

## THE RELATIONSHIP OF ABO BLOOD GROUPS WITH MYOCARDIAL INFARCTION AND SERUM LIPID LEVELS

Çayan ÇAKIR (MD)

Van Regional Training and Research Hospital, Cardiology clinic, e-mail: cayancakir@hotmail.com

Serdar YÜKSEL (PhD)

Ministry of National Education, Kiraz MTAL, Kiraz / IZMIR, e-mail: serdarykl@gmail.com

Özgür EROĞLU (Bio.)

Van Regional Training and Research Hospital, e mail: ozgur27051978@hotmail.com

### SUMMARY

Coronary artery disease (CAD) is the leading cause of death in the world and in our country. CAD, which is sometimes a fatal and often chronic disease, is a social problem with both a serious economic burden and negative effects on the quality of life. The statistical studies conducted since the discovery of blood groups suggest that there is a positive correlation with coronary artery disease and blood group, especially group A. In the studies conducted on this subject, the lowest CAD risk is observed in people with O blood group. Although the mechanism of the relationship is not fully elucidated, the findings indicate the WCAA gene, the Willebrand Factor (vWF), Factor VIII, and the ABCA2 gene responsible for cholesterol homeostasis in the coagulation mechanism. The studies conducted on this subject in our country are insufficient. Therefore, it was aimed to retrospectively examine the association of MI cases with blood groups in order to determine the association of MI and CAD cases with blood groups. According to the results of the study, the blood group A and B are more common in the MI and CAD patients and less in the O group. This value was found to be 46% for group A, 40% for normal population, 20% for B group, 17% for normal population and 25% for patients and 28% for normal group.

**Key Words:** ABO blood groups, Myocardial Infarction, Willebrand Factor (vWF), Factor VIII, total cholesterol, LDL cholesterol, HDL cholesterol, total triglyceride.

### INTRODUCTION

Since Karl Landsteiner discovered blood groups in 1901, a wide range of studies have been conducted on the relationship between blood groups, cancer, eclampsia, or even a lifetime. Recent research reveals a connection between ABO blood groups and the risk of venous thrombosis (1-3). In this context, Dentali et al. (2012), as stated in their meta-analysis, the risk of venous thrombosis is thought to be associated with von Willebrand Factor (vWF) and coagulation factors Factor VIII (FVIII) (4). Therefore, theoretically, coronary artery disease (CAD) and myocardial infarction (MI) risk show that there may be a relationship between blood groups (4). Medaile et al., Garison et al., Jick et al., Erikssen et al., Sukhu et al. found their study, that compared to the O group, patients with A blood group increased the risk of MI., angina, peripheral vascular disease, and cerebral ischemia (CIAO) with arterial origin. They also found a positive relationship between the blood group A and the risk of venous thrombosis (5-9). The level of WF and FVIII in the blood is at the least level in the group O. The vWF molecule, which undertakes the task of carrying FVIII from the procoagulant factors, also enables the interaction of platelets with the blood vessel wall in the wound area (10). In addition, according to the findings of some researchers, there was a correlation

between blood groups and serum cholesterol, LDL and Non HDL cholesterol levels. Lee et al. In a controlled study of 277 people (2012) reported that A group for CAD had a high risk (39.7% / 30.1%) compared to O group (11). In the same study, total cholesterol (TC) and LDL-Cholesterol levels were found to be higher in patients with A blood group than O group. In the same study, LDL-C and total cholesterol (TC) were determined as  $(124 \pm 42/104 \pm 29) / (199 \pm 46/179 \pm 36)$  in group A and O. It has been reported that ATP binding cassette 2 (ABCA2) gene is found in 9 chromosome q34 genes along with ABO blood groups genes responsible for cholesterol homeostasis in spite of the mechanism of this relationship between CAD and blood lipids is not fully elucidated (12).

In our country, there are only a few studies on the relationship of blood groups with cardiovascular diseases (13). Studies in this area in different regions of our country are important for the determination of risk groups of myocardial infarction and coronary artery disease. For this reason, it was aimed to determine the relationship between blood groups, MI / CAD and blood lipid levels of the cardiovascular patients who applied to our hospital in our region.

## METHOD

In this study, the test results of 447 MI / CAD patients were evaluated retrospectively. The results of blood group and serum lipid values of MI / CAD patients who applied to our clinic in 2018-2019 were evaluated. Local ethic committee of Van Regional Training and Research Hospital approved this study. In addition, age, gender, hypertension, diabetes, smoking, obesity, hyperlipidemia and creatine kinase, CK-MB, troponin, total cholesterol, glucose, HDL and LDL levels were recorded. In the evaluation, the distribution of MI, CAD patients with blood group A, B, AB and O according to blood groups were identified. In addition, serum cholesterol, LDL, HDL, triglyceride levels were evaluated according to blood groups in CAD, VT, MI patients.

### Statistical analysis

Power analysis of the study was performed with G-Power 3.1.9.2. In the power analysis for Anova test, the power of the study was over 80% which showed that the test parameters were significant. In order to determine which parametric or non-parametric analysis would be applied after the power analysis, Kolmogorov-Smirnov and Shapiro-Wilk tests were used to determine whether the data were normally distributed. As a result of these analyzes, serum cholesterol, LDL, HDL, triglyceride levels were found to be in normal distribution due to  $p > 0.05$ . Therefore, in order to determine whether the difference between the mean of serum cholesterol, LDL, HDL, triglyceride values was significant and variance analysis (F test, Anova) was applied. If  $p$  value  $< 0.05$  (two-sided) then it was considered statistically significant.

## RESULTS

The age of the patients included in the study ranged from 19 to 79 years, with an average of 55.55 males and 50.59 females. 37% of the patients were female and 67% were male. In this study, the data of 447 MI / CAD patients and blood group distribution percentages of the province of Van were given. A total of 7429 blood group data were used.

The data obtained by comparing 447 patients with MI / CAD with blood group distributions were compared with the results of the distribution of blood groups in Van province.

Table 1. Distribution of cardiovascular diseases according to blood groups

	Distribution of patients		Van province blood group distribution*	
	Number	%	Number	%
<b>A</b>	204	46%	2792	40%
<b>B</b>	90	20%	1193	17%
<b>AB</b>	42	9%	1024	15%
<b>O</b>	111	25%	1973	28%
<b>Sum</b>	447		6982	

\* According to the data of Akın and Dostbil (2005).

Serum cholesterol, LDL, HDL, triglyceride levels were found to be in normal distribution according to Kolmogorov-Smirnov and Shapiro-Wilk tests.

The power analysis of the study for the ANOVA test was performed with GPower 3.1.9.2. The power of the study was 95% (n = 12) for triglyceride, 96% (n = 24) for cholesterol, 90% (n = 36) for LDL and 85% (n = 39) for HDL.

The mean and standard deviations of serum cholesterol, LDL, HDL, triglyceride levels from descriptive statistical values are given in Table 2.

Table 2. Descriptive statistical values of serum lipid values classified by blood groups

	Triglyceride (mg/dl)		Cholesterol (mg/dl)		LDL (mg/dl)		HDL (mg/dl)	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
<b>A</b>	169	85	161	44	108	36	33	8
<b>AB</b>	89	30	121	37	90	17	34	8
<b>B</b>	124	89	106	31	43	19	38	18
<b>O</b>	196	107	168	39	87	42	37	8

Table 3. Results of ANOVA statistics comparing serum lipid values with blood groups

	F	Sig. (p)
<b>Triglyceride</b>	1,982450079	0,135128
<b>Cholesterol</b>	5,801289144	0,052671
<b>LDL</b>	2,831920442	0,069358
<b>HDL</b>	0,436912255	0,728054

Table 3 shows the F and p values obtained according to ANOVA test results comparing serum cholesterol, LDL, HDL, triglyceride levels of patients with A, B, AB and O blood groups.

## DISCUSSION

A positive relationship between blood group A and CAD has been reported in studies conducted in American (14), Norwegian (15), German (16), British (17), Pakistan (18), Hungarian (19) and Italian (20) societies. According to the results of this study, A blood group is more common in MI / CAD patients compared to normal population (46% / 40%) (Table 1). According to studies conducted on this subject, the risk of coronary heart disease increases due to high cholesterol absorption in A,B blood groups other than O blood group. (21-22). The risk of CAD with A, B and AB groups other than O and TC, LDL- C level is higher than O group. In addition, the relationship between CAD and ABO blood groups is due to TC, LDL-C and Non HDL-I Cholesterol (23). In this study, it was concluded that serum LDL, HDL and triglyceride levels did not differ among patients with A, B, AB and O groups (Table 2,3). In addition to blood group (A, B, AB), there are high risk studies for MI (24). It is stated that there is a high risk for CAD in people other than O group, especially A. A blood group has a risk for MI and CAD (25), and group A is associated with arterial thrombosis (26), B blood group associated with CHDs (coronary heart disease) (27). Similarly, in this study, patients with O blood group had less MI (25% / 28%) and CAD disease compared to the normal population (Table 1). On the other hand, it is known that there is no connection between blood groups and MI / CAD diseases in our country. According to studies on serum lipid levels, TC, LDL-C and NHDL-C levels were found to be high in CHD patients other than O blood group (28). However, no difference was found between serum lipid levels in this study. In addition, in other studies, it has been found that mortality in young people in bone and heart diseases is high in blood groups other than O (29), and a relation has been found between the region of the gene encoding the blood groups and the gene region determined for the risk of MI (30). On the other hand, spontaneous recanalization (SR) is reported to be more common in patients with O blood group in MI (31). The increased plasma tPA / PAI-1 complex is a risk predictor for recurrent MI in men and women, most likely due to the increased levels of tPA / PAI-1 complex associated with impaired fibrinolysis, and the plasma concentration of von Willebrand factor is also important for recurrent MI. So risk factor should be evaluated in the same way (32).

56

## LIMITATIONS

This study, which was conducted to determine the relationship between blood groups and MI and CAD diseases and serum cholesterol, LDL, HDL, triglyceride levels, involved only the province of Van. In order to better clarify this issue, studies including other regions are needed. In this study, gene polymorphisms weren't investigated. Serum cholesterol, LDL, HDL, triglyceride levels may vary depending on time and patient's lifestyle. Therefore, homogeneous groups should be formed in the examination of these blood values.

## CONCLUSION

The findings of this study are important for determining the risk groups for MI and CAD diseases in Van province. In this context, while investigating the relationship between MI / CAD and blood groups, we also investigated plasma tPA / PAI-1 levels, ATP binding cassette 2 (ABCA2) gene polymorphisms and 9th chromosome q34 region polymorphisms. The evaluation of the factors together will be useful.

**REFERENCES**

1. Alpoim PN et al. Preeclampsia and ABO blood groups: a systematic review and meta-analysis. *Mol Biol Rep* 2013;40:2253–61.
2. Liumbruno GM, Franchini M. Hemostasis, cancer, and ABO blood group: the most recent evidence of association. *J Thromb Thrombolysis* 2014;38:160–6.
3. Franchini M, Bonfanti C. Evolutionary aspects of ABO blood group in humans. *Clin Chim Acta* 2015;444:66–71.
4. Dentali F, Sironi AP, Ageno W, Crestani S, Franchini M. ABO blood group and vascular disease: an update. *Semin Thromb Hemost* 2014;40:49–59.
5. Medalie J, Levene C, Papier C, Goldbourt U, Dreyfuss F, Oron D. Blood groups, myocardial infarction and angina pectoris among 10,000 adult males. *N Engl J Med* 1971;285:1348–53.
6. Garrison R, Havlik R, Harris R, Feinleib M, Kannel W, Padgett S. ABO blood group and cardiovascular disease. *Atheroscler* 1976;25:311–8.
7. Jick H, Dinan B, Herman R, Rothman KJ. Myocardial infarction and other vascular diseases in young women. Role of estrogens and other factors. *Jama* 1978;240:2548–52.
8. Erikssen J, Thaulow E, Stormorken H, Brendemoen O, Hellem A. ABO blood groups and coronary artery disease (CHD): a study in subjects with severe and latent CHD. *Thromb Haemost* 1980;43:137–40.
9. Sukhu K, Poovalingam V, Mahomed R, Giangrand PL. Ethnic variation in Von Willebrand Factor levels can influence the diagnosis of Von Willebrand Disease. *Clin Lab Haematol* 2003;25 (4):247–9.
10. Zhou, S., & Welsby, I. (2014). Is ABO blood group truly a risk factor for thrombosis and adverse outcomes?. *World journal of cardiology*, 6(9), 985.
11. Lee HF, Lin YC, Lin CP, Wang CL, Chang CJ, Hsu LA. Association of blood group A with coronary artery disease in young adults in Taiwan. *Intern Med*. 2012;51(14) 1815-1820. doi:10.2169/internalmedicine.51.7173. PMID: 22821093.
12. Schmitz G, Kaminski WE. ABCA2: a candidate regulator of neural transmembrane lipid transport. *Cell Mol Life Sci* 59: 1285-1295, 2002.
13. Sari I, Ozer O, Davutoglu V, Gorgulu S, Eren M, Aksoy M. ABO blood group distribution and major cardiovascular risk factors in patients with acute myocardial infarction. *Blood Coagul Fibrinolysis*. 2008 Apr;19(3) 231-234. doi:10.1097/mbc.0b013e3282f54522. PMID: 18388504.
14. Garrison RJ, Havlik RJ, Harris RB, Feinleib M, Kannel WB, Padgett SJ. ABO blood group and cardiovascular disease: the Framingham study. *Intern Med* 51: 1815-1820, 2012 DOI: 10.2169/internalmedicine.51.7173
15. Erikssen J, Thaulow E, Stormorken H, Brendemoen O, Hellem A. ABO blood groups and coronary heart disease (CHD). A study in subjects with severe and latent CHD. *Thromb Haemost* 43: 137-140, 1980.
16. Platt D, Muhlberg W, Kiehl L, Schmitt-Ruth R. ABO blood group system, age, sex, risk factors and cardiac infarction. *Arch Gerontol Geriatr* 4: 241-249, 1985.
17. Whincup PH, Cook DG, Phillips AN, Shaper AG. ABO blood group and ischaemic heart disease in British men. *BMJ* 300: 1679-1682, 1980.
18. Stakishaitis DV, Ivashkiavichene LI, Narvilene AM. Atherosclerosis of the coronary arteries and the blood group in the population of Lithuania. *Vrach Delo* 8: 55-57, 1991 (in Russian).

19. Tarján Z, Tonelli M, Duba J, Zorándi A. Correlation between ABO and Rh blood groups, serum cholesterol and ischemic heartdisease in patients undergoing coronarography. *Orv Hetil* 136: 767-769, 1995 (in Hungarian).
20. Carpeggiani C, Coceani M, Landi P, Michelassi C, L'Abbate A. ABO blood group alleles: a risk factor for coronary artery disease. An angiographic study. *Atherosclerosis* 211: 461-466, 2010.
21. Silbernagel G, Chapman MJ, Genser B, Kleber ME, Fauler G, Scharnagl H, et al. High intestinal cholesterol absorption is associated with cardiovascular disease and risk alleles in ABCG8 and ABO: evidence from the LURIC and YFS cohorts and from a meta-analysis. *J Am Coll Cardiol*. 2013;62:291–299.
22. Teupser D, Baber R, Ceglarek U, Scholz M, Illig T, Gieger C, et al. Genetic regulation of serum phytosterol levels and risk of coronary artery disease. *Circ Cardiovasc Genet*. 2010;3:331–339.
23. Chen Z, Yang SH, Xu H, Li JJ. ABO blood group system and the coronary artery disease: an updated systematic review and meta-analysis. *Sci Rep*. 2016 Mar;6 23250. doi:10.1038/srep23250. PMID: 26988722; PMCID: PMC4796869.
24. Hu X, Qiao S, Qiu H, Ye S, Feng L, Song L. [Association between ABO blood group and acute myocardial infarction]. *Zhonghua Xin Xue Guan Bing Za Zhi*. 2015 Sep;43(9) 785-787. PMID: 26652818.
25. Lee HF, Lin YC, Lin CP, Wang CL, Chang CJ, Hsu LA. Association of blood group A with coronary artery disease in young adults in Taiwan. *Intern Med*. 2012;51(14) 1815-1820. doi:10.2169/internalmedicine.51.7173. PMID: 22821093.
26. Ba DM, Sow MS, Diack A, Dia K, Mboup MC, Fall PD, Fall MD. Cardiovascular disease and ABO blood-groups in Africans. Are blood-group A individuals at higher risk of ischemic disease?: A pilot study. *Egypt Heart J*. 2017 Dec;69(4) 229-234. doi:10.1016/j.ehj.2017.03.002. PMID: 29622982; PMCID: PMC5883502.
27. Shi Y, Lin Y, Liu H, Ji Q, Lu Z, Lu Z, Xu N, Yuan J, Liu L. [Association between ABO blood groups and coronary heart disease in Chinese Guangxi Zhuang population]. *Zhonghua Xin Xue Guan Bing Za Zhi*. 2015 Sep;43(9) 788-792. PMID: 26652819.
28. Chen Y, Chen C, Ke X, Xiong L, Shi Y, Li J, Tan X, Ye S. Analysis of circulating cholesterol levels as a mediator of an association between ABO blood group and coronary heart disease. *Circ Cardiovasc Genet*. 2014 Feb;7(1) 43-48. doi:10.1161/circgenetics.113.000299. PMID: 24395926.
29. Carpeggiani C, Coceani M, Landi P, Michelassi C, L'abbate A. ABO blood group alleles: A risk factor for coronary artery disease. An angiographic study. *Atherosclerosis*. 2010 Aug;211(2) 461-466. doi:10.1016/j.atherosclerosis.2010.03.012. PMID: 20371059.
30. Reilly MP, Li M, He J, Ferguson JF, Stylianou IM, 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 Jan;377(9763) 383-392. doi:10.1016/S0140-6736(10)61996-4. PMID: 21239051; PMCID: PMC3297116.
31. Lin XL, Zhou BY, Li S, Li XL, Luo ZR, Li JJ. Correlation of ABO blood groups with spontaneous recanalization in acute myocardial infarction. *Scand Cardiovasc J*. 2017 Aug;51(4) 217-220. doi:10.1080/14017431.2017.1312013. PMID: 28387531.
32. Wiman, B., Andersson, T., Hallqvist, J., Reuterwall, C., Ahlbom, A., & deFaire, U. (2000). Plasma levels of tissue plasminogen activator/plasminogen activator inhibitor-1 complex and von Willebrand factor are significant risk markers for recurrent myocardial infarction in the Stockholm Heart Epidemiology Program (SHEEP) study. *Arteriosclerosis, thrombosis, and vascular biology*, 20(8), 2019-2023.
33. Akin, G., & Dostbil, N. (2005). Türkiye'de kan grubu arařtırmaları. *Ankara Üniversitesi Dil ve Tarih-Coğrafya Fakültesi Dergisi*, 45, 1-15.