Study of association of ABO blood group distribution and ischemic heart disease

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Abstract

Background: Different blood groups respond in a different way to environmental stimuli, thereby different blood groups must have different vulnerability to human illnesses.

Objective: To find out an association of ABO blood group distribution and ischemic heart disease (IHD).

Materials and Methods: A prospective study, in a sample of 410 patients attending the medicine OPD, was done in a tertiary-care hospital to find out an association of ABO blood group distribution and IHD.

Result: Of 410 patients, 226 patients were of myocardial infarction (MI) and 133 of angina. MI was seen predominantly in blood group "B" subjects (38.49%) and angina in blood group "A" subjects (37.59%). The highest numbers of men with MI were in the age group 31–40 and 41–50 years. Occurrence of MI among women was common in 20–30 and 31–40 years age group, and the highest number of them belonged to blood group "A". While 57.14% male patients with angina belonged to blood group "O" and were in the age group of 41–50 years. Majority of women with blood group "A" presented with angina in 31–40 years age group, blood group "B" in 20–30 years age group, "AB" blood group in 41–50 years age group, and blood group "B" in 31–40 years age group.

Conclusion: IHD was more common among men when compared with women. The ratio of male to female with MI was 1.4:1 and, for angina, 1.1:1. The occurrence of IHD was highest among subjects with age younger than 40 years. The incidence of IHD was three times more among blood groups A and B subjects when compared with blood group O subjects, whereas the highest incidence of MI was seen among subjects with blood group B. Men with blood group B and women with blood group A showed higher prevalence of MI, whereas angina was more common among A blood group patients of both sexes.

KEY WORDS: Angina, epidemic, ischemia, myocardial infarction

Introduction

Blood groups represent a system of antigenic determinants found on the surface of red blood cells. ABO blood group was the first system to be described and remains the most significant one in transfusion medicine. The knowledge provides the scientific basis for understanding disease of newborn and autoimmune hemolytic anemia. Blood group antigens play a critical role in susceptibility to many infections such as parasitic, viral, and bacterial.[1] The absence of certain RBC antigens is related with specific clinical disorders, and the recognition of these associations has led to an improved understanding of functions of antigens in RBC membrane.

Landsteiner discovered three blood groups A, B, and O in 1900.[2] Indications of the fourth group AB were found in 1902.[3]

In humans, 26 blood groups systems with 228 antigens have been identified. These are ABO, MNS, P, Rh, Lutheran, Kell, Lewis, Duffy, Kidd, Diego, Yt, Xg, Scianna, Dombrock, Colton, Landsteiner–Weiner, Chido/Rodgers, Hh, Kx, Gerbich, Cromer, Knops, Indian, Ok, Raph, and John Militon Hagen.[4]

The blood groups are transmitted through genes. The genes for A and B phenotypes are found on chromosomes 9p and are expressed in Mendelian codominant manner.[5]

For the first time, authors observed an association between carcinoma of colon, rectum, and peptic ulcer among blood group "O" and carcinoma of stomach among "A" blood group patients.[6]

Cardiovascular diseases are becoming major health burden in the developing countries. Ischemic heart disease emerged as a major health problem in the twentieth century. It is considered as a modern epidemic, which started first in the developed nations (i.e., United States of America and UK). The epidemic is emerging now in the developing nations because of the changing lifestyles and the dietary habits. The cardiovascular diseases are projected to replace the infections by the year 2015 in India.[7]

There is sufficient evidence in the literature to incriminate a genetic factor also in the incidence of ischemic heart disease (IHD).

The influence of hereditary factors in a disease is difficult to recognize. Blood group studies are now being used to access the role of such factors. The different blood groups react differently to environmental stimuli, thereby different blood groups should have different susceptibility to human diseases showing an excellent examples of genetic polymorphism.[8,9]

Many blood group studies have been done in IHD, the results have so far been inconclusive. These inconclusive reports led us to conduct a study to find out an association of ABO blood group distribution and IHD.

Materials and Methods

This study was undertaken in Santosh Medical College, Ghaziabad, Uttar Pradesh, India, within a span of 1 year. This study was done on 410 subjects who were selected from the Medicine Outpatient Department of Santosh Hospital.

All the subjects were personally interviewed to screen them for general information such as age, sex, occupation, personal habits, lifestyle, socioeconomic status, and physical activity. The Rose Questionnaire, recommended by the WHO, was narrated to all the persons under the study in their local language. Information on symptoms such as chest pain on effort (angina), history of heart attack or any pain lasting for half-an-hour or more across the front of the chest in the past (possible infarction), pain in legs on walking (intermittent claudication), and presence or absence of previous diagnosis of IHD was elicited. History of diabetes and hypertension was enquired from all the subjects. Family history of IHD was also included in the history.

General physical examination, including general appearance, record of pulse, respiratory rate, blood pressure, jugular venous pressure, weight, height, and edema was done. The systemic examination including examination of CVS, respiratory system, abdomen of all the subjects was done.

Diagnostic Criteria

Ischemic Heart Disease

(a) "Rose Questionnaire": It includes information on symptoms such as pain on effort (angina) and history of heart attack or any pain lasting for half-an-hour or more across the front of chest in the past (possible infarction).

(b) Electrocardiogram (ECG): The persons responding positive to the Rose Questionnaire were subjected to 12-lead ECG by single compact electrocardiograph unit. The ECG showing changes of infarction were recorded as a case of myocardial infarction (MI).

Of 410 subjects, 226 showed MI, 133 showed angina, and 51 were without MI and angina. They were considered as control subjects.

Result

This study was done on 410 subjects with a history of chest pain. Of 410 patients, 226 patients (55.12%) were of MI, 133 (32.43%) of angina, and 51 (12.43%) were healthy controls.

In our study, 89.47% male subjects with MI were Hindus, 6.01% were Muslims, and 4.51% belonged to other different religion groups. Among female subjects, 91.39% were Hindus, followed by 6.45 % Muslims and 2.15% other religion groups. Of 226 subjects with MI, 133 were male and 93 female subjects [Table 1].

MI was seen predominantly in blood group B subjects (38.49%), followed by group "A" (32.74%), group "AB" (17.25%), and the lowest number of subjects had blood group "O" (11.50%). Angina was most common among blood group A subjects (37.59%), followed by blood group B (31.57%), group AB (17.29%), and the lowest percentage was seen in blood group O (13.53%). The controls had the highest number of O blood group subjects (41.17%). The occurrence of IHD was more prevalent among A, B, and AB blood groups than O blood group [Table 2].

In our study, 132 male subjects showed MI. The highest numbers of male subjects with MI were in the age group of 31–40 and 41–50 years. The lowest numbers of subjects with MI were with age older than 50 years. With advancing age, occurrence of MI decreases among patients of different blood groups. It is also seen that blood group B subjects were predominant among age group of 31–40 years, whereas blood group A subjects were higher among 41–50 years age group.

The numbers of female subjects with MI were 94. Majority of them (36) belonged to blood group A, followed by blood group B (32). Twenty female patients had blood group AB and six patients belonged to blood group O. Occurrence of MI among female subjects was common in 20–30 and 31–40 years age group, and the highest number of them had blood group A, whereas female subjects with blood group O showed MI in the late years of life (>50 years) [Table 3].

Table 1: Religion and sex-wise distribution of patients with history of chest pain

Religion	Myocardial infarction		Angina		Control	
	Male, *n* (%)	Female, *n* (%)	Male, *n* (%)	Female, *n* (%)	Male, *n* (%)	Female, *n* (%)
Hindu	119 (89.47)	85 (91.39)	51 (72.85)	51 (80.95)	27 (90.00)	20 (95.23)
Muslim	8 (6.01)	6 (6.45)	14 (20.00)	8 (12.69)	2 (6.66)	1 (4.76)
Others	6 (4.51)	2 (2.15)	5 (7.14)	4 (6.34)	1 (3.33)	Nil
Total	133	93	70	63	30	21

Table 2: Blood group distribution among IHD and control subjects

Blood group	MI, *n* (%)	Angina, *n* (%)	Control, *n* (%)	Total, *n* (%)
A	74 (32.74)	50 (37.59)	8 (15.68)	132 (32.19)
B	87 (38.49)	42 (31.57)	16 (31.37)	145 (35.36)
AB	39 (17.25)	23 (17.29)	6 (11.76)	68 (16.58)
O	26 (11.5)	18 (13.53)	21 (41.17)	65 (15.85)
Total	226	133	51	410

Table 3: Relation of age with blood groups in males and females with MI

Males, *n* (%)					
Age (years)	A	B	AB	O	Total
20–30	7 (18.91)	10 (28.57)	4 (21.05)	5 (23.8)	26 (19.69)
31–40	10 (27.02)	23 (65.71)	8 (42.1)	5 (23.8)	46 (34.84)
41–50	12 (32.43)	16 (45.71)	6 (31.57)	10 (47.61)	44 (33.33)
>50	8 (21.62)	6 (17.14)	1 (5.26)	1 (4.76)	16 (12.12)
Total	37	35	19	21	132
Females, *n* (%)					
Age (years)	A	B	AB	O	Total
20–30	15 (41.66)	12 (37.75)	8 (40.00)	Nil	35 (37.23)
31–40	14 (38.88)	10 (31.25)	10 (50.00)	1 (16.66)	35 (37.23)
41–50	4 (11.11)	8 (25.00)	1 (5.00)	2 (33.33)	15 (15.95)
>50	3 (8.33)	2 (6.00)	1 (5.00)	3 (50.01)	9 (9.57)
Total	36	32	20	6	94

Table 4: Relation of age with blood groups in males and females with angina

Males					
Age (years)	A	B	AB	O	Total
20–30	11 (40.74)	6 (26.08)	3 (23.07)	1 (14.28)	21 (30.00)
31–40	9 (33.33)	10 (43.47)	2 (15.38)	2 (28.57)	23 (32.85)
41–50	5 (18.51)	6 (26.08)	6 (46.15)	4 (57.14)	23 (32.85)
>50	2 (7.40)	1 (4.34)	2 (15.38)	Nil	5 (7.14)
Total	27	23	13	7	70
Females, *n* (%)					
Age (years)	A	B	AB	O	Total
20–30	7 (30.43)	6 (33.33)	2 (20.00)	4 (33.33)	19 (30.15)
31–40	14 (60.86)	5 (27.77)	2 (20.00)	6 (50.00)	27 (42.85)
41–50	2 (8.69)	5 (27.77)	4 (40.00)	1 (8.33)	12 (19.04)
>50	Nil	2 (11.11)	2 (20.00)	1 (8.34)	5 (7.93)
Total	23	18	10	12	63

In our study, 40.74% of male patients with angina belonged to blood group A in 20–30 years of age, 43.47% patients were in the age group 31–40 years, with blood group B, whereas 46.15% male patients with angina were in the age group of 41–50 years, and they belonged to blood group AB; while 57.14% male patients with angina had blood group O and belonged to age group 41–50 years of age. Majority of male angina patients with blood group A (11) belonged to age group 20–30 years, whereas, 10 male patients with blood group B showed a higher prevalence of angina in the age group of 31–40 years. A lower number of patients with blood group 'O' were present in all age groups. Majority of female patients with blood group A presented with angina in 31–40 years age group, blood group B in 20–30 years age group, AB blood group in 41–50 years age group, and blood group B female patients in 31–40 years of age group showed angina [Table 4].

Discussion

The discovery of ABO blood group, over 100 years ago, caused great excitement. As understanding of ABO blood group grew, not only blood transfusion became safer but also scientists could now study one of the first human characteristics proven to be inherited. The ABO blood group antigens also appeared to have been important throughout our evaluation, because the frequencies of different ABO blood types vary among different populations, suggesting that a particular blood type conferred a selection of advantages e.g., resistance against many diseases. The ABO phenotype has been linked with stomach ulcers, gastric cancer. IHD, the most important cardiovascular disease, emerged as a major health problem in most societies in the twentieth century, affecting many people and often resulting in death or disability, and, during this period, only an effort to associate ABO blood group system with IHD had started to evaluate ABO gene as a possible risk factor in its causation. This study includes 410 subjects who reported in medicine outpatient department with chief complaint of chest pain. Their history was taken, and they were examined. They were administered Rose Questionnaire. A total of 359 subjects were reported to be positive and rest negative. Twelve-lead ECG was done for 359 subjects, of which 226 subjects showed infarction changes. They were diagnosed as a case of MI, whereas 133 subjects showed no infarction changes. They were diagnosed as a case of angina. Blood grouping was done for all the subjects. Among MI patients, the most predominant blood group was blood group B (38.49%), followed by blood group A (32.74%) and AB (17.25%). O blood group patients comprised 1.50% only. Among angina patients, blood group A was the commonest (37.59%), followed by B (31.57%), AB (17.29%), and O (13.53%). The blood groups A and B showed the highest probability of IHD, and blood group O had the least chance. Among blood group A, majority of male patients (27.02%) belonged to 31–40 years age group, and 32.43% belonged to 41–50 years age group. Higher number of MI male patients belonging to blood group A presented in

middle age group, whereas male elderly MI patients were only eight, and young male MI patients were only seven. Blood group B male patients with MI also presented in middle age group. Elderly male MI group comprised of only six patients, and young male MI patients were 10 in number. Majority of blood groups AB and O male patients with MI presented in middle age group. Female patients with blood groups A and B with MI presented in age group 20–30 years and 31–40 years (i.e., 15 and 14 females, respectively for blood group A, and 12 and 10 females for blood group B), whereas blood group O female patients presented with MI in the age group of 41–50 years and >50 years. It was observed that 40% male subjects of blood group A presented with angina in the early life (20–30 years), whereas 43.47% male subjects of blood group B presented during 31–40 years. Among blood group AB, 46.15% male subjects presented with angina during 41–50 years, and among blood group O, 47% male subjects with angina belonged to 41–50 years age group. Majority of female subjects with blood groups A and B presented angina in early years of life (21–30 years).

Similar findings were observed by Jaegermann.[10] Excess of groups A and B over group O was demonstrated by Bronte et al.,[11] whereas excess of A and O blood groups was demonstrated by Akhund et al.[12] Allan and Dawson[13] observed that there are significantly less number of IHD cases with blood group O. Srivastava et al.[14] found a significant deficit of O and excess of A blood groups among patients with IHD. They concluded that group A people are more susceptible to develop IHD, whereas group O people are unlikely to develop IHD. Contrary to the present observations, a study labeled slight excess of group O and deficit of group A among patients with angina pectoris alone. These variations in their study may have been owing to racial, environmental, and genetic factors.[15] In few studies, no significant relationship between blood groups and IHDs were found.[16,17] The present observations are similar to Rosenberg et al.,[18] wherein postmenopausal women appeared to present lower risk of MI than menopausal women. The present observation is also consistent with a study, where excess of blood group A over blood group O in less than 50 years of age group was observed.[13]

Contrary to the present observations, Srivastava et al.,[14] in an Indian study, found that most of the A blood group people were over the age of 50 years with IHD. In a study on racially mixed South African subjects with IHD, the author observed that excess of blood group A is present in over 70 years of age group with IHD.[11] In this study, the association of sex was also tested. Our results were similar to Kannel and Feinleib,[19] who labeled the common occurrence of IHD among men when compared with women.

Conclusion

This study reveals that the highest incidence of MI was seen among subjects with blood group B, whereas angina was more common among blood group A subjects. Male patients with blood group B and female patients with blood

group A showed a higher prevalence of MI, whereas angina was more common among A blood group patients of both sexes. The occurrence of IHD was highest among subjects with age younger than 40 years. IHD was more common among men when compared with women. The ratio of male to female with MI was 1.4:1 and, for angina, was 1.1:1.

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