



Original Article

Frequency of Myocardial Infarction with the Frame of ABO Blood Group System

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Abstract

Background: The ABO blood group exhibits a blood cell surface protein and an endothelial cell-associated Willebrand factor, and there is evidence that the blood type of individuals can determine the risk of thrombosis in advance. Due to the importance and high prevalence of coronary artery disease, the association between myocardial infarction and ABO blood groups has not been proven, and there are even controversial results.

Aims: To determine the relationship between the ABO blood group and acute myocardial infarction.

Materials and Methods: It was a cross-sectional descriptive study carried out at the department of Transfusion Medicine, Bangabandhu Sheikh Mujib Medical University, Dhaka. A total of 384 patients with a history of infarction as the sample. Purposive sampling was applied for the selection of data. The collected data were organized and analyzed using SPSS-22.

Results: Mean age was 54.34 ± 17.26 years, from 25-73 years. Most of the patients, 182 (47.4%) within the 45-65 age group. More than one-third of patients, 295 (76.8%), were male, and 89 (23.2%) patients were female; the male: female ratio was near about 3:1. The association of blood group between STEMI and NSTEMI patients in males and females patients was not statistically significant ($p > 0.05$). However, the prevalence of MI in blood group O is more significantly associated with NSTEMI and STEMI patients than in all other ABO blood groups.

Conclusion: The study shows the relation between the ABO blood group and MI, where patients with the O group are more prone to STEMI and NSTEMI.

Keywords: ABO Blood group, Myocardial infarction.

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Introduction

The ABO blood group exhibits a blood cell surface protein and an endothelial cell-associated Willebrand factor, and there is evidence that the blood type of individuals can determine the risk of thrombosis in advance.

Due to the importance and high prevalence of coronary artery disease, the association between myocardial infarction and ABO blood groups has not been proven, and there are even controversial results. The major blood group ABO type of a person depends on genes. Genes do not contain synthesis antigens directly.

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Gene	Glycosyltransferase	Immunodominant sugar	Antigen
H	α -2-L-fucosyltransferase	L-fucose	H
A	α -3-N-acetylgalactosaminyltransferase	N-acetyl-D-galactosamine	A
B	α -3-D-galactosyltransferase	D-galactose	B

(Harmening, 2012)²

The products of A, B, and H genes are transference enzymes. The precursor substance is acted upon by the H gene-specified transference enzyme and converted into an H substance. Next, the A and B specified transferase enzyme act on the H substance to convert the H substance to the A and B antigen. O genes is an amorph (no gene product), and group O cell contains only H substance.¹

Lee et al. study³ in Taiwan showed that individuals with A blood group are at higher risk for coronary artery disease and cardiac infarction than other blood groups. On the other hand, Amirzadegan et al.⁴ study in India and Sari et al. study⁵ in Turkey showed no correlation between blood groups and coronary artery disease. However, according to the findings of Mahmoodi and Salarzaei conducted a study⁶ in Tehran, coronary artery diseases are more common in the O blood group than in other blood groups.

Khan et al.⁷ found that persons having blood group A have 3.34 times more chances of developing ischaemic heart disease than other blood groups. Due to the importance and high prevalence of coronary artery disease, the association between myocardial infarction and ABO blood groups has not been proven so far, and there are, even, controversial results; therefore, the present study will be conducted to evaluate the relationship between ABO blood group and acute myocardial infarction. Suadicani et al. 8 reported that long-term occupational exposure to airborne pollutants is a stronger risk factor for ischemic heart disease in men with blood type O than in men with other ABO phenotypes. Von Beckerath et al. 9 showed that carriage ABO locus of the O1 allele is associated with decreased risk of myocardial infarction.

Acute myocardial infarction is caused by long-term myocardial ischemia.⁶ The onset of coronary artery disease causes the vessels to narrow and reduces blood flow to the affected area.¹⁰ In the atrial area, cholesterol, and tissue fibrosis plaques develop along with calcium sediments.⁶ These plaques cause more stenosis of the vessels and rupture of the inner surface of the vessels. The plaques are exposed to these laconic surfaces; consequently, they are activated and attached.¹¹

Due to the importance and high prevalence of coronary artery disease, the association between myocardial infarction and ABO blood groups has not been proven so far, and there are even controversial results; therefore, the present study will be conducted to evaluate the relationship between ABO blood group and acute myocardial infarction.

Materials and Methods

It was a cross-sectional descriptive study in the Department of Transfusion Medicine and Cardiology at Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. 384 Myocardial infarction (MI) disease patients diagnosed by the physician based on ECG, Creatine Kinase-Muscle/Brain (CK-MB), and Troponin I in the Department of Cardiology, BSMMU– study group.

Selection criteria:

Inclusion Criteria for case:

- Physicians in the Department of Cardiology, BSMMU, for the study group diagnosed patients of MI aged above 20 years.

Exclusion Criteria:

- Unstable angina and other cardiac diseases
- Subjects with active psychiatric illness or CNS disorder
- Subjects not willing to participate.

Sampling method

Patients were selected by non-random purposive sampling. The ethical review committee of Bangabandhu Sheikh Mujib Medical University,

Dhaka, approved the study protocol. The risk and benefits of the study were explained to all subjects and informed written consent was obtained. After a thorough clinical examination of each subject, the information was recorded in a data schedule. Standard tube method tests for determining ABO blood groups of all topics were used. Data thus obtained was analyzed statistically to determine any association between MI and different ABO blood groups.

Data were expressed as a percent and an absolute number of frequency. All categorical variables were analyzed- by either the Chi-square test or Fisher's exact test. Statistics and probability were determined by SPSS version-22 Computer based software at a 95% confidence limit. A p-value less than 0.05 is considered a significant level. The data was presented table and graph.

Results

Table 1: Demographic characteristics of the study patients (n=384)

Variables	No of patients	Percent (%)
Age group (years)		
25-35	15	3.9
36-45	42	10.9
46-65	182	47.4
> 65	145	37.8
Gender		
Male	295	76.8
Female	89	23.2
Living area		
Rural	208	54.2
Urban	176	45.8
Socioeconomic status		
Poor class	30	7.8
Middle class	280	72.9
Upper class	74	19.3

The mean age was 54.34 ± 17.26 years, minimum of 25 and maximum of 73 years. Most of the patients, 182(47.4%), were within 46-65 years age group. Maximum patients 295(76.8%) were male and 89(23.2%) patients were female. Male: female ratio is 3.3:1. Regarding residence, a maximum of 208(54.2%) participants came from rural areas, followed by 176(45.8%) who came from urban. Regarding socioeconomic status maximum of 280(72.9%) patients were middle class (BDT 6827.79-26851.99 Tk./month) and Upper Middle (BDT 26858.64-83018.22 Tk./month) families followed 74(19.3%) patients were upper class (BDT >-83024.87 Tk./month), 30(7.8%) patients were poor class (BDT \leq 6821.14 Tk/month).

Table 2: Association ABO blood group with the residence of the study patients (n=384)

Blood groups	n	Rural	Urban	p-value
		(n=208) n (%)	(n=176) n (%)	
A	58	43(74.1%)	15(25.9%)	0.001*
B	109	52(47.7%)	57(52.3%)	0.109 ^{ns}
AB	29	10(34.5%)	19(65.5%)	0.026*
O	188	103(54.8%)	85(45.2%)	0.811 ^{ns}
Total	384	208 (84.4%)	176 (15.6%)	

Chi-square test was done, *significant, ns= not significant

The table showed the association of the ABO blood group with residence, blood group A was significantly higher in the rural population, and blood group AB was significantly higher in urban respondents. Blood groups B and A were insignificant distributions between rural and urban respondents.

Table 3: Association of ABO blood groups with MI (n=384)

Blood groups	Male (n=295)			Female (n=89)		
	STEMI	NSTEMI	p-value	STEMI	NSTEMI	p-value
	(n=257) n (%)	(n=38) n (%)		(n=67) n (%)	(n=22) n (%)	
A	32(12.5%)	4(10.5%)	0.669 ^{ns}	13(19.4%)	9(45.5%)	0.091 ^{ns}
B	74(28.8%)	11(28.9%)		18(26.9%)	6(27.3%)	
AB	19(7.4%)	5(13.2%)		3(4.5%)	2(9.1%)	
O	132(51.4%)	18(47.4%)		33(49.3%)	5(18.2%)	
Total	257(100.0%)	38(100.0%)		67(100.0%)	22(100.0%)	

A Chi-square test was done, ns= not significant

In male patients, the highest prevalence of STEMI 132 (51.4%), NSTEMI 18(47.4%) was found in blood groups O then, followed by blood group B STEMI 74(28.8%) and NSTEMI 11(28.9%) blood group A was found 32 (12.5%) in STEMI and 4 (10.5%) in NSTEMI and lastly blood group AB was 19 (7.4%) in STEMI and 5 (13.2%) in NSTEMI. However, the association of blood group between STEMI and NSTEMI patients in male patients was not statistically significant ($p>0.05$).

In female patients, the highest prevalence of STEMI was found in blood group O STEMI 33 (49.3%) and NSTEMI 5 (18.2%). Blood group B STEMI 18 (26.9%) and NSTEMI 6 (27.3%). In blood groups, AB 3 (4.5%) was STEMI, and NSTEMI was 2 (9.1%). In blood group A, 13 (19.4%) was STEMI, and NSTEMI was 9 (45.5%). The association of blood group between STEMI and NSTEMI patients in female patients was not statistically significant ($p>0.05$).

Table 3: Relation of blood group with STEMI and NSTEMI patients (n=384)

Blood groups	n	STEMI (n=324) n (%)	NSTEMI (n=60) n (%)	p-value
A	58	45(77.59%)	13(22.41%)	0.063 ^{ns}
B	109	92(84.4%)	17(15.6%)	0.992 ^{ns}
AB	29	22(75.9%)	7(24.1%)	0.189 ^{ns}
O	188	165(87.77%)	23(12.23%)	0.042*
Total	384	324(84.4%)	60(15.6%)	

Chi-square test, ns= not significant, *significant

Chi-square analysis indicates that blood group O was significantly higher in STEMI and NSTEMI patients than in A, B, and AB blood group systems.

Discussion

The present study evaluated the relationship between the ABO blood group and acute myocardial infarction in patients referring to the Department of Transfusion Medicine, BSMMU. A total of 384 patients were analyzed in the present study; the mean age of participants was 54.34±17.26 years, minimum of 25 and a maximum of 73 years. Most of the patients were 182(47.4%) within the 45-65 age group. Mahmoodi and Salzaei¹² reported the mean age of participants was 56.24±8.17 years, and the oldest age group turned out to be 51 to 60 years which is consistent with the present study.

In the present study, 295(76.8%) were male and 89(23.2%) were female. Male: female ratio is 3.3:1. The mean age of male patients was 56.42±14.16 years, and the mean of female patients was 52.31±17.36. In accordance with the present study, Anvari et al.¹³ studies reported that 28.1% of female patients had a mean age of 60.5±8.63 years, and 71.9% of whom were male with a mean age of 58.17±9.88. Sheikh et al.¹⁴ studies were carried out on 170 patients with myocardial infarction, with a mean age of 58.17±9.89, and 170 individuals, with a mean age of 47±8.66.

In the present study within male patients, the highest prevalence of STEMI and NSTEMI was found in blood groups O 132 (51.4%), 18(47.4) then, followed by blood group B 74(28.8%), 11(28.9%) blood group A was found 32(12.5%) in STEMI and 4(10.5%) in NSTEMI and lastly blood group AB was 19(7.4%) in STEMI and 5(13.2%) in NSTEMI. The association of blood group between STEMI and NSTEMI patients in male patients was not statistically significant ($p>0.05$). Results from the Framingham study and several other reports indicated that ischemic heart disease might be higher in subjects of blood group A or its subgroups.¹⁵ The blood group A was the commonest among myocardial infarction and angina pectoris patients, while these diseases were least in blood group O patients, as reported by Akhund.¹⁶

In female patients, the highest prevalence of STEMI was found in blood group O STEMI 33 (49.3%) and NSTEMI 5 (18.2%). Blood group B STEMI 18 (26.9%) and NSTEMI 6 (27.3%). In blood groups, AB 3(4.5%) was STEMI, and NSTEMI was 2 (9.1%). In blood group A, 13 (19.4%) was STEMI, and NSTEMI was 9 (45.5%). The association of blood group between STEMI and NSTEMI patients in female patients was not statistically significant ($p>0.05$).

The present study analysis indicates that blood group O was significantly higher in STEMI and NSTEMI patients than in the A, B, and AB blood group systems. Stakisaitis et al.¹⁷ observed a significant relationship between blood group B and IHD. They studied 441 female patients with coronary atherosclerosis. They found 22.9 % of patients had group B against 15% of healthy females in group B. They further found that blood group A is not a risk factor for atherosclerosis in the Lithuanian population. Nevertheless, Sheikh et al.¹⁴ found no association of MI with blood group B in a sample population in Malaysia.

On the other hand, several investigators observed varying results. Amirzdegan et al.⁴ found that blood group A was more frequent and blood group O was less frequent among the patients with CAD. Abdollahi and his colleagues¹⁸ found that group A subjects reported more family history of CAD than those with other blood groups. Again, Skaikh et al.¹⁴ found that group A was the most common (57%) and the group O was the second (30.5%) among the MI patients in Gaza Stripe of Palestine. Different clinical studies have shown that individuals of the A phenotype blood group are more susceptible to cardiovascular diseases.^{19,20} In British men and in the Hungarian population, the incidence of ischaemic heart disease is higher in patients with blood group A.^{20,21}

In Bangladesh, Biswas et al.¹⁹ showed the prevalence of Coronary Artery Disease (CAD) was invariably higher in blood group O than all other blood groups whereas the major blood group in Bangladeshi people is phenotype B. It is similar to the observation of Anvari and his colleagues¹³ and Whincup et al.²¹ who concluded that the prevalence of CHD in blood group O was markedly higher than in all other blood groups which were in contrast with other studies done in Europe and United States. Yet another group of scientists found no difference between the different blood group frequencies in MI patients.^{5,22}

Amirzadegan et al.⁴ investigated a possible association of ABO blood groups with coronary

artery disease in 2026 CAD patients. Their analysis did not show any significant difference between the frequencies of ABO blood groups in coronary artery disease patients compared to the general Iranian population. Their findings suggest no correlation between various ABO blood groups and the development of coronary artery disease. Moreover, the prevalence of major risk factors was equal in patients with different blood groups. Therefore, blood groups did not impact the development of premature coronary artery disease in individual subjects.

Lutfullah and associates²² investigated 907 IHD patients for blood groups, hypertension, lipid profile, and other predisposing factors like obesity, smoking, BMI, etc. They concluded that there was no association between ABO blood groups and significant ischemic heart disease risk factors. Kanbay et al.²³ found no statistical differences among the various blood groups concerning any biochemical parameters. Biancari et al.²⁴ reported a similar distribution of ABO blood groups among patients undergoing coronary artery bypass graft (CABG) surgery compared to the general population. Sari et al.⁵ investigated 470 patients with acute ST elevation MI. Their results showed no direct correlation between the ABO blood group in patients and MI.

Conclusion

This study attempted to evaluate the association of ABO blood groups with MI in BSMMU. Data from this study suggest that both male and female individuals belonging to O are significantly related to STEMI and NSTEMI. Therefore, patients with the O blood group should pay extra attention to prevent MI development. Future studies at the community level with a larger sample size are recommended.

Conflict of interest: None declared

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