

ORIGINAL ARTICLE

ASSOCIATION OF ABO AND Rh BLOOD GROUPS
WITH HYPERTENSION

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Background: Hypertension has been termed 'silent killer' a chronic illness with adverse effects principally involving the central nervous system, the retina, the heart and the kidneys. Since hypertension is multifactorial, the ABO antigens may indirectly influence arterial pressure. This study was conducted to evaluate the prevalence of ABO and Rh blood groups among controls and hypertensives to assess the relationship between hypertension and blood group. **Methods:** This cross-sectional study included 300 apparently healthy, normotensive controls and 500 hypertensive subjects. The basal blood pressures were determined using palpatory and auscultatory method in both control and hypertensive group and their blood groups were determined using the slide haemagglutination technique. Statistical analysis was done using Chi-square test. **Results:** The frequency of ABO blood groups in both control and hypertensive group was found to be B>O>A>AB. The prevalence of blood group B and O was found to be increased in hypertensive group by 3%, prevalence of blood group A and AB was found to be decreased by 4.3% and 1.5% respectively, but was not significant statistically ($p>0.05$). **Conclusion:** There is no correlation of developing hypertension with a particular blood group.

Keywords: Hypertension, ABO blood group, Rh blood group

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INTRODUCTION

Hypertension is an asymptomatic condition, therefore people are unaware of their high blood pressure. This is the main reason that it remains undetected leading to organ damage. It is estimated to cause 7.1 million deaths globally (13% of total).¹ In developing countries, hypertension is on the rise due to the increase in urbanization and adoption to western lifestyles.² Hypertension in adults affects the quality of life of people and economic burden of the country.³ People get aware of being hypertensive only after developing its complications.

Diagnosis of hypertensive patients is very important as it can easily be prevented by recognizing its probable risk factors.⁴ Hypertension is dependent on modifiable and non-modifiable factors. Obesity and weight gain are the strongest modifiable independent risk factors in developing hypertension.⁵ Familial patterns of hypertension suggests genetic factor as another important non-modifiable predisposing factor, and ABO blood group is one such factor which needs to be investigated in more details.

The ABO blood groups are determined by presence or absence of antigen A and B on membrane of human red blood cell. These blood group antigens, which are actually complex oligosaccharide differ in their terminal sugar.⁶ The antibodies against red blood cell antigens are called agglutinins, which are present in the sera of individuals whose red cells lack corresponding antigen. The presence of these antigens and agglutinins in individuals, divides them into 4 major blood groups A, B, AB and O.^{6,7} In addition, if human RBCs contain another important antigen D, the blood is known as

Rhesus (Rh) positive, while persons without antigen D in their RBCs are termed Rh negative.^{8,9} Immunological characteristics determine and classify the differentiation of blood by type.¹⁰

Studies have shown that various blood group phenotypes have been implicated in increased susceptibility to certain diseases¹¹, e.g., *Helicobacter pylori* and increased risk of peptic ulcer^{12,13}, haemolytic uremic syndrome, and *Escherichia coli*¹⁴, elevated serum antibody titer levels to *Vibrio cholera*¹⁵, carcinomas¹⁶ and infertility in women¹⁷. Thus its frequency distribution follows a known pattern governed by gene transmission, and varies with the race and geographical distribution of human being.¹⁸

Familial patterns of primary hypertension suggests that there could be some genetic factors for the development of hypertension. There are reports of increased cardiovascular (CV) risks in different blood groups and increase in BP is considered as a common CV risk. The ABO system is one such genetic make-up that can provide much valuable information for early detection of vulnerable groups.

Some studies suggest that those carrying the ABO blood group sublet A^{19,20}, group B²¹⁻²³, group O²⁴⁻²⁶ have a greater risk of developing hypertension. On the contrary, some studies^{27,28} could not find relevant data in favour of subjects with the ABO blood group being susceptible to hypertension. Though the blood type cannot be modified as a risk factor, having knowledge of the relationship between blood groups and heart disease can help to improve the control of other modifiable risk factors of developing hypertension.

The objectives of this study were to evaluate the prevalence of hypertension in various ABO and Rh blood group subjects, and to see any association between ABO and Rh blood groups with hypertension.

SUBJECTS AND METHODS

It was a cross-sectional study carried out in two groups of subjects. The Control group included 300 normal, healthy subjects in the age group 20–70 years, males and females, attending a general medicine outpatient department of Sri Guru Ramdas Institute of Medical Sciences and Research, Amritsar. The Study group comprised of 500 age-matched male and female subjects having essential hypertension.

Criteria for inclusion were blood pressure more than 140/90 mm Hg to be included in study group and below it to be included in control group. Subjects with diabetes mellitus and renal hypertension (serum creatinine levels above 1.5 mg/dl) were not included in the study. The written and informed consent of the subjects was obtained prior to collection of data.

Conventional slide agglutination tests were done to determine the blood groups and Rh factor. The blood pressure was recorded using mercury sphygmomanometer by palpatory and auscultatory methods. Systolic and diastolic blood pressure of each subject was recorded in the resting supine position. Three readings were recorded on each subject and their average was taken as final record. Individuals with raised blood pressure (BP) values of systolic blood pressure above 140 mmHg and diastolic blood pressure above 90 mmHg were classified as hypertensive.

Statistical analysis of data was done by applying Chi-square test to see any association of blood groups and hypertension.

RESULTS

This cross-sectional study was conducted on 800 subjects, 406 males and 394 females, out of which 500 (261 males and 239 females) were from hypertensives group and 300 (145 males and 155 females) were from control group who were randomly selected from the General Medical OPD.

The percentage distribution of ABO blood groups in the Control group of 300 normotensives showed predominance of blood group B (36.66%), followed by O (31.66%), A (24.33%), and AB (7.33%) in both sexes. The same prevalence of blood groups (B, O and AB) was observed in Hypertensive group of 500

study subjects showing blood group B (39.6%), followed by O (34.6%), A (20%), and AB (5.8%). The percent distribution of ABO blood groups in the Total study group of 800 was found to be (38.5%) blood group B, (33.5%) O, (21.62%) A, and (5.12%) AB. There was an increase in prevalence of hypertension by 3% in blood group B and O, and a decrease in prevalence of hypertension by 4.3% in blood group A, and 1.5% in blood group AB which was not statistically significant ($p>0.05$). (Table-1).

The percentage distribution of Rh factor in the control group showed 91% Rh+ve and 9% Rh-ve, while hypertensive group showed 93.6% Rh+ve and 6.4% Rh-ve. The percentage distribution of Rh factor in total group of 800 subjects was found to be 92.62% Rh+ve and 7.37% Rh-ve. There was increase in prevalence of Rh+ve by 2.6% and decrease of Rh-ve by 2.6% in the hypertensive group which was statistically not significant ($p>0.05$). (Table-2).

In Control group the genderwise percentage distribution of blood group A was more in males while the percentage distribution of blood group B, AB and O was increased in females. In hypertensive group the percentage distribution of blood group A, B, and O was increased in males and blood group AB was increased in females (Table-3). Blood groups in both genders do not vary significantly ($p>0.05$).

In the hypertensive group Rh+ve males were 93.48% and females were 93.72%, while Rh-ve males were 6.51% and females were 6.27% respectively, showing no significant variation in males and females ($p>0.05$). Thus hypertension was not related to blood group or gender. (Table-4).

Table-1: Frequency and distribution of ABO blood groups [n (%)]

Blood group	Control	Hypertensive	Total
A	73 (24.33)	100 (20)	173 (21.62)
B	110 (36.66)	198 (39.6)	308 (38.5)
AB	22 (7.33)	29 (5.8)	41 (5.12)
O	95 (31.66)	173 (34.6)	268 (33.5)
Total	300	500	800

$p=0.29$

Table-2: Frequency and distribution of Rh factor [n(%)]

Rh factor	Control	Hypertensive	Total
Rh+ve	273 (91)	468 (93.6)	741 (92.6)
Rh-ve	27 (9)	32 (6.4)	59 (7.37)
Total	300	500	800

$p=0.29$

Table-3: Genderwise distribution of ABO blood groups [n (%)]

Blood Group	Control Male	Control Female	Total	Hypertensive Male	Hypertensive Female	Total
A	40 (54.79)	33 (45.20)	73 (24.33)	51 (51)	39 (39)	100 (20)
B	50 (45.45)	60 (54.54)	110 (36.6)	112 (56.56)	86 (43.43)	198 (39.6)
AB	10 (45.45)	12 (54.54)	22 (7.33)	13 (44.82)	16 (55.17)	29 (5.8)
O	45 (47.36)	50 (52.63)	95 (31.66)	92 (53.17)	8 (146.82)	173 (34.6)
Total	145 (48.3)	155 (51.66)	300	261 (52.2)	239 (47.8)	500
p-value	$p=0.45$			$p=0.41$		

Table-4: Genderwise frequency and distribution of Rh factor [n (%)]

Rh factor	Control Male	Control Female	Total	Hypertensive Male	Hypertensive Female	Total
Rh+ve	132 (91.03)	141 (90.96)	273 (91)	244 (93.48)	224 (93.72)	468 (93.6)
Rh-ve	13 (8.96)	14 (9.03)	27 (9)	17 (6.51)	15 (6.27)	32 (6.4)
Total	145 (48.33)	155 (51.66)	300	261 (52.2)	239 (47.8)	500
p-value	0.45			0.94		

DISCUSSION

High blood pressure is a major public health problem in India, rapidly increasing in urban and rural populations.^{29,30} Majority of hypertensive subjects remain undetected due to its initial asymptomatic course, and thus its control is inadequate. This calls for urgent prevention and control measures for hypertension.³¹ Studies suggest the genetic basis of essential hypertension in populations of different ethnicity.^{32,33} Thus, a non-modifiable factor like blood group can be used as a predictor for hypertension and its awareness in the population can be used to initiate lifestyle modifications in the susceptible category.

In India, the ABO blood group frequency is variable, the frequency of blood group B is 6% in Negritos of Andamans while it is 48% in Birijas of Bihar. On the other hand blood group A is 20–30% in Western and Eastern Himalayas.³⁴ The blood group frequency distribution in North India is B>O>A>AB. There is a mixed population of Caucasian and Indoscythian racial stock in the state of Punjab, and the blood group frequency is B (34–39%)>O (30.0–31.5%)>A (20%)>AB (7.8%).³⁵ Our study also observed similar frequency distribution B (38.5%)>O (33.5%)>A (21.62%)>AB (5.12%). Similarly, percent distribution of Rh+ve (92.62%) and Rh-ve (7.37%) is in accordance with earlier studies.

The increase in prevalence of hypertension was observed in blood group B and O by 3%, while a decrease in prevalence of hypertension was found 4.3% and 1.5% in blood group A and AB respectively, but it was not statistically significant. It can be concluded that there is no association between ABO blood groups and essential hypertension. Our results are consistent with earlier studies.^{32,36} A significant association was found between the blood group B and O, and diastolic blood pressure.^{35,37} Various studies show significant association of hypertension with blood group B^{21–23}, and blood group O^{24,25}. Similarly, in our study, there was an increase in hypertensives by 2.6% in Rh+ve, and a decrease by 2.6% in Rh-ve, but it was not significant.

Genderwise percentage distribution of blood groups B, AB and O is increased in females of the control group while blood group A, B, and O increased in males of hypertensive group but it does not vary significantly. In other words inheritance of ABO blood group is not related to gender. This study shows that there is no association between development of hypertension in a particular blood group.

CONCLUSION & RECOMMENDATIONS

Blood group B is the most prevalent blood group in North Indian Punjabi population. The frequency of occurrence of hypertension was found to be highest in blood group B and O, but it was statistically not significant. Certain precautions may be taken against hypertension in hypertension susceptible blood groups right from their childhood in some specific blood group population. More studies to genetic level may be done and anti-hypertensive medication engineered to help in combating the consequences of hypertension.

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