

Original article

Association of ABO and Rh blood groups with blood pressure: A cross sectional study in South Indian population

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Abstract:

Introduction: The importance of human blood groups in blood transfusion is a well-known fact. In recent times, much interest is focused in understanding their role in certain disease processes. As blood groups are genetically determined, they may play a role in the development of certain genetic disorders. Hypertension is a well-known genetic disorder with a high degree of inheritance. Though a handful of studies have been conducted in various populations to recognise the blood group-hypertension relationship; the reports were entirely different in each case. Therefore, aim of the present study was to identify the association of ABO and Rh blood group with blood pressure in south Indian population.

Materials and methods: It was a cross-sectional, population-based study comprised of 228 subjects. Two variables were noted from each individual: Arterial blood pressure and blood group. Chi-square test was applied to assess the relation between these two variables.

Results: The mean systolic blood pressure was significantly high in AB blood group when compared to other blood groups (p value 0.02). There was no difference in diastolic blood pressure of A, B, AB and O groups. Similarly, there was no association of blood pressure with Rhesus (Rh) blood group.

Conclusion: Findings of this study suggest that AB blood group individuals have more susceptibility for hypertension indicating a potential genetic association between ABO blood group and hypertension. Further studies are essential in larger population to more clearly elucidate these results.

Keywords: Blood group, Blood pressure, Hypertension

Introduction:

All human blood may perhaps look alike, but it's not so. Based on the presence or absence of antigens on erythrocyte membrane, blood is categorized into different groups. So far, International Society of Blood Transfusion has approved thirty-five major blood groups in humans.^[1] The first blood group, ABO, was discovered in 1900 by Austrian scientist, Karl Landsteiner. The ABO blood group antigens (A, B and AB) are widely expressed on the membranes of

red cells and a variety of tissue cells.^[2] Apart from their importance in blood transfusion process, the ABO and Rh blood groups are useful in other fields as well, like genetics, certain medicolegal issues and to study population migration patterns.

In modern medicine, relationship of blood groups to disease has become an interesting area of research because of a known genetic connection of specific blood groups to certain diseases, in certain population. Thus far, several reports have suggested important associations between ABO

blood groups and various diseases, for example, peptic ulcer, gastric cancer, pernicious anaemia^[3], certain bacterial and viral infections^[4], hypertension^[5, 6, 7] and ischemic heart diseases^[8,9].

Some studies have been done to discern the role of genetic factors in the pathophysiology of hypertension. One such important genetic factor is individual's blood group system. Blood groups are genetically determined and hypertension is one of the most common complex genetic disorders, with genetic heritability averaging 30%. Although our understanding of the pathophysiology of elevated arterial pressure has increased, in 90 to 95% of cases the aetiology is still largely unknown. Many factors contribute to the development of hypertension which can broadly be categorized into two; modifiable and non-modifiable. Modifiable risk factors such as adiposities, age, stress, high salt intake, overweight and obesity are strongly correlated with high blood pressure. Whereas, genetic factors remain as an important non-modifiable predisposing factors in the development of hypertension.^[10]

Many efforts have been made in India and other parts of the world to understand the blood type and elevated BP relationship. A study from Himachal Pradesh, India, reported that the incidence of hypertension was highest in O group, followed by A, B and AB, suggesting O blood group individuals have more risk of developing Hypertension.^[5] A tribal-population based study from Rajasthan, India, found that people having B blood group were more susceptible for hypertension.^[6]

Study done in African population stated that there was no significant association between systolic BP and any of the blood type, however they observed high diastolic BP was associated with B, O and Rhesus (Rh) D type.^[9] Another study in White population could not find any significant difference in frequency distribution of blood groups between

essential hypertensive patients and controls and it was concluded that, although an inherited factor in essential hypertension is accepted, there was no association with ABO inheritance.^[11]

As it is evident, the results from previous studies are somewhat inconclusive and it may be due to variance in the study population, study design, regional and racial differences that might have affected the results. Therefore, the present study was performed to assess the relation between ABO and Rh blood types and blood pressure in South Indian population.

Materials and methods:

The present study was conducted in the Department of Physiology of Sri Manakula Vinayagar Medical College and Hospital, Puducherry and approved by Research and Ethical Committee of the institution. It was a Cross-sectional, population-based study involving 228 medical students. The study was carried out during exam-free period and without disturbing their academic schedule. The participation was entirely voluntary. Written informed consent was taken from each participant after explaining the study purpose and procedure. Demographic data like, age, gender, height, weight, family history of Hypertension and history of any medications, were collected.

After 5 minutes of rest blood pressure (BP) was recorded twice in non-dominant arm of each student in sitting position; with 5mins interval between two recordings and mean value was taken. Blood pressure was recorded using a mercury Sphygmomanometer (Diamond, Industrial Electronic and Allied Products, Pune). The appearance (phase I) and disappearance (phase V) of Korotkoff sounds were considered for systolic and diastolic BP, respectively.^[12] Measurement of BP was done by the same observer to avoid bias. Individuals are classified into Normal,

Prehypertensive and Hypertensive according to the guidelines by The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-VII).^[13]For blood group determination, blood was collected from left ring-finger under aseptic precautions. ABO and Rh blood grouping were done by agglutination test using monoclonal anti-A, anti-B and anti-D (IgM) sera (from Tulip Diagnostics, Verna, Goa).

Statistical analysis was done using OPEN EPI software. Chi-square test was applied to know the association of blood groups to blood pressure. 'P' value < 0.05 was taken as significant.

Results:

The mean age of the study population was 19±2yrs (Mean±SD). Females constituted 55.26% (126) and males constituted 44.74% (102) of this study. Table 1 indicates Blood group O is predominant in

distribution with the highest frequency (42.11%), followed by blood group B (33.33%), A (17.54%) and AB (7.02%). In the Rhesus system, 91% of individuals were Rh(D) positive and only 9% were Rh(D) negative (Figure 1). We can also find in table 1, the mean Systolic Blood Pressure (SBP) in AB group is statistically significant with 'p' value of 0.02, and no significant difference in the mean Diastolic Blood Pressure (DBP) of ABO group. In this study the overall prevalence of prehypertension and hypertension was 30.70% and 15.79% respectively. The prehypertensive and hypertensive students were referred to the Department of Medicine for further evaluation.

Table 2 indicates there is no significant association of elevated blood pressure with A, B and O blood groups, whereas AB group shows a significant association (p value, 0.02) with blood pressure.

Table 1. Shows frequencies of ABO of blood groups and mean blood pressure in the study population.

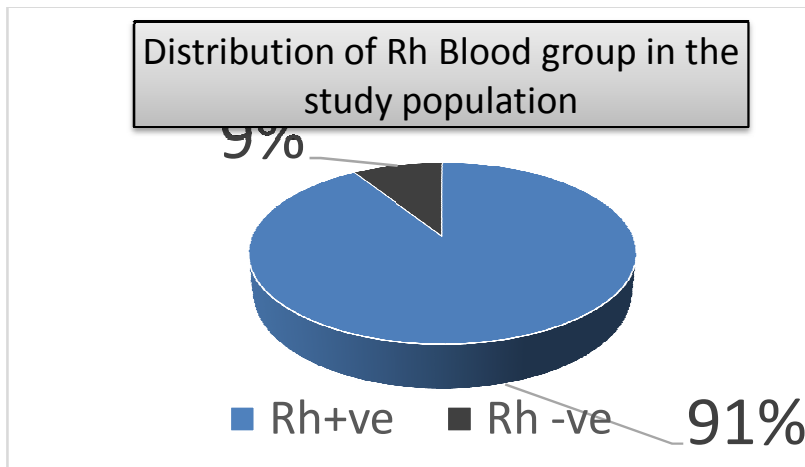
Blood type	Number of subjects (N)	Percentage	Mean SBP in mmHg (Mean±SD)	Mean DBP in mmHg (Mean±SD)
A	N=40	17.54%	120.6 ±11.8	74 ±10.1
B	N=76	33.33%	120.3± 12.5	73.24± 9.7
AB	N=16	7.02%	128.4 ±13.8	76.4 ±11.5
O	N=96	42.11%	121.1 ±15.5	73.6± 10.2

Table 2. Distribution of ABO blood group system in subjects with normal and elevated blood pressure.

Blood type	Subjects with normal BP (N=122)	Subjects with elevated BP (N=106)	P value
A	22	18	0.9
B	40	36	0.9
AB	4	12	0.02*
O	56	40	0.2

*p value < 0.05 is considered significant

Figure 1. Shows distribution of Rh Blood group system in the study population



Discussion:

The arterial blood pressure is influenced by several factors and it is strongly associated with age, weight, height, social class, smoking habits, degree of physical activity etc.^[14] Influence of Blood group systems on blood pressure was explored by many researchers in various populations. In the present study, we didn't find any association between blood groups A, B, O and Rh systems with blood pressure. However, in AB group, majority of individuals had higher SBP which was a significant finding. Similar kind of association between AB blood type and blood pressure was found in other study as well.^[14]

In earlier studies, from northern part of India, it was observed that AB blood group individuals had least chance of developing hypertension compared to other groups^[5,6]. Results of this study suggest a reverse tendency in AB blood group. The reason for this differential findings in AB group may be due to dissimilarity in the study population. Findings of the current study add support to the hypothesis that genetic factors related to ABO blood group system may play role in the development of hypertension.

A clear-cut hypertensive tendency among young medical students was also observed in this study.

The younger the patient when hypertension is first noted, the greater is the reduction in life expectancy if it is left untreated. Therefore, it alerts the young doctors to adopt healthy lifestyle measures from the student period itself.

Limitations of the study: The high prevalence of elevated blood pressure observed in AB blood group may be a chance occurrence as the sample size of the AB group in the current study was very small. Therefore, additional studies, involving larger population with more criteria, are essential to completely explain the present findings.

Conclusion:

This study indicates that individuals with AB blood group have a greater chance of developing hypertension, supporting the role of genetic factors in the pathophysiology of hypertension. We also emphasize that further research has to be done in larger population to fully elucidate these findings. In addition, we suggest the need of regular screening programmes in this population to detect high blood pressure, so that, concerned authorities can take immediate steps to curb the unwanted cardiovascular complications of hypertension - a 'silent killer'.

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