Relationship between Blood Groups and Occurrence of Coronary Artery Disease (CAD) In Patients Hospitalized In Vali-Asr Hospital of Zanjan

Reza Hassanzadeh Makoui

Assistant Professor, Department of Cardiology, Zanjan University of Medical Sciences, Zanjan, Iran
E-mail: Makoui42@yahoo.com

Abstract: Many reports have appeared in recent years suggesting an association between blood groups and various manifestations of heart disease. Most of these studies investigated patients with Coronary Heart Disease. The aim of present study was to evaluate the relationship between blood groups and occurrence of coronary artery disease (cad) in patients hospitalized in Vali-asr hospital of Zanjan in 2006-2011. In present study, data were collected based on questionnaires which were prepared previously. Questionnaires were filled about patients who were hospitalized in the CCU with unstable angina or myocardial infarction diagnosis. Data showed that blood group O has the most incidence among the patients (127 patients; 35.3%). While, other groups such as A (114 patients; 31.7%), B (88 patients; 24.4%) and AB (31 patients; 8.6%) were latters, respectively. Our results showed that blood group phenotype O without considering the Rh factor is associated with a substantially increased risk for CAD.
[Reza Hassanzadeh Makoui. **Relationship between Blood Groups and Occurrence of Coronary Artery Disease (CAD) In Patients Hospitalized In Vali-Asr Hospital of Zanjan.** *Life Sci J* 2013;10(5s):142-146] (ISSN:1097-8135). http://www.lifesciencesite.com. 26

Keywords: blood group, CAD, Vali-Asr Hospital, Zanjan.

1. Introduction

Coronary artery disease (CAD; also atherosclerotic heart disease) is the result of the accumulation of atheromatous plaques. Within the walls of the coronary arteries (Thomas et al., 1988) that supply the myocardium (the muscle of the heart) with oxygen and nutrients. The deposition of the plaque in the lumen (free space in the artery for the flow of nutrients, oxygen etc.) of an artery causes narrowing of lumen of the artery by decreasing its diameter. It is sometimes also called coronary heart disease (CHD).

CAD is the leading cause of death worldwide (Rosamond et al., 2007). While the symptoms and signs of coronary artery disease are noted in the advanced state of disease, most individuals with coronary artery disease show no evidence of disease for decades as the disease progresses before the first onset of symptoms, often a "sudden" heart attack, finally arises. After decades of progression, some of these atheromatous plaques may rupture and (along with the activation of the blood clotting system) start limiting blood flow to the heart muscle. The disease is the most common cause of sudden death (Lanza, 2007), and is also the most common reason for death of men and women over 20 years of age (Kaski, 2004). According to present trends in the United States, half of healthy 40-year-old males will develop CAD in the future, and one in three healthy 40-year-old women (Smith et al., 1997).

As the degree of coronary artery disease progresses, there may be near-complete obstruction of the lumen of the coronary artery, severely restricting the flow of oxygen-carrying blood to the myocardium. Individuals with this degree of coronary artery disease typically have suffered from one or more myocardial infarctions (heart attacks), and may have signs and symptoms of chronic coronary ischemia, including symptoms of angina at rest and flash pulmonary edema (Ghatrehsamani et al., 2009; Kaski, 2004).

A distinction should be made between myocardial ischemia and myocardial infarction. Ischemia means that the amount of blood supplied to the tissue is inadequate to supply the needs of the tissue. When the myocardium becomes ischemic, it does not function optimally. When large areas of the myocardium become ischemic, there can be impairment in the relaxation and contraction of the myocardium. If the blood flow to the tissue is improved, myocardial ischemia can be reversed. Infarction means that the tissue has undergone irreversible death due to lack of sufficient oxygen-rich blood (Danesh et al., 2000).

An individual may develop a rupture of an atheromatous plaque at any stage of the spectrum of coronary artery disease. The acute rupture of a plaque may lead to an acute myocardial infarction (heart attack).

Limitation of blood flow to the heart causes ischemia (cell starvation secondary to a lack of oxygen) of the myocardial cells. Myocardial cells may die from lack of oxygen and this is called a myocardial infarction (commonly called a heart attack). It leads to heart muscle damage, heart muscle death and later myocardial scarring without heart

muscle regrowth. Chronic high-grade stenosis of the coronary arteries can induce transient ischemia which leads to the induction of a ventricular arrhythmia, which may terminate into ventricular fibrillation leading to death (Smolders et al., 2007).

CAD is associated with smoking, diabetes, and hypertension. A number of recent studies have shown that family history of early CAD is an important predictor of CAD. Most of the familial association of coronary artery disease may be related to common dietary habits. Screening for CAD includes evaluating high-density and low-density lipoprotein (cholesterol) levels and triglyceride levels. Despite much press, most of the alternative risk factors including homocysteine, C-reactive protein (CRP), Lipoprotein (a), coronary calcium and more sophisticated lipid analysis have added little if any additional value to the conventional risk factors of smoking, diabetes and hypertension (Schreiner et al., 1993).

In 1901, Landsteiner identified ABO blood groups as the first recognized human blood group system. The clinical significance of ABO blood type extends beyond transfusion medicine and solid organ/hematopoietic transplantation. To date, numerous reports have suggested important associations between ABO blood groups and various diseases, for example, gastric cancer (El-Hajj et al., 2007), periodontal diseases (Demir et al., 2007), and cardiometabolic diseases (Qureshi and Bhatti, 2003; Reilly et al., 2011).

The aim of present study was to evaluate the relationship between blood groups and occurrence of coronary artery disease (cad) in patients hospitalized in Vali-asr hospital of Zanjan in 2006- 2011.

2. Subjects and Methods

This study was prospective type of studies and carried out in Vali-asr hospital of Zanjan in 2006-2011. In present study, data were collected based on questionnaires which were prepared previously. Questionnaires were filled about patients who were hospitalized in the CCU with unstable angina or myocardial infarction diagnosis. Patients were selected by chance from males and females. On the other hand, paraclinic evidences such as CPK-T, CPK-MB and LDH also were recorded. The data which we recorded were age, gender, history of HTN, diabetes mellitus, smoking, definitive diagnosis of recent admission, blood group, history of familiar heart disease, ejection fraction, cholesterol and TG.

At the end, data were analyzed using the SPSS software and $P<0.05$ considered as statistically significant.

3. Results

In present study, patients were classified into 6 age-group include <40, 40-50, 50-60, 60-70, 70-80 and >80. Data showed that the most incidence of heart disease is related to patients in the range 60-70 age (101 patients, 28.1%). Also, the incidence of disease was declining age-dependently, means that the incidence was low in age groups on both sides of range 60-70. It was most interesting that 8 patients (2.2%) were under 40 year old.

Of 360 patients, 184 (51.1%) of them were male and 176 (48.9%) of them were female. In term of hypertension, 185 (51.4%) of the patients didn't have any history of HTN and 175 (48.6%) of them had history of HTN. In term of DM, 321 (89.2%) of them didn't have diabetes mellitus and only 39 patients (10.8%) had DM. of 39 diabetic patient, 36 of them were under treatment with insulin and 3 of them were using tablets. Smoking as another risk factor was positive in 95 (26.4%) patients and negative in 265 patients (73.6%).

Definitive diagnosis was unstable angina (273 patients; 75.8%), non-ST elevation MI (19 patients; 5.3%) and ST elevation MI (68 patients; 18.9).

In term of blood groups without considering the Rh factor, blood group O has the most incidence among the patients (127 patients; 35.3%). While, other groups such as A (114 patients; 31.7%), B (88 patients; 24.4%) and AB (31 patients; 8.6%) were latters, respectively (table 1).

In term of blood groups considering the Rh factor, among the 8 groups, blood group O^+ has the most incidence among the patients (115 patients; 31.9%). While, other groups such as A^+ (105 patients; 29.2%), B^+ (84 patients; 23.3%), AB^+ (29 patients; 8.1%), O^- (12 patients; 3.3%), A^- (9 patients; 2.5%), B^- (4 patients; 1.1%) and AB^- (2 patients; 0.6%) were latters, respectively (table 2). it must be noted that adding Rh factor to 4 proper blood groups don't increase incidence of heart disease. In term of familiar history of heart diseases, 64 patients (17.8%) had familiar heart diseases while 296 of them (82.2%) didn't have familiar heart disease.

Data related to blood lipids showed that 173 patients (48.1%) had triglycerides and cholesterol lower than 200mg/dl. Contrary, 187 patients (51.9%) were suffered from hyperlipidemia.

Table 1: relationship between blood groups and CAD without considering Rh factor

Blood group	Frequency	%
A	114	31.7
B	88	24.4
O	127	35.3
AB	31	8.6
Total	360	100

Table 2: relationship between blood groups and CAD in term of Rh factor

Blood group	Frequency	%
A^+	105	29.2
B^+	84	23.3
O^+	115	31.9
AB^+	29	8.1
A^-	9	2.5
B^-	4	1.1
O^-	12	3.3
AB^-	2	0.6
Total	360	100

4. Discussion and conclusion

According to World Health Organization (WHO) data, cardiovascular diseases (CVDs) are and will remain the leading causes of death globally: an estimated 17.3 million people died from CVD in 2008, representing 30% of all global deaths (WHO Media Centre, 2011), cardiovascular diseases. Studies on the associations between CVD and ABO blood groups have a long history. In 1955, Woolf proposed an odds ratio as a measure to quantify the disease risk conferred by blood group type (Woolf, 1955). In 1969, Jick et al. reported a deficit of patients with blood group O among those who received anticoagulants for venous thromboembolism (Jick et al., 1969). Prior to mutation detection in haemophilia carriership analysis, likelihood ratios of carriership of hemophilia A were based on Factor VIII levels conditional on blood group (Green et al., 1986). A number of later studies elucidated that ABO blood groups, particularly non-O blood groups, are associated with major cardiovascular risk factors and/or increased rate of cardiovascular events (Medalie et al., 1971; Ketch et al., 2008; Erikssen et al., 1980; Nydegger et al., 2003; Platt et al., 1985; Sari et al., 2008). However, there is limited consensus regarding the magnitude and significance of the ABO effects at the population level and whether it relates to all disorders equally or predominantly modulates thrombotic pathways and disorders (Wu et al., 2008).

Blood group ABO antigens are known to be carried by several platelet GPs, for example, GPIb, GPIIb, GPIIIa, and platelet endothelial cell adhesion molecule (PECAM) (Hou et al., 1996), that play important roles in platelet function. Platelet ABH expression is a stable, donor-specific characteristic with 5% of A1 donors typing as either ABH high- or lowexpressers (Cooling et al., 2005), with high levels of A antigen on various GPs from high-expresser platelets, especially GPIIb and PECAM (CD31) (Curtis et al., 2000). GPIIb is an integral component of the GPIIb-GPIIIa fibrinogen receptor complex, which represents the critical final common pathway for plateletdriven thrombosis in hemostasis and pathologic arterial thrombosis including acute MI. Genetic variation in GPIIb that modulates fibrinogen binding has been associated with altered risk of thrombosis and MI (Cadroy et al., 2001; Meisel et al., 2004; Carter et al., 1998), so it is conceivable that ABO-driven carbohydrate modification of GPIIb might alter its functional interactions with fibrinogen and thus platelet-mediated thrombosis. However, this hypothesis has not been adequately addressed to date. Besides GPIIb and PECAM, blood group A antigen is also expressed on other uncharacterized platelet proteins (70–90 kDa) having electrophoretic mobilities closely resembling those of GPIV and GPV (Stockelberg et al., 1996). Thus these and other uncharacterized ABO-expressing platelet proteins may also act as potential functional modulators of the ABO associations with arterial thrombosis and cardiovascular events.

The results obtained in study of Biswas et al., 2008 they showed that the prevalence of Coronary Artery Disease (CAD) in blood group O is invariably higher than in all other ABO blood groups ($p<0.05$). It is striking that despite the fact that the most prevalent blood group among Bangladeshi people is phenotype B, the prevalence of CAD risk is associated with phenotype O (Odd ratio 2.034, 95% confidence interval 1.127 to 3.67). This suggests that a certain CAD risk is associated with phenotype O. Thus they concluded that, in Bangladeshi people, blood group phenotype O is associated with a substantially increased risk for CAD which is compatible with our research results.

The obtained data by Stakishaĭtis et al., 1991 indicate that the A and B blood groups are one of the genetically based factors of risk in the link of atherosclerosis pathogenesis.

In one other study by Stakisaitis et al., 2002, O blood group was found significantly more rarely in the women group I as compared to that of healthy donors group (28.4% vs 38.2%, $p<0.04$). The B blood group was significantly more often in group II (22.9% vs 15.0%, $p<0.04$) compared with the frequency of the B blood group in the healthy donors' group. In the long-livers' group the frequency of the B group was significantly more rare than in healthy donors (6.7% vs 15%, $p<0.01$) as well as in the groups of tested pts (20.2% and 22.9% respectively, $p<0.01$). They did not find any significant changes in the frequency of AB blood group in women with coronary atherosclerosis. They concluded that he B blood group can be related with coronary atherosclerosis in women. The O blood group can possibly serve as a protective antiatherogenic factor

in women. The A blood group is not a risk factor for atherosclerosis in women in Lithuanian population.

The findings of Amirzadegan et al., 2006 suggest that there is no correlation between various ABO blood groups and development of coronary artery disease. Moreover, the prevalence of major risk factors was equal in patients with different blood groups, and blood groups had no impact on development of premature coronary artery disease in individual subjects.

Our results showed that blood group phenotype O without considering the Rh factor is associated with a substantially increased risk for CAD. This seems to be independent of conventional cardiovascular risk factors. There is much to be done to understand the role of ABO in CAD, and the next decade should see many advances in the basic biology, mechanistic actions, and diagnostic, prognostic, and therapeutic possibilities in humans. Thus, future studies to further define the association between ABO blood groups and cardiovascular events and risks, and to elucidate biochemical mechanisms responsible for these associations, are not only of basic scientific interest but also of translational clinical importance.

References:

1. Amirzadegan A, Salarifar M, Sadeghian S, Davoodi G, Darabian C, Goodarzynejad H. Correlation between ABO blood groups, major risk factors, and coronary artery disease. Int J Cardiol 2006;110(2):256-8.
2. Biswas J, Islam MA, Rudra S, Haque MA, Bhuiyan ZR, Husain M, Mamun AA. Relationship between blood groups and coronary artery disease. Mymensingh Med J 2008;17(2):S22-7.
3. Cadroy Y, Sakariassen KS, Charlet JP, Thalamas C, Boneu B, Sie P. Role of 4 platelet membrane glycoprotein polymorphisms on experimental arterial thrombus formation in men. Blood 2001;98(10):3159–3161.
4. Carter AM, Mansfield MW, Grant PJ. Polymorphisms of platelet glycoproteins in relation to macrovascular disease in type 2 diabetes mellitus. Diabetic Medicine 1998;15(4):315–319.
5. Cooling LLW, Kelly K, Barton J, Hwang D, Koerner TAW, Olson JD. Determinants of ABH expression on human blood platelets. Blood 2005;105(8):3356–3364.
6. Curtis BR, Edwards JT, Hessner MJ, Klein JP, Aster RH. Blood group A and B antigens are strongly expressed on platelets of some individuals. Blood 2000;96(4):1574–1581.
7. Danesh J, Collins R, Peto R. Lipoprotein(a) and coronary heart disease. Meta-analysis of prospective studies. Circulation 2000;102(10):1082–5.
8. Demir T, Tezel A, Orbak R, Eltas A, Kara C, Kavrut F. The effect of ABOblood types on periodontal status. European Journal of Dentistry 2007;1(3):139–143.
9. El-Hajj II, Hashash JG, Baz EMK, Abdul-Baki H, Sharara AI. ABO blood group and gastric cancer: rekindling an old fire? SouthernMedical Journal 2007;100(7):726–727.
10. Erikssen J, Thaulow E, Stormorken H. ABO blood groups and coronary heart disease (CHD). A study in subjects with severe and latent CHD. Thrombosis and Haemostasis 1980;43(2):137–140.
11. Ghatrehsamani K, Darabi M, Rahbani M, Hashemzadeh Chaleshtory M, Farrokhi E, Noori M. Combined hepatic lipase -514C/T and cholesteryl ester transfer protein I405V polymorphisms are associated with the risk of coronary artery disease. Genet Test Mol Biomarkers 2009;13(6):809–15.
12. Green PP, Mannucci PM, Briet E. Carrier detection in hemophilia A: a cooperative international study. II. The efficacy of a universal discriminant. Blood 1986;67(6):1560–1567.
13. Hou M, Stockelberg D, Rydberg L, Kutti J, Wadenvik H. Blood group A antigen expression in platelets is prominently associated with glycoprotein Ib and IIb. Evidence for an A1/A2 difference. Transfusion Medicine 1996;6(1):51–59.
14. Jick H, Slone D, Westerholm B, et al. Venous thromboembolic disease and ABO blood type: A cooperative study. The Lancet 1969;1(7594):539–542.
15. Kaski JC. Pathophysiology and management of patients with chest pain and normal coronary arteriograms (cardiac syndrome X). Circulation 2004;109(5):568–72.
16. Ketch TR, Turner SJ, Sacrinty MT, et al. ABO blood types: influence on infarct size, procedural characteristics and prognosis. Thrombosis Research 2008;123(2):200–205.
17. Lanza GA. Cardiac syndrome X: a critical overview and future perspectives. Heart 2007;93(2):159–66.
18. Medalie JH, Levene C, Papier C, et al. Blood groups, myocardial infarction and angina pectoris among 10,000 adult males. New England Journal of Medicine 1971;285(24):1348–1353.

19. Meisel C, Lopez JA, Stangl K. Role of platelet glycoprotein polymorphisms in cardiovascular diseases. Naunyn-Schmiedeberg's Archives of Pharmacology 2004;369(1):38–54.
20. Nydegger UE, Wuillemin WA, Julmy F, Meyer BJ, Carrel TP. Association of ABO histo-blood group B allele with myocardial infarction. European Journal of Immunogenetics 2003;30(3):201–206.
21. Platt D, Muhlberg W, Kiehl L, Schmitt-Ruth R. ABO blood group system, age, sex, risk factors and cardiac infarction. Archives of Gerontology and Geriatrics 1985;4(3):241–249.
22. Qureshi MA, Bhatti R. Frequency of abo blood groups among the diabetes mellitus type 2 patients. Journal of the College of Physicians and Surgeons Pakistan 2003;13(8):453–455.
23. Reilly MP, Li M, He J, Ferguson JF, Stylianou IM, Mehta NN, 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. The Lancet 2011;377(9763):383–392.
24. Rosamond W, Flegal K, Friday G. Heart disease and stroke statistics--2007 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Circulation 2007;115(5):e69–171.
25. Sari I, Ozer O, Davutoglu V, Gorgulu S, Eren M, Aksoy M. ABO blood group distribution and major cardiovascular risk factors in patients with acutemyocardial infarction. Blood Coagulation and Fibrinolysis 2008;19(3):231–234.
26. Schreiner PJ, Morrisett JD, Sharrett AR, Patsch W, Tyroler HA, Wu K, Heiss G. Lipoprotein (a) as a risk factor for preclinical atherosclerosis. Arterioscler Thromb 1993;13(6):826–33.
27. Smith FB, Lee AJ, Fowkes FG, Price JF, Rumley A, Lowe GD. Hemostatic factors as predictors of ischemic heart disease and stroke in the Edinburgh Artery Study. Arterioscler Thromb Vasc Biol 1997;17(11):3321–5.
28. Smolders B, Lemmens R, Thijs V. Lipoprotein (a) and stroke: a meta-analysis of observational studies. Stroke 2007;38(6):1959–66.
29. Stakisaitis D, Maksvytis A, Benetis R, Viikmaa M. Coronary atherosclerosis and blood groups of ABO system in women (own data and review). Medicina (Kaunas) 2002;38(2):230-5.
30. Stakishaĭtis DV, Ivashkiavichene LI, Narvilene AM. Atherosclerosis of the coronary arteries and the blood group in the population of Lithuania. Vrach Delo 1991;(8):55-7.
31. Stockelberg D, Hou M, Rydberg L, Kutti J, Wadenvik H. Evidence for an expression of blood group A antigen on platelet glycoproteins IV and V. Transfusion Medicine 1996;6(3):243–248.
32. Thomas AC, Knapman PA, Krikler DM, Davies MJ. Community study of the causes of "natural" sudden death. BMJ 1988;297(6661):1453–6.
33. Woolf B. On estimating the relation between blood group and disease. Annals of Human Genetics 1955;19(4):251–253.
34. Wu O, Bayoumi N, Vickers MA, Clark P. ABO(H) blood groups and vascular disease: a systematic review and meta-analysis. Journal of Thrombosis and Haemostasis 2008;6(1):62–69.

3/2/2013