EUROPEAN ACADEMIC RESEARCH
Vol. XI, Issue 9/ December 2023

Impact Factor: 3.4546 (UIF)
DRJI Value: 5.9 (B+)

ISSN 2286-4822
www.euacademic.org

Frequency of Heart failure in STEMI after thrombolysis

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Abstract

Introduction: *Ischemic heart disease (IHD) is the most important cause of morbidity and mortality in developed countries. Acute ST-segment elevation myocardial infarction (STEMI) is generally associated with a significant injury to the myocardium, and no treatment or late treatment portends poor prognosis.*

Objective: *To determine the Frequency of Heart failure in STEMI after thrombolysis*

Material and Methods: *This case control study was carried out over a period of six months from 12-12-2022 to 13-06-2023 conducted at Bolan Medical College/SPH Cardiology Department Quetta, after the approval from the ethical committee of the hospital was taken. A total of 286, detailed medical history and physical examination was performed to exclude the possibility of CAD in controls. The study population including age, gender was taken. The data collected from the laboratory.*

Results: *Total of 286 patients, 2.4 % (7) were between 18-35 years of age and 47.6% (136) were in 36-60 years of age in case group whereas 1.0 % (3) were between 18-35 years of age and 49.0% (140) were in 36-60 years of age in control group. Mean age was 46.26±6.154 years in case group and 46.39±5.239 years in control group. Total of 286 patients, 14.7% (42) were male whereas 35.3% (101) were females in case group and 25.9% (74) were male whereas 24.1% (69) were females in control group. Distribution of blood group A was 30.4% (87) in case group and 20.6% (59).*

Conclusion: *We found that distribution of group A was 30.4% (87) in case, so we concluded that the frequency of ST-elevation myocardial infarction in our population is higher patients having blood group A as compared to control group.*

Keywords: ST-elevation myocardial infarction, Blood grouping, Ischemic heart disease

INTRODUCTION:

Cardiovascular diseases (CVDs) are the most important causes of morbidity and mortality in many developing and developed countries. Different risk factors affect the development of atherosclerosis and coronary artery disease (CAD). Diabetes mellitus, hypertension, age, sex, smoking, and family history are considered major risk factors. These factors are believed to be valid in the prediction and prevention of coronary disease[1]. The recent studies have revealed that ABO blood groups particularly non-O

blood group is associated with the risk of CVD [2]. There is a proven association between ABO blood groups and diseases that leads to the shift of the coagulation balance toward thrombus formation. ABO antigen may affect plasma levels of VWF and coagulation factor VIII[3], and blood group non-O has the lowest expression of O antigen and relatively higher levels of VWF and factor VIII. That blood group O is a potentially important genetic risk factor for bleeding, which also supports this mechanism theory.[4,5] Another biologically plausible mechanism involves glycotransferase-deficient enzyme which renders the ABO blood group to encode O phenotype, resulting in protection of subjects from MI risk. The latest study reveals that serum lipid mediates the effect of the ABO blood group on CAD. Blood group A is one of the risk factors of CAD mainly due to higher serum total cholesterol (TC) concentration in subjects. Our recent study also indicated that there is an association between blood group A and risk of CAD, and around 10.5% of the effect of blood group A on CAD is mediated by total cholesterol levels.[6] Another study in 2012 shows that prevalence of Blood group A in patients with CAD is 34% while it is 20.9% in general population. [12]

Studies on arterial disease and myocardial infarction (MI) have yielded contradictory results, although an association of these processes with the ABO system is physiologically justified because the carbohydrate erythrocyte antigens are also found on platelets and vascular endothelium. Results of a meta-analysis by Clark and Wu, published in March 2011, indicate a low impact of ABO blood groups on the risk of MI.[7] In a study published by Sari et al., it has been stated that the ABO blood group might not be significantly associated with the development of MI.[8] On the other side, Framingham's study results and several other reports have suggested that in A blood group subjects the incidence of ischemic disease higher than in other blood groups. In a study by Mahmoodi et al., a total of 300 patients with myocardial infarction (case group) and 303 patients without myocardial infarction were included and the Chi-square test analysis showed that, with a confidence of 95% and 0.5%, there was a significant correlation between the incidence of myocardial infarction and the blood group ($P<0.012$).[9] According to a study by Lin et al., multivariate logistic regression analysis showed that blood type O was positively associated with spontaneous revascularization in patients presenting with myocardial infarction (odds ratio: 1.40, $p = 0.02$).[10].

Our study aimed to investigate the association between the risk of ST-elevation myocardial infarction (STEMI) in the local population. A limited literature is available regarding this study in our region and no such kind of study has been conducted in our institute. This research could aid clinicians in predicting a patient's risk of myocardial infarction based on their blood group.

METHODOLOGY

Approval from the ethical committee of the hospital was taken. A total of 286 in the study, the inclusion criteria was applied (age between 10 to 60, with acute ST elevation MI 4-Controls: Patients without ST elevation MI) Detailed medical history and physical examination was performed to exclude the possibility of CAD in controls. Demographic data of the study population including age, gender was taken. The data of blood typing of the cases and controls were collected from the laboratory.

Patients with associated conditions i.e., diabetes (blood sugar random ≥200 mg/dl, smoking, hypertension (blood pressure ≥120/80 mmHg) and obesity (body mass index ≥25 kg/m^2) were excluded.

All the data was entered and analyzed with SPSS Ver. 26.0. Continuous variables i.e., age were expressed as mean and standard deviation. Categorical data i.e., gender, blood groups were expressed as number and percentages. Odds ratio were calculated for risk of myocardial infarction for different blood groups. P value ≤ 0.05 was considered statistically significant. Data was stratified for age and gender. Post-stratification chi-square test was applied taking p-value ≤0.05 as significant.

RESULTS:

A total of 286 fulfilling the inclusion/exclusion criteria were enrolled to study the association between ST-elevation myocardial infarction (STEMI) with blood group A.

Age distribution of the patients was done, it showed that out of 286 patients, 2.4 %(n=7) were between 18-35 years of age and 47.6 %(n=136) were in 36-60 years of age in case group whereas 1.0 %(n=3) were between 18-35 years of age and 49.0 %(n=140) were in 36-60 years of age in control group. Mean age was calculated as 46.26±6.154 years in case group and 46.39±5.239 years in control group. **(Table No. 1)**

Gender distribution of the patients was done, it showed that out of 286 patients, 14.7 % (n=42) were male whereas 35.3 %(n=101) were females in case group and 25.9 %(n=74) were male whereas 24.1 %(n=69) were females in control group. **(Table No. 2)**

Distribution of blood group A was 30.4% (n=87) in case group and 20.6% (n=59). (p=0.001), OR=2.212. **(Table No. 3-4)**

The data was stratified for age and gender shown in Table No. 5-6 respectively.

Table no. 1 Distribution of age N= 286

Age group	Group Case Control		Total	p value
18-35 years	7 (2.4 %)	3 (1.0%)	10 (3.5%)	0.198
36-60 years	136 (47.6%)	140 (49.0%)	276 (96.5%)	
Total	143 (50.0%)	143 (50.0%)	286 (100.0%)	

Mean ± SD (case group) = 46.26±6.154 years
Mean ± SD (control group) = 46.39±5.239 years

Table no. 2 Distribution of gender N= 286

Gender	Group Case Control		Total	p value
Male	42 (14.7 %)	74 (25.9%)	116 (40.6%)	0.000
Female	101 (35.3%)	69 (24.1%)	170 (59.4%)	
Total	143 (50.0%)	143 (50.0%)	286 (100.0%)	

Table no. 3 Distribution of different blood groups N= 286

Blood group A	Group Case Control		Total
Yes	87 (30.4 %)	59 (20.6%)	146 (51.0%)
No	56 (19.6%)	84 (29.4%)	140 (49.0%)
Total	143 (50.0%)	143 (50.0%)	286 (100.0%)

Table no. 4: Association of myocardial infarction with different blood groups N= 286

Blood group A	Group Case Control		Total	p value
Yes	87 (30.4 %)	59 (20.6%)	146 (51.0%)	0.001
No	56 (19.6%)	84 (29.4%)	140 (49.0%)	
Total	143 (50.0%)	143 (50.0%)	286 (100.0%)	

Odds ratio = 2.212
95% confidence interval = 1.378 - 3.549

Table no. 5: Stratification of both groups for different blood groups with respect to age using chi-square test (odds ratio) N= 286

Age group	Blood group A	Groups Case control		Total	p value
18-35 years	Yes	3 (30.0%)	3 (30.0%)	6 (60.0%)	0.091
	No	4 (40.0%)	0 (0.0%)	4 (40.0%)	OR=0.500
	Total	7 (70.0%)	3 (30.0%)	10(100.0%)	CI=0.225-1.113
36-60 years	Yes	84 (30.4%)	56 (20.3%)	140 (50.7%)	0.000
	No	52 (18.8%)	84 (30.4%)	136 (49.3%)	OR=2.423
	Total	136 (49.3%)	140 (50.7%)	276(100.0%)	CI=1.494-3.930

Table no. 6: Stratification of both groups for different blood groups with respect to gender using chi- square test (odds ratio) N= 286

Gender	Blood group A	Groups Case control		Total	p value
Male	Yes	29 (25.0%)	30 (25.9%)	59 (50.9%)	0.003
	No	13 (11.2%)	44 (37.9%)	57 (49.1%)	OR=3.272 CI=1.467-7.297
	Total	42 (36.2%)	74 (63.8%)	116(100.0%)	
Female	Yes	58 (34.1%)	29 (17.1%)	87 (51.2%)	
	No	43 (25.3%)	40 (23.5%)	83 (48.8%)	0.049
	Total	101 (59.4%)	69 (40.6%)	170(100.0%)	OR=1.860 CI=1.001-3.458

DISCUSSION

Coronary artery disease occurs mostly from atherosclerosis, when arteries become stenosed due to the accumulation of plaques rich in cholesterol in their walls. [13]Many reports have appeared in recent years suggesting an association between blood groups predominantly the ABO blood groups and MI. [14]

Nowadays, ABO blood group is suggested to be a risk factor for the development of several vascular diseases, such as hypertension, thromboembolism, and coronary artery disease (CAD). The ABO gene locus has been mapped to chromosome 9 at locus 9q34 and blood group antigens (A, B, and H) have been demonstrated to consist of complex carbohydrate molecules, which are placed on the extracellular surface of the red blood cell (RBC) membrane; however, they are actually expressed on a variety of human tissues i.e. epithelium, sensory neurons, platelets, and vascular endothelium. Additionally, it seems that ABO blood group is associated with serum lipids' metabolism, and there is a great interest about the impact of ABO blood groups on cardiovascular risk factors. [15]

In current study, Age distribution of the patients was done, it showed that out of 286 patients, 2.4% (n=7) were between 18-35 years of age and 47.6 %(n=136) were in 36-60 years of age in case group whereas 1.0 %(n=3) were between 18-35 years of age and 49.0 %(n=140) were in 36-60 years of age in control group. Mean age was 46.26±6.154 years in case group and 46.39±5.239 years in control group. Total of 286 patients, 14.7 %(n=42) were male whereas 35.3 %, 101 were females in case group and 25.9%, 74 were male whereas 24.1 %(n=69) were females in control group. Distribution of blood group A was 30.4% (n=87) in case group and 20.6% (n=59). (p=0.001), OR=2.212.

Biswas et al established type - O blood as a risk factor for CADs in Bangladeshi people [OR: 2.034 (1.127-3.67)]. [16] Furthermore, Ketch et al in a cohort study on 1198 patients who underwent PCI for acute myocardial infarction, showed higher prevalence of atherosclerosis and prior history of PCI among patients with O blood type, despite of no difference in procedural success, in-hospital blood transfusion, and incident MACE after 1 year follow-up.[17]

On the other hand, in a study by Carpeggiani et al in Italy, it has been reported that non-O blood group is associated with increased risk for cardiac death and mortality.[18] Zhou et al in another study among 2708 patients, suggested that A blood group was an independent risk factor for the presence and severity of CAD. [19]According to the findings of a meta-analysis study, non-O blood group increased risk of myocardial infarction by 25% (95% CI: 1.14–1.36); however, by focusing only on the results of prospective studies, this association was not confirmed (OR 1.01; 95% CI: 0.84–1.23). [20] In a Pakistani study done by Iftikhar et.al, the mean age of patients was 57.3 years. 36.4% were between 18-50 years of age while 63.6%were between 51-80 years of age. 79.2% were male and 20.8% were females. Frequency of ABO blood groups among patients with acute myocardial infarction in our study population was recorded as 28.8% with O +ve, 26% with B+ve, 18.4% with A+ve, 13.2% with AB +ve, 5.6% with A-ve, 4.4% with B-ve, 3.2% with O-ve and 0.4% with AB-ve [21]

Abdollahi et al 12investigated whether there was an association between ABO blood groups and cardiovascular risk factors in a healthy population and recorded that amongst 5000 subjects, 2920 had blood laboratory tests and their types of blood groups were known. Of the total of 2920, 57.4% were male, 70% were inactive, 14% were smokers, 25% were hypertensive, 23% obese, 21% had a family history of CAD , and the mean age was 41.52±12.317. Blood group O (32.9%), A (30.1%), B(23.3%) and AB(13.7%), respectively had most frequency. Amongst cardiac risk factors, only frequency of family history of CAD in an individual with different blood groups was different ($P< 0.01$) and individual with A blood group reported more family history of CVD versus other blood groups and concluded that amongst cardiovascular risk factors, only family history of CAD had a significant relation with ABO. [22]

The mechanisms through how ABO antigens may participate in the pathogenesis of CAD and myocardial infarction remain unproved. Most of the familial CAD might be linked to heritable risk factors, and the inheritance of ABO antigens could have important roles in this condition. The effects of blood group antigens on the level of inflammatory proteins and their central role for inflammation in all phases of the atherosclerotic process have been previously identified.[23-24] It is well-known that inflammation may increase the presence and progression of cardiovascular diseases, probably through mediating C-reactive protein, interleukin-6 and tumor necrosis factors.[25]

Moreover, the etiology of an acute coronary syndrome (ACS) varies from embolization of a fractured atheroma to a sudden occlusion of the coronary artery by a fresh clot on the thrombogenic surface of chronic atheromatous lesion.[26] The less frequent causes of ACS may include spasm of coronary arteries and embolization of calcium or vegetations. The response to thrombolytic therapy depends on the nature of the occluding lesion and burden of thrombus. Lesions with higher thrombus burden are more likely to respond to the administration of thrombolysis. The presence of A or B antigens in peripheral blood are considered a risk factor to hypercoagulability. Topcu et al investigated thrombus burden in patients with STEMI undergoing primary PCI.[27] Non-O blood group associated with high angiographic thrombus burden that may explain the higher response rate to thrombolysis among patients with Blood groups of A, B and AB. On the other hand in patients with O blood group the presence of smaller thrombus burden as the main occluding lesion correlates with a less favorable response to thrombolysis in patients with this blood group.

CONCLUSION

In current study we determine the association between ST-elevation myocardial infarction (STEMI) with blood, so we concluded that the frequency of ST-elevation myocardial infarction in our population is higher among patients having blood group A as compared to control group.

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