Frequency of ABO Blood Group and its Association with Acute Coronary Syndrome in Patients Presenting in a Tertiary Care Center of Nepal

Surya R Pathak, Sunil C Jha, Ratna M Gajurel, Chandra M Poudel, Hemant Shrestha, Sanjeev Thapa, Ravi Sahi, Shovit Thapa, Paras Koirala

Department of Cardiology, Maharajgunj Medical Campus, Manmohan Cardiothoracic Vascular and Transplant Centre, Institute of Medicine, Maharajgunj, Kathmandu, Nepal

Corresponding author:

Surya R Pathak, MBBS, MD

Department of Cardiology, Maharajgunj Medical Campus, Manmohan Cardiothoracic Vascular and Transplant Centre, Institute of Medicine, Maharajgunj, Kathmandu, Nepal
Email: *drsuryaraj@gmail.com*

ABSTRACT

Introduction

Coronary artery disease is the major cause of death all over the world. There are studies suggesting association between blood group and coronary artery disease. We attempted to study the frequency of ABO blood group and its association with acute coronary syndrome (ACS) in our hospital.

Methods

This is a retrospective, cross sectional study carried out in Manmohan Cardiothoracic Vascular and Transplant Centre from March 2018 to February 2019. Patients who were admitted with diagnosis of ACS were enrolled in the study. Data were recorded and analyzed using SPSS 20. Association between blood group and ACS was analyzed using chi square test and logistic regression.

Results

Total 430 patients were admitted with diagnosis of ACS during the study period, of which 307 (71.4 %) were male and Mean age was 61.22 years (±10.75). Blood group O was the most common type of blood group observed in 207 (48%) patients. ACS was significantly higher in blood group O compared to other groups after adjusting for normal ABO blood group prevalence in general population: blood group O vs. A (OR: 3.45, 95% CI: 2.48- 4.79, p- <0.001), blood group O vs. B (OR: 5.08, 95% CI: 3.53-7.33, p- <0.001), blood group AB vs. O (OR: 0.65, 95% CI: 0.41- 1.02, p- 0.064). Individuals with blood group O and B had increased risk of having STEMI and NSTEMI where as those with blood group A had increased risk of having unstable angina.

Conclusion

There was association between ABO blood group and coronary artery disease. Individuals with blood group O have increased incidence of ACS.

Keywords: *ABO blood group, acute coronary syndrome, coronary artery disease*

INTRODUCTION

Ischemic heart disease (IHD) is the most common cause of mortality worldwide with over 7 million deaths annually.[1] It is estimated that 32% of all deaths will be due to coronary artery disease (CAD) and it will be the leading cause of disability world wide by 2020.[2] Acute coronary syndrome (ACS) refers to a group of conditions resulting in a decrease in blood flow in coronary arteries, so that part of heart muscle is not able to function correctly or is dead and it includes the spectrum of clinical conditions ranging from unstable angina (UA) to non ST segment elevation myocardial infarction (NSTEMI) and ST segment elevation myocardial Infarction (STEMI).[3] The most common symptom of this syndrome is chest pain, which often radiates to arm, forearm, neck and jaws and is often associated with nausea, vomiting and sweating.[4]

CAD has multiple risk factors such as age, gender, family history of CAD, hypertension, diabetes, smoking and dyslipidemia.[5] The incidence of CAD may be affected by the prevalence of particular type of blood group in a community.[6] The relationship of ABO blood group and level of Von Willebrand Factor and factor VIII has been shown in few studies with increased levels of VWF and factor VIII implicated in increased risk of thrombosis.[7, 8]

Different studies have shown the controversial results about the ABO blood group and IHD. Only limited studies have been done about the possibility of relationship between the antigen of ABO blood group and acute coronary event. So we aimed to investigate whether ABO blood groups were associated with severity of CAD and a risk factor for CAD in Nepalese population.

METHODS

This retrospective, cross sectional study, was conducted on patients admitted to the coronary care unit of Manmohan Cardiothoracic Vascular and Transplant Centre, Kathmandu Nepal, from March 2018 to February 2019. Approval for the study was obtained from the Institutional Review Committee of Institute of Medicine.

All patients above the age of 18 years with the diagnosis of ACS were included in the study. Diagnosis of ACS (STEMI, NSTEMI, and UA) was based on clinical history, examination, serial electrocardiography, and measurement of cardiac enzymes and was confirmed by a specialist physician. ABO blood groups, age, sex, family history of CAD, and other risk factors such as hypertension, diabetes, smoking habits, and dyslipidemias were recorded.

Dyslipidemias was defined as the presence of any of the following: patient on lipid lowering drugs or total cholesterol >240mg/dl, triglycerides (TG) >150mg/dl, low density lipoprotein >130mg/dl and high density lipoprotein (HDL) < 50mg/dl for female and < 40mg/dl for male.[9]

Positive family history was considered if first degree relatives had CAD before the age of 55 years in men and 65 years in women.[9] Diabetes mellitus was defined as classical symptoms of diabetes, fasting plasma glucose $\geq$ 126mg/dl (7.0mmol/l) or 2-hr plasma glucose $\geq$ 200mg (11.1mmol/l) during an 75gm oral glucose tolerance test or HbA1C level $\geq$ 6.5% or if patient was on oral hypoglycemic agents.[10]

Hypertension was defined as systolic blood pressure >140mm Hg and or diastolic >90mm Hg and or on anti-hypertensive treatment.[11] Current smokers was defined as person who smoked > 100 cigarettes during their lifetime and were smoking every day or some days at the time of interview.[12]

Significant CAD was defined as a diameter of stenosis > 50% in each major epicardial coronary artery. Normal vessels were defined as the complete absence of any disease in the left main coronary artery (LMCA), left anterior descending (LAD), left circumflex (LCx), right coronary artery (RCA) and their main branches (diagonal, obtuse marginal, posterior descending, artery and postero lateral branch). Patients were classified as having single vessel disease (SVD), double vessel disease (DVD) and triple vessel disease (TVD) accordingly.

The results were reported as mean and standard deviation for the quantitative variables and percentages for the categorical variables. Chi-square test was used for categorical variables. We complied data from different studies[13,14,15] and obtained mean distribution of ABO blood group. We used direct standardization for adjustment of incidence of ACS according to population prevalence of blood groups. To evaluate the adjusted effects of blood group on severity of CAD, post hoc analysis for chi square test with adjusted residual method was carried out and value was

Table 1. Distribution of ACS cases according to blood group and adjusted distribution after direct standardization (n=430)

Blood Group	Number (%)	Adjusted distribution (%)	p-value
O	207 (48%)	62%	<0.001
A	102 (23%)	16%	
B	78 (19%)	11%	
AB	43 (10%)	11%	

Table 2. Distribution of type of ACS according to blood group and association using adjusted residual method

ACS spectrum	Blood Group Number(%), Adjusted residual value				p-value
	O (n-207)	A (n-102)	B (n-78)	AB (n-43)	
Unstable Angina (n-95)	50 (24.2%) 1.0	14 (13.7%) -2.3	17 (21.8%) -0.1	14 (32.6%) 1.7	0.001
NSTEMI (n-120)	68 (38.9%) 2.2	34 (33.3%) 1.4	10 (12.8%) -3.3	8 (18.6%) -1.4	
STEMI (n-215)	89 (43.0%) -2.8	54 (52.9%) 0.7	51 (65.4%) 3.0	21 (48.8%) -0.2	

considered significant if adjusted residual was >+1.96. Logistic regression was carried out to calculate odds ratio. Statistical significance was determined as a p-value of <0.05. All statistical analysis were performed using SPSS software version 20.

RESULTS

A total of 430 patients were enrolled during a study period of one year. The average age of the patients was 61.22 years (±10.75), among them 307 (71.4%) were male and 123 (28.6%) were female (fig 1). It was observed that hypertension was the most common risk factor. In our study, 232 (53.97%) had hypertension, 151 (35.11%) had diabetes mellitus, 93 (21.6%) had dyslipidemia and 146 (33.95%) were smoker.

The distribution of blood groups were as follows: blood group A was 23%, AB-10%, B-19% and O-48%. Among these blood group, blood group O was the most common type of blood group and AB was the least common. Prevalence of blood group showed variability in different population studies.

The complied data of prevalence of different blood groups from different studies[13,14,15,17] availed mean distribution of ABO blood group was as: O- 31%, A- 28%, B-27% and AB- 8%. After adjusting for this prevalence of ABO blood group, and incidence of ACS in our study by direct standardization, the relative incidence of ACS according to blood group was as shown in Table 1. Individuals with O blood group had increased odds of having ACS followed by blood group AB compared to blood groups A and B: blood group O vs. A (OR: 3.45, 95% CI: 2.48- 4.79, p- <0.001), blood group O vs. B (OR: 5.08, 95% CI: 3.53-7.33, p- <0.001), blood group AB vs. O (OR: 0.65, 95% CI: 0.41- 1.02, p- 0.064), blood group B vs. A (OR: 0.68, 95% CI: 0.44- 1.024, p- 0.065), blood group AB vs. A (OR: 2.26, 95% CI: 1.38- 3.67, p- 0.001), blood group AB vs. B (OR: 3.33, 95% CI: 1.99- 5.55, p- <0.001).

Among the type of acute coronary syndrome in these patients, STEMI was the most common ACS, which was diagnosed in 215(50%) patients, followed by NSTEMI 120(27.9%) and UA 95 (22.1%) (Table 2).

Table 3. Distribution of severity of CAD according to blood group and association using adjusted residual method

Coronary Angiography findings	Blood Group Number(%), Adjusted residual value				p-value
	O (n-207)	A (n-102)	B (n-78)	AB (n-43)	
Normal Cor-onaries (n-110)	65 (31.4%) -2.7	16(15.7%) -2.6	13(16.7%) -2.0	16(37.2%) -1.8	0.015
Minor CAD (n-13)	5(2.4%) -0.9	3(2.9%) -0.1	5(6.4%) 1.9	0(0%) -1.2	
SVD (n-101)	46(22.2%) -0.6	23(22.5%) -0.3	22(28.2%) 1.1	10(23.3%) 0.0	
DVD (n-99)	43(20.8%) -1.1	34(33.3%) 2.8	17(21.8%) -0.3	5(11.6%) -1.9	
TVD (n-107)	48(23.2%) -0.8	26(25.5%) 0.2	21(26.9%) 0.5	12(27.9%) 0.5	

In our study, individuals with blood group O and B had increased risk of having STEMI and NSTEMI, whereas those with blood group A had increased risk of having unstable angina.

Among the positive angiographic population i.e. 309 (71.38%), 107 (24.9%) patients had TVD, 99 (23%) had DVD, 101 (23.5%) had SVD and 110 (25.6%) had normal coronaries while 2 patients were diagnosed with having left main with TVD and 13(3%) had minor CAD (Table 3).

In our study, individuals with blood group A had increased risk of having DVD, whereas there was no significant association between severity of CAD and blood group with other blood groups.

DISCUSSION

CAD is the leading cause of death worldwide, so evaluation of all aspects that may predispose to the development of this disease is important.

The result of the present study seems to claim the significant links between the blood group phenotype as a risk factor for CAD. The results obtained in this study shows the prevalence of ACS in blood group O is markedly higher than all other ABO blood groups. In our study, blood group O was the most common blood group, followed by blood group A. Different studies done among different Nepalese population also showed that blood group O was the commonest blood group followed by group A[16,17], which was similar with our study. Omidi N et al reported that blood group O had more severe CAD.[5] Likewise Mayan SA et al reported the prevalence of CAD in Blood group O is significantly higher than in other blood groups[18] which was consistent with our study. In the study of Amirzadegan A et al, there was no significant differences between frequency of ABO blood group in patients with CAD in an Iranian Population.[19] Likewise, a study conducted by Dodiya et al in Gujarati population shows that patients with blood group O and A have higher relative risk of having CAD and the prevalence of CAD was higher in blood group O. In the same study it was also observed that the early onset of CAD was common with blood group A.[20]

As shown by Biswas S et al in a Bengali Asian Indian population, AB blood group decreased the risk of CAD and the O blood group was more frequent, which was same with our study.[21]

Impact of confounding factors in the form of major risk factors of CAD, such as diabetes, hypertension, smoking habits, and dyslipidemia should be considered while predicting association between blood group and CAD. In addition, other factors as genetics, race, sex, socioeconomic condition, environmental and lifestyle may have further impact on correlation of blood group with CAD.

CONCLUSION

Our results suggests that there is association between ABO blood group and coronary artery disease, independent of other risk factors. Moreover, ABO blood group is also associated with spectrum of presentation in ACS. Further studies are needed to confirm these findings and to investigate the potential mechanisms underlying the links between ABO blood group types and CAD risk.

CONFLICT OF INTEREST

None declared.

REFERENCES

1. Mathers CD, Loncar D, et al. Projections of global mortality and burden of disease from 2002 to 2030. PLoS med. 2006; 3(11).

2. Murray CJ, Lopez AD et al. Mortality by cause for eight regions of the world: Global Burden of disease study. Lancet 1997; 349: 1269-1276.

3. Kumar A, Cannon CP et al. Acute coronary syndromes: diagnosis and management, part I. Mayo Clin Proc. 2009;84(10):917–938.

4. Achar AS, Kundu S, Norcross AW et al. Diagnosis of acute coronary syndrome. Am Fam Physician. 2005;72(1):119- 126.

5. Omidi N, Rafie K M, Effatpanah M, et al. Association between ABO blood group and severity of coronary artery disease in unstable angina. ARYA Atheroscler. 2017;13(4):172–175.

6. Sari I, Ozer O, Davutoglu V, et al. ABO blood group distribution and major cardiovascular risk factors in patients with acute myocardial infarction. Blood Coagul Fibrinolysis 2008; 19(3): 231-4

7. Yip SP et al. Sequence variation at the human ABO locus. Ann Hum Genet. 2002;66(Pt 1):1–27

8. Helgadottir A, Thorleifsson G, Manolescu A, et al. A common variant on chromosome 9p21 affects the risk of myocardial infarction. Science. 2007;316 (5830):1491–93.

9. National Cholesterol Education Program (US). Third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (adult treatment panel III). National Cholesterol Education Program, National Heart, Lung, and Blood Institute, National Institutes of Health; 2002.

10. American Diabetes Association. Classification and diagnosis of diabetes: standards of medical care in diabetes-2018. Diabetes care. 2018; 41(Supplement 1):S13-27.

11. Thomas L, Schwenk, MD, et al. JAMA 2003 May 21. New Hypertension Guidelines: JNC 7

12. Jamal A, King AB, Neff LJ et al. Current cigarette smoking among adults—United States, 2005–2015.centres for disease control and prevention, Morbidity and mortality weekly report. 2016;65(44);1205-11

13. Das PK, Nair SC, Harris VK, et al. Distribution of ABO and Rh- D blood groups among blood donors in a tertiary care centre in south india. Trop.doct. 2001; 31(1):47-8

14. Chandra T, Gupta A et al. Prevalence of ABO and Rhesus blood groups in Northern india. J Blood Disorders transf .2012 :3(5):132.

15. Akhter S, Kibria G, Akhter N et al. ABO and Lewis Blood Grouping with ABH Secretor and Non-secretor Status: A Cross Sectional Study in Dhaka. Faridpur Med. Coll. J. 2011;6(1):38-40

16. Pramanik T, Adhikari P et al. Trend of blood group distribution among the different ethnic groups of Kathmandu Valley. Nepal medical college journal 2006; 8(4): 248-9.

17. Dhungel KU, Banskota GN,Das PK et al. Distribution of ABO and Rh blood groups in Nepalese medical students. Janaki Medical College Journal of Medical 2013; 1(2): 17-20.

18. Mayam SA, Boroumand MA, Emami B, et al. ABO Blood Group and coronary artery disease in Iranian patients awaiting coronary artery bypass graft surgery: A review of 10641cases. Laboratory Medicine.2009: 40(9); 528-30.

19. Carpeggiani C, Coceani M, Landi P et al. ABO blood group alleles: A risk factor for coronary artery disease. An angiographic study. Atherosclerosis. 2010;211(2):461–66

20. Amirzadegan A, Salarifar M, Sadeghian S et al. Correlation between ABO blood groups, major risk factors, and coronary artery disease. Int J Cardiol.2006;110(2):256–58

21. Dodiya D, Panchal V, Patel V et al. Association of ABO blood groups with coronary artery disease in Gujarati population. Indian journal of applied basic medical science. 2013;15b(21):66-72.

22. Biswas S, Ghoshal PK, Halder B, et al. Distribution of ABO blood group and major cardiovascular risk factors with coronary heart disease. Biomed Res Int. 2013; 2013:782941.