

Association of ABO Blood Groups with Cardiovascular Diseases in Adult Indian Population

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Abstract This study was designed to investigate whether there was an association between ABO blood groups and major cardiovascular diseases (ischemic heart diseases) in adult Indian population. The present retrospective study analyzed ABO blood groups among 1527 patients with documented IHD, who were treated at CIMS Hospital in Ahmedabad city from January to December, 2011 comparing with a control group of 860 subjects. Data were analyzed with GraphPad Prism 6.0 and by using chi square test. A p-value less than 0.05 were considered as +statistically significant. No significant difference in distribution of ABO blood groups was seen in patients with IHD (A, 21.95%; B, 35.41%; AB, 8.61%; O, 34.01%) and also after adjustment for common cardiovascular risk factors such as age, gender, addiction history, obesity, hypertension, diabetes in these patients (A, 25.47%; B, 37.53%; AB, 9.04%; O, 27.94%) as compared to the controls (A, 22.32%; B, 35.58%; AB, 8.83%; O, 33.25%), p-value = 0.9916 and 0.2778 respectively. The findings of the study suggest that there seems to be no correlation between various ABO blood groups and development of cardiovascular diseases. Moreover, the prevalence of major risk factors was equal in patients with different blood groups and blood groups had no impact on development of cardiovascular pathogenesis in individual subjects.

Keywords: ABO blood groups, ischemic heart diseases, cardiovascular risk factors

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1. INTRODUCTION

After the discovery of ABO blood groups numerous studies have been reported correlating the frequency of various diseases with the blood groups e.g. carcinoma of stomach (Aird *et al.* 1953),

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duodenal and gastric ulcers (Clarke *et al.* 1955), cholera (Glass *et al.* 1985), and cardiometabolic diseases (Bates, 1971; Cronenwett *et al.* 1983; Erikssen *et al.* 1980). As a matter of serious concern, cardiovascular diseases (CVD) have emerged as the leading causes of death, the world over, including India (<http://www.who.int/mediacentre/factsheets/fs317/en/index.html>). Gender, age, obesity, smoking, diabetes mellitus, hypertension and family history are considered major cardiovascular risk factors. Several studies have revealed that the ABO blood group phenotype of individuals, particularly non O groups are associated with major cardiovascular risk factors and/or increased rate of cardiovascular events (Erikssen *et al.* 1980; Platt *et al.* 1985; Whincup *et al.* 1990). 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 mainly modulates thrombotic pathways and disorders, as outlined in a meta-analysis (Wu *et al.* 2008).

In India, Gujarat state has one of the highest incidences of cardiovascular diseases and contributes to the highest number of deaths by these diseases (<http://www.harneedi.com/index.php/healthcare/4362-ahmedabad-tops-heart-disease-emergencies-in-state>). Lack of investigations examining the association between ABO blood groups and CVD in India and absence of such study in Gujarat was recognized as an important lacuna to be filled. We conducted a retrospective case-control study to evaluate the effect of the ABO blood groups on the risk of IHD, in a cohort who had undergone coronary artery bypass grafting (CABG) or percutaneous transluminal coronary angioplasty (PTCA). In the majority of previous studies subjects who were understudy were known cases of CAD, however, presence of major cardiovascular risk factors (i.e. hypertension, smoking, diabetes and obesity) was not taken into account, and therefore we investigated data with cardiovascular risk factors in our study to investigate the relation between ABO blood groups and cardiovascular pathogenesis in documented IHD patients.

2. MATERIALS AND METHODS

Data of adult (≥ 18 years) male and female patients with Ischemic Heart Disease (MI or Angina) who underwent procedural intervention, including patients with or without risk factor/s like obesity, hypertension, diabetes mellitus, smoking, alcohol, tobacco was included in this study. Data from cases with incomplete data record was not included in this study.

The investigation was a retrospective single centric case-control study. This study included 1527 adult hospitalized patients of both genders (1267 males and 260 females), who underwent CABG or PTCA at the Cardiac Division,

Care Institute of Medical Sciences (CIMS) Hospital, Ahmedabad, India, during January, 2011 to December, 2011. Subjects without IHD served as controls (n=860). Age, sex, risk factors, diagnoses, interventional procedure/s as well as blood group and rhesus factor were recorded for all IHD patients. The clinical data like random blood sugar, systolic and diastolic blood pressure, body mass index, prothrombin time, bleeding time and clotting time were also recorded. ABO blood groups were determined using standard agglutination techniques. Conventional CAD risk factors, such as cigarette smoking, diabetes mellitus, hypertension, obesity were recorded for all the study participants. Family history of CAD and lipid profile for the study population was incomplete, hence were not recorded. The ethics committee at CIMS hospital (IRB Regd. No.: IROG 0006900) approved this study.

The patients were divided into two different age groups: those who were below 60 years (younger); and 60 years and above (elderly). The patients were also examined after excluding the IHD patients with risk factor/s. Data was recorded in paper case record form and organized by using spread sheet and represented as percentage. Data were analyzed using GraphPad Prism 6.0 and chi square tests for significance were used. p-value less than 0.05 were considered as statistically significant.

3. RESULTS

Distribution of blood groups in 1527 patients with IHD was investigated along with a control group of 860 subjects. Amongst the control group blood group B was the commonest 306 (35.53%), followed by O, 288 (33.25%); A, 192 (22.32%) and AB 76 (8.83%) as shown in Figure 1.

Almost similar frequency of ABO blood groups was observed in younger and elderly both the age groups of total IHD patients. We found no significant association in total IHD patients between age and different blood groups, p-value > 0.05. However, after excluding all patients with risk factor/s, a significant association was found between age and blood groups with blood

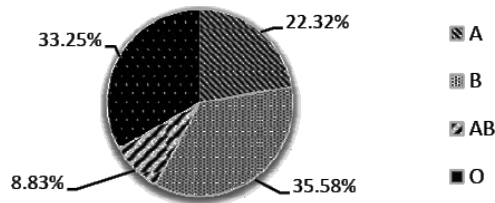


Figure 1. Distribution of blood groups in controls

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group B being the most prevalent in both age groups, in IHD patients, p-value < 0.05 (Table 1).

Table 1. Distribution of blood groups in younger and elderly patients with IHD

Blood Group	Total IHD Patients		IHD Patients Without Risk Factor/s	
	Younger % (n)	Elderly% (n)	Younger % (n)	Elderly% (n)
A	23.25 (212)	21.30 (131)	25.40 (62)	25.61 (31)
B	35.75 (326)	33.50 (206)	39.75 (97)	33.05 (40)
AB	7.24 (66)	11.22 (69)	5.73 (14)	15.70 (19)
O	33.77 (308)	33.98 (209)	29.09 (71)	25.61 (31)
Total	(912)	(615)	(244)	(121)
p-value	0.0515		0.0169	

Comparable frequency of ABO blood groups was observed in both the gender groups of total IHD patients as well as IHD patients without risk factors. There was no significant impact of gender differences either in total IHD patients or the IHD patients without risk factor/s between the distribution of different blood groups, p-value > 0.05 (Table 2).

Table 2. Distribution of blood groups in male and female patients with IHD

Blood Group	Total IHD Patients		IHD Patients Without Risk Factor/s	
	Males % (n)	Females % (n)	Males % (n)	Females % (n)
A	22.02 (279)	24.62 (64)	25.35 (75)	31.57 (18)
B	35.52 (450)	31.54 (82)	38.96 (120)	29.82 (17)
AB	8.76 (111)	9.23 (24)	8.76 (27)	10.52 (6)
O	33.70 (427)	34.62 (90)	27.92 (86)	28.07 (16)
Total	(1267)	(260)	(308)	(57)
p-value	0.6294		0.5278	

Among 1527 total IHD patients, after excluding all patients with risk factor/s IHD was present in 365 patients. Comparing with controls, quite similar frequency of ABO blood groups was observed in both the groups of IHD

patients, p-value > 0.05 (Table 3). According to this study no statistically significant association between IHD and different blood groups was found.

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Table 3. Distribution of blood groups in controls and in IHD patients

Blood Group	Control %(n)	IHD %(n)	IHD Without Risk Factor/s %(n)
A	22.32 % (192)	21.95 % (335)	25.47 % (93)
B	35.58 % (306)	35.41 % (541)	37.53 % (137)
AB	8.83 % (76)	8.61 % (132)	9.04 % (33)
O	33.25 % (286)	34.01 % (519)	27.94 % (102)
Total	(860)	(1527)	(365)
p-value		0.9916	0.2778

Although frequency of Rh -ve phenotype was higher in blood group B and lower in blood group O in IHD patients as compared to controls, statistically there was no significant difference. As shown in Table 4, we found no statistical significant relationship between IHD and Rh positivity or negativity of ABO blood groups, p-value > 0.05.

Table 4. Distribution of Rh +ve and Rh -ve blood groups in controls and in IHD patients

Blood Group	Control %(n)	IHD %(n)	Blood Group	Control %(n)	IHD %(n)
A +	22.14 (182)	21.91 (316)	A -	26.32 (10)	22.35 (19)
B +	36.25 (298)	35.64 (514)	B -	21.05 (8)	31.76 (27)
AB +	9.00 (74)	8.73(126)	AB -	5.26 (2)	7.05 (6)
O +	32.60 (268)	33.70(486)	O -	47.37 (18)	38.82 (33)
Total	(822)	(1442)	Total	(38)	(85)
p-value	0.9604		p-value	0.6092	

4. DISCUSSION

The present study aimed to find out the association between different ABO blood groups and major cardiovascular diseases i.e. IHD and risk factors.

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Results of this study showed no significant association between ABO blood groups and cardiovascular pathologies.

The control group in this study showed a proportionate frequency of the ABO blood groups as: A (22.32%), B (35.58%), AB (8.83%), O (33.25%), Rh +ve (95.58%) and Rh -ve (4.42%). This is similar to the findings of Patel et al. (2012) in their study conducted at Western Ahmedabad, Gujarat (A, 21.94%; B, 39.40%; AB, 7.86%; O, 30.79%; Rh +ve, 95.05%; Rh -ve, 4.95%). It is also comparable to findings in the studies at nearby areas of Eastern Ahmedabad, Punjab and Pakistan (Patel et al., 2012). All these studies described B as the most frequent blood group, O being the second most common blood group and AB as the least common blood group. Southern India have described contrast findings with O being the most common blood group, followed by B, A and AB. In Nepal, which is connected to northeast of India, as well as Australia, Britain and USA, O and A are the common blood groups that are followed by B and AB (Patel et al., 2012). The distribution of blood groups varies regionally, ethnically and from one population to another. While looking at Rh grouping, 89-95% donors all over the world are detected as Rh +ve, except at Britain and USA where the frequency of Rh positivity is 83-85% (Patel et al., 2012).

A multitude of risk factors are responsible for development of cardiovascular diseases (CVDs) including environmental factors. Control of these risk factors has been shown to reduce the severity and complications of the disease. In this study, correlation between blood groups and IHD was examined in two different age groups: ≥ 60 years old, and younger patients < 60 years. Similar distribution of ABO blood groups was found in patients with IHD in both age groups ($p > 0.05$), however, after excluding patients with risk factor/s, there was significant association in IHD patients between age and different blood groups ($p < 0.05$). Similar results were found in the studies of Amirzadegan et al. (2006), Abdollahi et al. (2009) and Lutfullah et al. (2010) in which they found that distribution of age was similar between ABO blood groups. This was in contradiction to the findings of Platt et al. (1985) who studied correlation between blood groups and cardiac infarction in two different age groups: those who were 65 years old and older, and younger patients and observed that the predominance of blood type A in patients with cardiac infarction was even higher in more elderly population (i.e. $p < 0.001$).

Gender distribution was also found to have no significant association with blood groups in IHD patients in this study, as also observed by Abdollahi et al. (2009) and Lutfullah et al. (2010). Also Rh positivity or negativity was found to be statistically not associated with ABO blood groups in IHD in this study. This study was distinct in that the other risk factors such as addiction history,

obesity, diabetes, high blood pressure were excluded from each category of patients to know the existence of genetic impact of ABO blood groups and independent of the other factors specifically, as was done in the studies of Platt et al. (1985).

More than 2/3rd of population in our control group had blood groups B and O. Similar pattern was also seen in IHD patients. Gender and blood Rh factor had no significant association with blood group distribution in IHD, however blood group B showed more association in both age groups of IHD patients without risk factor/s. In summary, the results in this study showed that, in this Indian cohort, the prevalence of various blood groups was almost similar to that in controls and no significant association was found between ABO blood groups and IHD. Some of the recent studies have also shown similar results. Sari et al. (2008) reported that the distribution of ABO blood groups in patients with MI was quite similar to that in control group and that of general Turkish population, which supports the idea that ABO blood group might not be significantly associated with the development of MI. Biancari et al. (2002) found a very similar frequency of ABO blood groups among patients under-going coronary artery bypass graft (CABG) surgery compared to the general population, suggesting that ABO blood groups have no impact on the development of coronary artery disease. Lutfullah and associates (2010) investigated 907 IHD patients for blood groups, hypertension, lipid profile and other predisposing factors like obesity, smoking, BMI etc. and showed that there was no direct correlation between ABO blood groups and major ischemic heart disease risk factors. Amirzadegan et al. (2006) investigated a possible relationship of ABO blood groups with coronary artery disease in 2026 CAD patients. Their results did not show any significant difference between the prevalence of ABO blood groups in coronary artery disease patients compared to the Iranian general population. Their analysis suggests that there is no relationship between various ABO blood groups and development of coronary artery disease. Moreover, the incidence of major risk factors was found equal in patients with different blood groups, and hence, blood groups had no impact on development of premature coronary artery disease in individual subjects.

In contrast, results in various investigations are conflicting. Several clinical studies have shown that individuals of the A phenotype blood group are more susceptible to cardiovascular diseases. In British men and in the Hungarian population, the incidence of ischemic heart disease is higher in patients with blood group A (Whincup et al., 1990; Tarjan et al., 1995). Also, Skaik (2009) found that group A was the most common (57%) and the group O was the second (30.5%) among the MI patients in Gaza Strip of Palestine. Abdollahi and his colleagues (2009) observed that group A subjects

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reported more family history of CAD than the subjects with other blood groups. Tarjan et al. (1995) concluded that blood group A was more frequent and the blood group O was less frequent among the patients with positive coronary angiography. Stakishaitis et al.(2002) found that the blood group B can be related with coronary atherosclerosis in women. The blood group O can possibly serve as a protective antiatherogenic factor in women.The blood group A is not a risk factor for atherosclerosis in women in Lithuanian population. Again, Nydegger et al. (2003) indicated that the ABO blood group B allele was an independent risk factor for myocardial infarction.In a study in Bangladesh, Biswas et al. (2008) found that the prevalence of Coronary Artery Disease (CAD) was invariably higher in blood group O than allother blood groups while the major blood group in Bangladeshi people is phenotype B.It is consistent with the observation of Anvari and his colleagues (2009), and Mitchell (1977) who concluded thattowns with a higher prevalence of blood group O had higher rates of cardiovascular mortality,whereas Meade et al.(1994)reported significantly higher incidence of IHD in blood group AB as compared to those of B & O,which were in contrast with other studies done in Europe and United States.Thus looking to the contradictory results from cross-sectional studies of various racial groups,relationship between ABO blood groups and CVDs is still not clear signifying need for more research to draw a decisive conclusion.

In recent Indian studies, Garg et al. (2012) concluded that there is a significant association between MI and blood group B; and Banerjee and Datta (2011) indicated that incidence of ischemic heart disease is highest in blood type A, wherein comparatively a smaller number of subjects (n=400 and 300 respectively) were investigated. Hence these variations could be a result of biological variations or could be because of sample size. Further investigations in other regional settings with much larger study population may more fully elucidate these findings.

5. CONCLUSION

From the results we can conclude that there is no significant relation or impact of ABO blood groups on major cardiovascular diseases (IHD) and their risk factor/s; however we get significant difference in distribution of blood groups in younger and elderly patients with IHD after excluding patients with risk factor/s. Also there is no impact of rhesus positive or negative phenotypes on these diseases.

Further investigations in other regional settings with much larger population may more fully elucidate these findings.

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