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Are Abo Blood Groups Associated with Aortic Stenosis?

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ABSTRACT

Objective: This study aimed to explore the association between ABO blood groups and aortic stenosis (AS), a progressive cardiovascular condition. Given the role of ABO blood group antigens in modulating coagulation and endothelial function, the study sought to determine if these genetic variations contribute to AS development or progression.

Methods: A retrospective, cross-sectional study was conducted between January 2005 and October 2023, involving 50 patients diagnosed with AS and 50 age- and sex-matched controls with normal coronary angiography. ABO blood group distribution, clinical characteristics, and serum lipid levels were analyzed. Statistical analysis was performed using SPSS, with p-values <0.05 considered significant.

Results: No significant differences were found in ABO blood group distribution between the AS and control groups ($p = 0.864$). Additionally, no associations were observed between ABO blood groups and clinical risk factors, including coronary artery disease and serum lipid levels. The distribution in both groups deviated slightly from the expected frequencies in the Turkish population, with blood group A being more prevalent in the AS group.

Discussion: The findings suggest that ABO blood groups do not directly influence the pathogenesis of AS. However, regional variation in blood group distribution and the complex nature of AS highlight the need for further studies with larger sample sizes. Other genetic, environmental, and pathological factors likely contribute more significantly to AS development.

Conclusions: This study did not find a significant relationship between ABO blood groups and aortic stenosis. Further research with larger, diverse populations is needed to explore the role of ABO blood groups in cardiovascular diseases.

Keywords: ABO blood groups, aortic stenosis, coronary artery disease, obstructive coronary artery lesions, von Willebrand factor, coagulation factors, myocardial infarction

I. Introduction

ABO blood groups have been extensively studied in relation to their genetic influence on vascular diseases. Evidence suggests that the genetic loci encoding ABO antigens also modulate levels of von Willebrand factor (vWF) and coagulation factor VIII (FVIII), which are critical mediators in hemostasis and thrombosis (1-6). Individuals with non-O blood groups (A, B, or AB) have consistently been associated with a higher risk of arterial and venous thrombotic events. This increased risk is largely attributed to elevated plasma levels of vWF and FVIII (3-5). In contrast, blood group O has been considered relatively protective against such conditions due to significantly lower circulating levels of these procoagulant factors (4-6).

Recent studies have also suggested that ABO blood groups could influence other aspects of vascular function, such as endothelial cell adhesion, blood flow dynamics, and the response to vascular injury, which are all critical factors in cardiovascular health (9-11).

The relationship between ABO blood groups and cardiovascular diseases, such as coronary artery disease and stroke, has been extensively documented (1-4). However, aortic stenosis (AS), a progressive and life-threatening condition characterized by the narrowing of the aortic valve, remains underexplored in this context. Aortic stenosis, which is associated with increased mortality, particularly in elderly populations, has been linked to various cardiovascular risk factors, including hypertension, hyperlipidemia, and diabetes (12, 13). The pathophysiology of AS involves complex mechanisms, including valvular calcification, inflammation, and endothelial dysfunction, which may intersect with the thrombotic pathways influenced by ABO blood group variations (6,7,8).

Recent findings have highlighted the importance of coagulation and thrombosis in the development of valvular diseases, particularly in the context of aortic valve calcification and stenosis (14,15). This study was designed to investigate the association between ABO blood groups and aortic stenosis, aiming to determine whether genetic predisposition via ABO antigen-related pathways contributes to the development or progression of AS.

II. Material and Method

Study Design, Period, and Ethical Considerations

This retrospective, cross-sectional, and descriptive study was conducted between January 2005 and October 2015. This study was conducted after obtaining approval from the Akay Hospital Ethics Committee for Experimental Animals (Decision No: 2015-04).

Study Population

Out of a total of 16,270 patients who underwent coronary artery angiography (CAA) for angina pectoris, 50 patients with aortic stenosis (AS) without prior coronary artery disease (CAD) or significant obstructive coronary artery lesions (stenosis >50%) were identified (AS group). For comparison, 50 age- and sex-matched controls with normal coronary angiography findings and no history of CAD were included (control group).

Exclusion Criteria

Patients with obstructive coronary artery lesions (>50% stenosis), previous revascularization, or systemic inflammatory conditions were excluded to eliminate confounding factors.

Study Variables

Both groups were compared based on their ABO blood group distribution and clinicalcharacteristics. Continuous variables, such as serum lipid levels and echocardiographic parameters, were also analyzed to provide a broader understanding of the patient profile.

Statistical Analysis

All analyses were performed using SPSS for Windows, version 28.0. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were reported as percentages. Group comparisons were made using independent samples t-tests for continuous variables and chi-square tests for categorical variables. A p-value of <0.05 was considered statistically significant.

III. Results

The mean ages of the AS and control groups were 61.59 ± 16.51 years and 62.83 ± 11.29 years, respectively (p = 0.707). The AS group consisted of 27 (69.2%) male and 12 (30.8%) female subjects, while the control group consisted of 24 (66.7%) male and 12 (33.3%) female subjects (p = 0.812). In the AS group, only 35.9% of patients had no risk factors for coronary artery disease (CAD) (p = 0.001). Additionally, 28.2% of the AS group had obstructive coronary artery lesions <50% (p = 0.001) illustrates the distribution of CAD risk factors in the AS group (Figure 1).

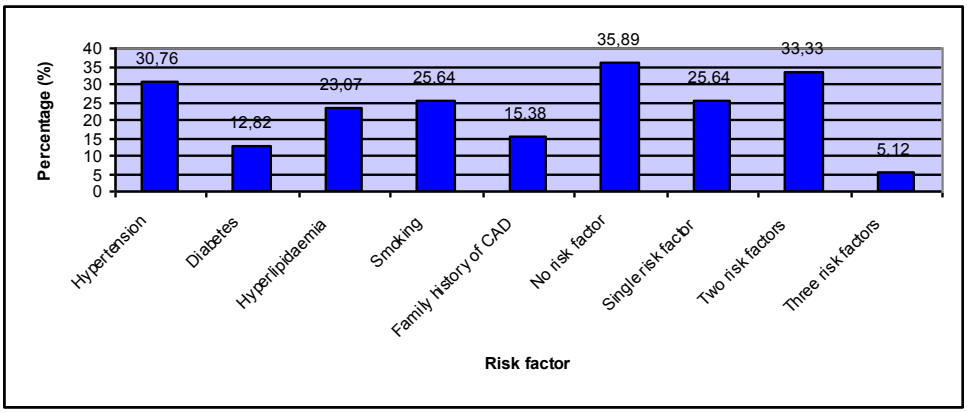

Figure 1. The distribution of risk factors for coronary artery disease in AS group

The distribution of blood groups in the AS group was similar to that in the control group (p = 0.864). There were no statistically significant differences between the AS and control groups with respect to non-A (p = 0.578), non-B (p = 0.636), and non-O blood groups (p = 0.930), respectively (Table 1).

Table 1. The distribution of ABO blood groups in AS and control groups

Blood group	AS group (n, %)	Control group (n, %)	Total (n, %)	P-value
A	20 (51.3)	17 (47.2)	37 (49.9)	
B	8 (20.5)	10 (27.8)	18 (24.0)	0.864
AB	2 (5.1)	1 (2.8)	3 (4.0)	
O	9 (23.1)	8 (22.2)	17 (22.7)	
Non-A	17 (43.6)	18 (50.0)	35 (46.7)	0.578
Non-B	29 (74.4)	25 (69.4)	54 (72.0)	0.636
Non-O	30 (76.9)	28 (77.8)	58 (77.3)	0.930

IV. Discussion

To the best of our knowledge, this is the first study to investigate the potential association between ABO blood groups and aortic stenosis (AS). In our study, no significant relationship was detected between ABO blood groups and AS, which could be attributed to the relatively small sample size of patients diagnosed with AS. These findings are consistent with prior studies, including one from Finland, which found no association between ABO blood groups and coronary artery disease (CAD). Similarly, a study from Iran reported no relationship between ABO blood groups and CAD or major cardiovascular risk factors in patients with acute myocardial infarction (7,8,16).These results suggest that ABO blood groups may not play a direct role in the development of CAD or AS, at least in the populations studied.

However, the distribution of ABO blood groups in both our AS and control groups was similar, with the exception of blood group B, which was more prevalent in the control group. This observation is noteworthy because the distribution in the control group deviated from the expected ABO blood group frequencies in the Turkish population. According to official data from the Turkish Red Crescent, the national authority responsible for blood products and transfusion, blood group A predominates in the Turkish population (44.6%), followed by blood group O (32.8%), blood group B (15.8%), and blood group AB (6.8%) (16). A similar distribution was reported in a study from Istanbul, Turkey, where blood group A was found in 44.8% of individuals, group O in 30.8%, group B in 15.9%, and group AB in 8.1% (17) .

In contrast to these national data, our study revealed that blood group A was more frequent in the AS group than in the general population, and blood group B was found to be more common than group O. This led to a notably high rate of non-O blood groups (A, B, and AB) in both the AS and control groups. The discrepancy between our findings and the national distribution may suggest regional variations or unique demographic characteristics within our study population. Additionally, the observed distribution pattern does not provide direct evidence of a causal relationship between ABO blood groups and the pathogenesis of AS. While blood group A's higher frequency in the AS group is an interesting finding, it is insufficient to draw definitive conclusions regarding its role in the development of AS.

The lack of a significant association in our study highlights the complex nature of AS, suggesting that other genetic, environmental, or pathological factors may play a more significant role in its development. AS is influenced by a multitude of factors including age, hypertension, lipid profile, and genetic predispositions, which may obscure any potential effects of ABO blood groups. Furthermore, the relatively small sample size in

our study limits the generalizability of our findings and may have contributed to the lack of statistical significance (14,15,18).

Individuals with non-O blood groups have been shown to have a higher susceptibility to various vascular disorders, which has been attributed to potential mechanisms involving coagulation, endothelial dysfunction, and inflammatory processes (19,20,21). Blood group A is particularly prevalent in the Turkish population, as evidenced by both national and regional studies (17). In the present study, no significant association was found between ABO blood groups and aortic stenosis (AS) within the small sample size examined. Although the ABO blood group distribution in the AS group did not show a clear correlation with AS development, the observed trends in blood group A and non-O blood groups suggest the need for further exploration.

V. Conclusions

While our findings do not establish a direct relationship between ABO blood groups and AS, they highlight the complexity of genetic and environmental factors that may influence its pathogenesis. Given the role of ABO blood groups in vascular and cardiovascular diseases, future studies involving larger and more diverse populations are necessary to better understand their impact on the development and progression of AS and other cardiovascular conditions. In conclusion, although the current study does not demonstrate a significant link between ABO blood groups and AS, it encourages further research on the influence of blood group type on cardiovascular health. A better understanding of these associations could lead to more targeted approaches in the prevention and management of vascular diseases, especially in populations with varying genetic backgrounds.

Limitations

Additional analyses that could provide deeper insights into the mechanisms associated with aortic stenosis (AS), such as genetic polymorphisms, levels of relevant biomarkers, and endothelial dysfunction, were not conducted. Furthermore, this study was single-center with a relatively small sample size, limiting the generalizability of the results to other populations. Multicenter studies encompassing diverse regions are needed to validate and expand upon these findings.

Declaration of interest

There is no "conflict of interest" among the authors. Furthermore, through any of the products used in this research, no financial engagement has been established with any company that makes and/or markets these products or with any corporation that produces and/or markets a competing product.

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Authors' Contributions

All authors contributed to the conception and design of the research, acquisition of data, analysis and interpretation of the data, statistical analysis, obtaining financing, writing of the manuscript, critical revision of the manuscript for important intellectual content, validation, and final approval of the version of the article to be published.

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