patients with SCF (5,6).

ABO blood type antigens are made of glycoproteins that are abundant on platelets, vascular endothelial cells, and erythrocytes (7). Multiple reports have demonstrated an association between ABO blood types and cardiovascular disease (8-10). It is well known that genetics can cause coronary artery disease. Since ABO blood types are genetically inherited, they may be involved in cardiovascular disease development.

In this retrospective case control study, the effect of ABO blood types on SCF was examined

METHODS

Study Design and Study population

A total of 250 subjects that underwent coronary angiography in our clinic between 2016 January and 2018 December were enrolled in the study. Angiographic images were evaluated retrospectively. One hundred and twenty five patients, who had SCF during angiography, were included in the study. One hundred and twenty five subjects, who had normal coronary arteries were designated the control group. Clinical and laboratory information including age, sex, diabetes mellitus (DM), blood pressure, smoking status, height, body weight, ABO blood type, and lipid profile were retrieved from the medical records. Echocardiography findings were obtained from medical records. Left ventricular ejection fraction measured by simpson method. The study exclusion criteria were presence of lung or liver disease, chronic kidney disease, heart disease, infection, and hematological disease or systemic rheumatoid disease. This study was accepted by the ethics committee and carried out with the guidelines put forth by the Declaration of Helsinki.

Laboratory parameters

A peripheral venous blood sample was collected from the antecubital vein before coronary angiography at our center. ABO blood typing was performed using a hemagglutination technique (Biostest, Germany) according to the manufacturer's protocol. HDL-C, TG, LDL-C, and TC levels were analyzed using an Abbott Architect C16000 analyzer (Abbott Laboratory).

TIMI Frame Count for Diagnosis of SCF

Coronary angiography was achieved using the femoral approach and the angiograms were examined for SCF. Assessment of SCF was done by two independent blind observers and TIMI frame count used for diagnosis of SCF (11). The mean values for coronary arteries visualization frames were, 22.2 ± 4.1 for LCx, 36.2 ± 2.6 for LAD and 20.4 ± 3 for RCA.

Statistical analysis:

The SPSS, v 22.0, statistical program (Chicago, USA) was used. Numerical and Categorical variables were given as mean \pm SD and percentage, respectively. For numerical variables, statistical analyses were made with independent samples using t-test/Mann-Whitney U-test. For categorical variables, chi-square test or Fisher's exact test was used. A p-value <0.05 was considered statistically significant.

RESULTS

Baseline demographic, laboratory and echocardiographic findings of groups are shown in Table 1. Age, gender, BMI, smoking status, DM, systolic/diastolic blood pressures were similar in both groups ($p>0.05$ for all). High density lipoprotein cholesterol (HDL-C) was higher in control group than SCF group ($p=0.003$). Low density lipoprotein cholesterol (LDL-C), triglyceride (TG) and total cholesterol (TC) were elevated in SCF group as compared to the controls ($p=0.003$, $p<0.001$, $p<0.001$, and $p<0.001$, respectively).

Table 1. The demographic, laboratory and echocardiographic findings of groups

Variables	SCF group (n=125)	Control group (n=125)	P value
Age (years)	51,0 \pm 7,2	51,3 \pm 7,6	0,793
Gender, male n %	99(79,2)	102(81,6)	0,633
BMI (kg/m ²)	25,9 \pm 3,0	25,7 \pm 3,1	0,719
Diabetes mellitus n (%)	11(8,8)	7(5,6)	0,328
Smoking n (%)	46(32,8)	41(36,8)	0,507
Systolic BP (mmHg)	128,9 \pm 6,2	125,4 \pm 11,2	0,169
Diastolic BP (mmHg)	74,8 \pm 5,9	72,4 \pm 5,5	0,621
LVEF (%)	60,0 \pm 3,6	62,1 \pm 3,2	0,883
LDL-C (mg/dl)	141,5 \pm 31,2	83,1 \pm 19,3	<0,001
HDL-C (mg/dl)	42,10 \pm 10,0	38,4 \pm 10,7	0,003
TC (mg/dl)	220,8 \pm 30,3	148,1 \pm 20,9	<0,001
TG (mg/dl)	179,7 \pm 74,0	130,7 \pm 61,5	<0,001

BMI, body mass index; BP, blood pressure; left ventricle ejection fraction; LDL-C, Low density lipoprotein cholesterol; HDL-C, High density lipoprotein cholesterol; TG, triglyceride; TC, total cholesterol.

The frequencies of ABO blood types in the study groups are shown in Table 2. The frequency of blood type A was increased compared in the SCF group in comparison to the control subjects ($p<0.001$). No difference regarding the frequency of non-A blood types for the group comparison ($p>0.05$ for all).

Table 2. The frequencies of ABO blood types of groups

	SCF group (n=125)	Control group (n=125)	P value
A, n %	56(44,8)	29(23,2)	<0.001
B, n %	20(16,0)	35(28,0)	0,168
AB, n %	33(26,4)	46(36,8)	0,266
O, n %	16(12,8)	15(12,0)	0.844

DISCUSSION

The association between SCF and ABO blood types were investigated in the present study. An association was found between blood type A and SCF. Recently, several studies examined the relationship between ABO blood types and coronary artery disease, and showed that non-A blood groups were associated with CAD (12,13). The present study is the first study to examine the association between SCF and ABO blood types.

SCF is responsible for nearly 7.0% of all cases undergoing coronary angiography due chest pain and suspicion of CAD (14). Cardiac functions are compromised in the case of SCF. Patients with SCF have been shown to have abnormalities of ventricular diastolic function, subclinical atherosclerosis, ventricular conductance disturbances, cardiac autonomic dysfunction, and increased ventricular arrhythmia (15-18). Patients with SCF have increased cardiac mortality and morbidity (19). Several studies have shown an important role of increased inflammatory activity in pathophysiology of cardiovascular disease and arrhythmia (20). Increased inflammatory activity has also been documented in patients with SCF. The pathogenic mechanism regarding the association between blood type A and SCF may involve various causes. The ATP Binding Cassette 2 (ABCA2) gene and the ABO gene are both located on chromosome 9q34. In parallel with this information, this study showed significantly increased levels of LDL, TG, and TC among patients with SCF, whom have significantly higher frequency of blood type A compared to the control group. The high cholesterol levels might play role in development of microvascular disease, which is responsible for pathogenesis of SCF. Blood type antigen A is expressed not only on the red blood cells but also on other cells such as platelets and vascular endothelial cells [7]. In addition, non-O blood types have high plasma levels of von Willebrand factor, which increase the risk of vascular thrombosis. As

conclusion, increased thrombotic activity and microvascular disease in the case of blood types A might be responsible for development of SCF. Some genetic studies have defined ABO gene as an important site for LDL cholesterol metabolism and the inflammatory biomarkers ICAM-1, E-selectin, and P-selectin. These molecules play active roles in hemostasis and inflammation. Blood type antigen A may modulate the risk of SCF by influencing the levels of hemostasis and inflammatory proteins in circulation.

Major limitations of the present study are its single-centered design and the few numbers of patients. Another limitation is that inflammatory markers and hemostasis markers were not measured

In conclusion, this study findings suggest that blood type A may pose an increased risk for SCF. However to investigate the association between ABO blood types and SCF, largescale, multi-centered studies that correlate ABO genotypes with hemostatic and inflammatory markers are required.

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