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# Association of ABO Blood Types With Atherosclerosis Risk Factors and Number of Involved Coronary Arteries

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## Abstract

**Objective:** Cardiovascular disease (CVD) is a common cause of morbidity and mortality. The relationship between ABO blood groups and main risk factors of CVD is unknown. So this study was designed to investigate whether there is an association between ABO blood groups and cardiovascular risk factors in otherwise healthy people.

**Materials and Methods:** In this cross-sectional study, risk factors for CVD were screened in 300 patients with coronary artery disease (CAD) who were hospitalized in Madani hospital (biggest heart center in Tabriz) in 2013-2014 and evaluated by a questionnaire that aimed to extract information about age, sex, smoking, blood group type, weight, height, blood pressure, diabetes mellitus and family history of CVD. Data were analyzed with SPSS 17.

**Results:** Of the total selected 300 patients, 69.3% were male, 35.3% were smoker, 61% were hypertensive, 30.3% were diabetic mellitus, 31% had hyperlipidemia, 70.97% were obese and 17.3% had family history of CVD. The mean age was 62.06 ± 11.40 years. Blood groups O (28%), A (43.3%), B (19%) and AB (7.3%) were the most frequent ones, respectively. According to our results, we found that the rate of CAD in individuals with the blood group A was higher than the other blood groups. Regarding the risk factors, however, no significant difference was observed between the blood groups.

**Conclusion:** A correlation was found between blood group A and the incidence of CAD and there was no significant difference between the blood groups and cardiovascular risk factors and number of involved coronary arteries.

**Keywords:** ABO blood-group system, Cardiovascular diseases, Risk factors

## Introduction

Cardiovascular diseases (CVDs), especially coronary or cerebral artery atherosclerosis, hypertension and its complications, are the most important health problems in developed countries. In developing countries, mortality due to infectious diseases and malnutrition are reduced significantly, but CVDs are growing (1). It is predicted that CVD will be the most common cause of premature death and disability around the world by 2020 (2). In Iran, one of the main causes of deaths is CVD, and the cause of half of all deaths of people aged 55 to 79 years is CVD (3). Nowadays, CVD accounting for 25%-45% of all deaths in the world has become a major public health problem, the first cause of death and the fifth-leading cause of disability. In our country, according to the World Health Organization (WHO) reports 41.3% of all deaths in 2005 were caused by CVD and it is expected to increase to 44.8% by 2030 (4).

Many risk factors have been known to be associated with coronary heart disease. Early detection and modification of these risk factors may lead to reduced incidence of the disease. Risk factors of coronary artery disease (CAD) are generally divided into two categories; modifiable and non-modifiable. Modifiable risk factors include lifestyle-related factors such as physical activity, diet, smoking, alcohol drinking and physiological and biochemical factors including hypertension, body weight, blood glucose and blood cholesterol. Modifying any one of these factors may reduce CVD (5).

Dr. Landsteiner introduced the ABO blood types as the first distinguished blood grouping system in 1901. The clinical significance of blood type ABO extends beyond the blood transfusion or bone marrow transplantation. There has been a lot of research into the relationship between blood groups as a cause of various disease or effective factor on prognosis or treatment of disease and cancers (6,7). Although the explanation for the relationship between ABO blood groups and some of the diseases has not yet been fully known, several reports have suggested the relationship between ABO blood types and some diseases such as breast cancer, pancreatic cancer, gastric cancer, periodontal and CVDs (8-12). Although about 400 blood grouping antigens have been reported, the ABO and Rh are recognized as major clinically significant blood group antigens. It has been found in some previous studies that, individuals with the A blood type phenotype are more susceptible to ischemic heart diseases in some communities (13-18). In contrast, another study showed that in cities which O blood type is more common, there is

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a higher mortality rate from CVDs (19). In another study it was found an increased risk of CAD in men with the Lewis blood phenotype Le; it seems to be independent of common risk factors for CVD such as smoking, obesity, diabetes, high cholesterol, triglycerides, etc. (20).

Some studies also have shown a relationship between blood groups and severity of lower extremity venous thrombosis (21,22). In fact, increased levels of factor VIII (22,23), von Willebrand factor (23,24), prothrombin fragment (25), and a low PTT (24) have been found in non-O blood types. Some previous studies have shown that there is not a significant relationship between blood groups and risk factors of CVD (26). Only people with A blood type with CVD are younger than those of other blood groups (27).

There are conflicting results about the relationship between blood groups and other risk factors of CVDs based on research areas. Although blood type cannot be modified as a risk factor, but having the knowledge of the relationship between blood groups and heart disease can help to improve the control of other modifiable risk factors of atherosclerosis.

Coronary heart disease is a multifactorial disease, involving the interactions between genetic and environmental factors. This study aimed to investigate the relationship between ABO blood groups and major risk factors of coronary heart disease and the number of involved vessels in the angiography in patients admitted in Shahid Madani Heart Center, Tabriz.

## Materials and Methods

This study was a descriptive-analytic research. Three hundred patients with confirmed diagnosis of coronary disease by angiography were selected as available convenience sampling method between 2013-2014. After signing the informed consent form, a questionnaire was set for all patients through interviews and records. The researchers designed questionnaire included demographic information (age, gender), place of residence, education level, occupation, weight, height and body mass index, the history of cigarette and hookah smoking, opium use, alcohol drinking and a family history of premature CAD, the patient's echocardiogram results, blood testing, kidney and liver function tests, lipid profile, and the patient's previous medical history (ischemic heart disease, hypertension, diabetes mellitus, hyperlipidemia).

Angiographic results were reviewed and reported by two cardiologists. Distribution of blood groups in East Azerbaijan province was obtained from Iranian Blood Transfusion Organization. To investigate the relationship between risk factors and the type of cardiovascular involvement, the chi-square test and variance analysis were used. *P* value less than 0.05 was considered to be significant. Data were analyzed with SPSS 17.

## Results

Of the total 300 patients examined in this study, 208 were male (69.3%) and 92 were females (30.7%) with mean age of 62.06 ± 11.4 years. The minimum and maximum ages were 25 and 84 years, respectively. Two hundred thirty patients (76.7%) were living in urban and 70 patients (23.3%) in rural areas. In the study 52 patients (17.3%) had a positive family history of ischemic heart disease. The mean left ventricular ejection fraction (LVEF) was 47.22% ± 8.79. Also 4.9% of patients had a history of ischemic cerebrovascular disease, 61% hypertension, 31% hyperlipidemia, 30.3% diabetes mellitus and 33% ischemic heart disease (IHD). This study showed that 35.3% of patients had a history of cigarette smoking, 2% opium use, 1% Hookah smoking and 1% alcohol drinking. Studying the body mass index (BMI) showed the mean BMI of patients was 28.97±14.67 (Min=16.44, Max=54.93). In angiography, 63 patients had one-vessel, 116 had two-vessel and 121 patients had three- vessel involvement. Distribution of coronary vessels involvement based on patient's blood type is shown in Figure 1.

Studying the relationship between atherosclerosis risk factors and blood groups showed that there is not any significant association between the risk factors and blood groups (Table 1). Relationship between BMI, hemoglobin, creatinin, ejection fraction and blood groups is shown in Table 2.

## Discussion

In this study, blood groups of participants were A type: 43.3%, B type: 19%, AB type: 7.3% and O type: 28%. Distribution of blood groups in East Azerbaijan province was as follows: A type: 36.24%, B type: 21.25%, AB type: 8.62% and O type 33.91%. Considering the distribution of blood groups in East Azerbaijan, the patients had a normal distribution.

In our study, there was no relationship between blood groups and number of involved vessels ($P$ = 0.18). In a study on 653 patients at the Heart Institute of Boston in 1980 and 1985 about the relationship between blood groups, serum cholesterol and ischemic heart disease, it

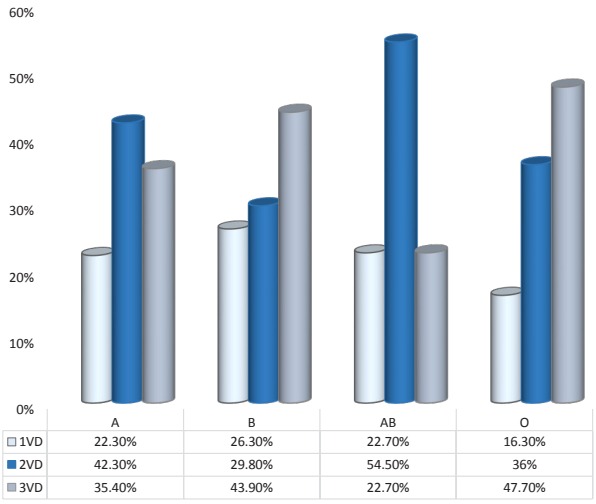


**Figure 1.** Frequency of distribution of vessel involvement based on patient's blood type.

**Table 1.** The Basic Characteristics of Qualitative Data Based on Blood Type

| Variables | Group | A | B | AB | O | P Value |
|---|---|---|---|---|---|---|
| Sex | Male | 92 (45.4%) | 34 (16.8%) | 16 (7.9%) | 60 (29.7%) | 0.42 |
| | Female | 37 (40.2%) | 23 (25%) | 6(6.5%) | 26 (28.3%) | |
| Residency | Urban | 110 (45.1%) | 41 (18.3%) | 15(6.7%) | 67 (29.9%) | 0.76 |
| | Rural | 29 (42%) | 14 (23%) | 7(10.1%) | 19 (27.5%) | |
| Hypertension | | 79 (43.4%) | 36 (19.8%) | 14(7.7%) | 53 (231%) | 0.98 |
| Diabetes mellitus | | 34 (37.4%) | 21 (23.1%) | 9(9.9%) | 27 (29.7%) | 0.34 |
| Hyperlipidemia | | 44 (47.8%) | 19 (20.7%) | 8(8.7%) | 21 (22.8%) | 0.44 |
| Ischemic heart disease | | 46 (46.9%) | 19 (19.4%) | 9(9.2%) | 24 (24.5%) | 0.58 |
| Family history of ischemic heart disease | | 27 (52.9%) | 9 (17.6%) | 1(2%) | 14 (27.5%) | 0.58 |
| Smoking | | 53 (52%) | 18 (17.6%) | 3(2.9%) | 28 (27.5%) | 0.07 |
| Number of involved vessels | 1 | 29 (46%) | 15 (23.8%) | 5(7.9%) | 14 (22.2%) | 0.18 |
| | 2 | 55 (47.8) | 17 (14.8%) | 12(10.4%) | 31 (27%) | |
| | 3 | 46 (39.3%) | 25 (21.4%) | 4(4.3%) | 41(35%) | |

**Table 2.** The Basic Characteristics of Quantitative Data Based on Blood Type

| Variables | A | B | AB | O | P Value |
|---|---|---|---|---|---|
| Body mass index | 27.72 | 30.20 | 28.05 | 30.15 | 0.35 |
| Hemoglobin | 13.86 | 13.51 | 13.05 | 13.24 | 0.33 |
| Creatinine | 2.73 | 3.02 | 1.2591 | 13.51 | 0.06 |
| Ejection fraction | 46.75 | 46.26 | 47.27 | 45.93 | 0.15 |

*$P<0.05$ is statistically significant.

was found that types A and O, respectively, were the most and the least prevalent blood groups in the studied population (16). In another study about the relationship between ABO blood type and the incidence of heart disease, on 1393 men aged 40 to 46 years, AB was the most prevalent blood type in patients with ischemic heart disease (18). The cause of different results of NPHS and our study can be due to differences in number of samples and sampling method, certain age and gender that were taken into account in NPHS study. However, we did not consider any limitations for gender and age and the mean age of participants was 62 years in this study. In another study, patients with CVD who had A blood type were younger than those with non-A blood groups (17).

Also hyperlipidemia was more prevalent in A blood type compared to non-A blood types, but there was no significant relationship between blood groups and hyperlipidemia ($P=0.44$). Information obtained from the Stakisaitis et al study in 1991 on the relationship between blood types and atherosclerosis in Lithuania showed that A and B blood types have a genetic base to atherosclerosis risk factors (28). Stakisaitis et al study in 2002 on the relationship between blood groups and atherosclerosis in the female population showed the relationship between blood type B with coronary atherosclerosis in women and came to the conclusion that O blood group can act as an anti-atherogenic factors in women (29). In study conducted by Foster et al on ABO blood groups distribution and severity of heart disease in patients undergoing bypass surgery in North Finland, showed that ABO blood groups has no relationship with coronary disease (30).

A study of the relation between ABO blood groups and venous thromboembolism found that among those who receive anticoagulant medications for thromboembolism, O blood group had the lowest frequency (31). In our study, no significant relationship was found between diabetes and blood type, while in a study conducted by McConnell of blood type in diabetic patients, it was found that A blood type with increasing age in men, increases the risk of diabetes (32). Several factors are involved in causing diabetes mellitus among which genetic and familial disorder and demographic situation can be noted. Most of these factors can be changed, such as diet, obesity, physical inactivity, etc., but genetic background and blood type are the most important factors that cannot be changed (33).

Although in our study A blood type had the highest percentage of hypertension, but there was no significant relationship between blood group and hypertension. Same results have been shown in some other studies (34).

The results of this study about the relationship between blood groups and family history of heart disease were not similar to the results of Framingham study and some other studies. They had found significant association between blood groups and family history of heart disease. Among smokers, blood groups A and AB, respectively had the highest and lowest frequencies, but smoking had no significant relationship with blood group.

Most patients had two coronary vessels disease and many

of them (47.8%) had A blood type that considering the distribution of blood groups in general population, there was no significant difference between patients with ischemic heart disease and the general population.

## Conclusion

Considering the relationship of atherosclerosis risk factors and blood groups, none of the risk factors were significantly associated with blood groups. In our study, there was no relationship between the number of involved vessels confirmed by angiography and the blood groups.

In some previous studies, it seems that there had been a relationship between blood groups and the incidence of ischemic disease. Mechanisms have been attributed to the effect of blood groups on the incidence of various diseases as well as the prognosis. Due to the role of genetics on the incidence of CVD and its effects on blood groups, the need for further investigation seems necessary in other races.

## Ethical issues

Written informed consent was obtained from the patients.

## Conflict of interests

The authors declare that there is no potential conflicting interest for this study.

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## References

1. Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJ. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. Lancet. 2006;367(9524):1747-57. doi:10.1016/S0140-6736(06)68770-9.
2. Azizi F, Hatami H, Janghorbani M. Epidemiology and control of common disorders in Iran. 2nd ed. Tehran: Didavar Publisher; 2002:10-55.
3. Kazemy T, Sharifzadeh G. Ten-year changes in mortality and risk factors in acute myocardial infarction in Birjand, 1994-2003. Ofoghe Danesh J (J Gonabad Univ Med Sci) 2004;10(3):38-42.
4. Lukkarine H, Hentinen M. Treatments of coronary artery disease improve quality of life in the long term. Nurs Res. 2006;55(1):26-33.
5. Grundy SM, Balady GJ, Criqui MH, et al. Primary prevention of coronary heart disease: Guidance from Framingham. Circulation. 1998;97:1876-87.
6. Iodice S, Maisonneuve P, Botteri E, Sandri MT, Lowenfels AB. ABO blood group and cancer. Eur J Cancer 2010;46(18):3345-50. doi:10.1016/j.ejca.2010.08.009.
7. Mohandas N, Narla A. Blood group antigens in health and disease. Curr Opin Hematol. 2005;12(2):135-40.
8. Miao SY, Zhou W, Chen L, Wang S, Liu XA. Influence of ABO blood group and rhesus factor on breast cancer risk: a meta-analysis of 9665 breast cancer patients and 244,768 controls. Asia Pac J Clin Oncol. 2014;10(2):101-8. doi:10.1111/ajco.12083.
9. Risch HA, Lu L, Wang J, et al. ABO blood group and risk of pancreatic cancer: a study in Shanghai and meta-analysis. Am J Epidemiol. 2013;177(12):1326-37. doi: 10.1093/aje/kws458.
10. El-Hajj II, Hashash JG, Baz EMK, Abdul-Baki H, Sharara AI. ABO blood group and gastric cancer: rekindling an old fire? South Med J. 2007;100(7):726-7.
11. Demir T, Tezel A, Orbak R, Eltas A, Kara C, Kavrut F. The effect of ABO blood types on periodontal status. Eur J Dent. 2007;1(3):139-43.
12. Reilly MP, Li M, He J, et al. Identification of ADAMTS7 as a novel locus for coronary atherosclerosis and association of ABO with myocardial infarction in the presence of coronary atherosclerosis: two genome-wide association studies. Lancet. 2011;377(9763):383-92. doi:10.1016/S0140-6736(10)61996-4.
13. Platt D, Muhlberg W, Kiehl L, Schmitt-Ruth R. ABO blood group system, age, sex, risk factors and cardiac infarction. Arch Gerontol Geriatr. 1985;4(3):241-9.
14. Fox MH, Webber LS, Thurmon TF, Berenson GS. ABO blood group associations with cardiovascular risk factor variables II. Blood pressure, obesity, and their anthropometric covariables: The Bogalusa Heart Study. Hum Biol. 1986;58(4):549-84.
15. Whincup PH, Cook Dg, Phillips AN, Shaper AG. ABO blood group and ischemic heart disease in British men. Br Med J. 1990;300(6741):1679-82.
16. Tarján Z, Tonelli M, Duba J, Zorándi A. Correlation between ABO and Rh blood groups, serum cholesterol and ischemic heart disease in patients undergoing coronarography. Orv Hetil. 1995;9;136(15):767-9.
17. Garrison RJ, Havlik RJ, Harris RB, Feinleib M, Kannel WB, Padgett SJ. ABO blood group and cardiovascular disease: the Framingham study. Atherosclerosis. 1976;25(2-3) 311-8. doi:10.1016/0021-9150(76)90036-8.
18. Meade TW, Cooper JA, Stirling Y, Howarth DJ, Ruddock V, Miller UJ. Factor VIII, ABO blood group and the incidence of ischemic heart disease. B J Haematol 3)88;1994.):601-7. doi:10.1111/j.1365-2141.1994.tb05079.x.
19. Mitchell JR. An association between ABO blood group distribution and geographical differences in death-rate. Lancet. 1977;309(8006):295-7. doi:10.1016/S0140-6736(77)91838-4.
20. Ellison RC, Zhang Y, Myers RH, Swanson JL, Higgins M, Eckfeldt J. Lewis blood group phenotype as an independent risk factor for coronary heart disease. Am J Cardiol. 1999;83(3):345-8.
21. Allan TM. ABO blood groups and age groups in surgical venous thromboembolism. Atherosclerosis.

1976;23(1):141-2. doi:10.1016/0021-9150(76)90124-6.
22. Gonzalez Ordonez AJ, Medina Rodriguez JM, Martin L, Alvarez V, Coto E. The O blood group protects against venous thromboembolism in individuals with the factor V Leiden but not the prothrombin (factor II G20210A) mutation. Blood Coagul Fibrinolysis. 1999;10(5):303-7.
23. Souto JC, Almasy L, Muniz-Diaz E, et al. Functional effects of the ABO locus polymorphism on plasma levels of von Willebrand factor, factor VIII, and activated partial thromboplastin time. Arterioscler Thromb Vasc Biol. 2000; 20:2024-8. doi: 10.1161/01.ATV.20.8.2024.
24. Green D, Jarrett O, Ruth KJ, Folsom AR, Liu K. Relationship among Lewis phenotype, clotting factors, and other cardiovascular risk factors in young adults. J Lab Clin Med. 1995;125(3):334-9.
25. Iturbe T, Cornudella R, de Miguel R, et al. Hypercoagulability state in hip and knee surgery: influence of ABO antigenic system and allogenic transfusion. Transfus Sci. 1999;20(1):17-20. doi:10.1016/S0955-3886(98)00086-1.
26. Biancari F, Satta J, Pokela R, Juvonen T. ABO blood group distribution and severity of coronary artery disease among patients undergoing coronary artery bypass surgery in Northern Finland. Thromb Res. 2002;108(2):195-6.
27. Cesena FH, da Luz PL. ABO blood group and precocity of coronary artery disease. Thromb Res. 2006;117(4):401-2.
28. Stakishaitis DV, Ivashkiavichene LI, Narvilene AM. Atherosclerosis of the coronary arteries and the blood group in the population of Lithuania. Vrachebnoe Delo. 1991;(8):55-7.
29. Stakisaitis D, Maksvytis A, Benetis R, Viikmaa M. Coronary atherosclerosis and blood groups of ABO system in women (own data and review). Medicina. 2002;38(Suppl 2):230-5.
30. Biancari F, Satta J, Pokela R, Juvonen T. ABO blood group distribution and severity of coronary artery disease among patients undergoing coronary artery bypass surgery in Northern Finland. Thromb Res. 2002;108(2):195-6.
31. Jick H, Westerholm B, Vessey M, et al. Venous thromboembolic disease and ABO blood type: A cooperative study. Lancet. 1969;1(7594):539-42.
32. McConnell RB, Pyke DA, Fraser Roberts JA. Blood groups in diabetes mellitus. Br Med J. 1956;1(4970):772-6.
33. Andersen J, Lauritzen E. Blood groups and diabetes mellitus. Diabetes. 1960;9:20-4.
34. MaxWell RD, Maxwell KN. ABO-blood group and hypertention. Br Med J. 1955;2(4932):179-80.