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RESEARCH ARTICLE

PREVALENCE OF ABO & RH POSITIVE BLOOD GROUPS AMONG THE HYPERTENSIVE MALE AND FEMALE POPULATION IN GREATER GUWAHATI

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ABSTRACT

Hypertension may be defined as that level of blood pressure at which the institution of therapy reduces blood pressure related morbidity and mortality. More than 140/90 mm Hg should be considered hypertensive and should get treated. This study was done to evaluate the prevalence of ABO and Rh positive blood groups among the hypertensive male and female patients in greater Guwahati. It was a population-based study done in greater Guwahati. 400 male and 400 female hypertensive subjects were selected according to inclusion and exclusion criterias. Their basal blood pressures were determined using palpatory and auscultatory method. Their blood groups were determined using slide haemagglutination technique. It was found that the prevalence of 'O' Rh positive blood group among male hypertensives was 45% and female hypertensives was 42%. Similarly, 35% male and 34% female hypertensives belonged to 'B' Rh positive, 18% male and 20% female hypertensives belong to 'A' Rh positive and lastly, 2% male and 4% female hypertensives belonged to 'AB' Rh positive blood group. Thus, 'O' Rh positive blood group is the most prevalent one followed by 'B' Rh positive, followed by 'A' Rh positive and lastly by 'AB' Rh positive blood group which is the least prevalent blood group among hypertensive patients in greater Guwahati.

INTRODUCTION

Hypertension is a growing concern which is engulfing the entire world. Hypertension is the subsequent elevation of the systemic arterial pressure to a level that places the patients at increased risk for target organ damage (Aird *et al*., 1954, 1956, 1953; Braunwald *et al*., 1998; William F. Ganong, 2003). From an epidemiologic perspective, there is no obvious level of blood pressure that defines hypertension. In adults, there is a continuous, incremental risk of cardiovascular disease, stroke and renal disease across levels of both systolic and diastolic blood pressure. Clinically, hypertension may be defined as that level of blood pressure at which the institution of therapy reduces blood pressure related morbidity and mortality. A recent classification recommends blood pressure criteria for defining normal blood pressure, prehypertension, which is a common occurance among the elderly (Table-1). In children and adolescents, hypertension generally is defined as systolic and/or diastolic blood pressure consistently 95th percentile for age, sex and height. Blood pressures between the 90th and 95th percentiles are considered prehypertensive and are an indication for lifetime interventions. Recommended criteria for a diagnosis of hypertension are average awake blood pressure ≥135/85 mmHg and asleep blood pressure ≥120/75 mmHg. These levels approximate a clinic blood pressure of 140/90 mmHg (Longo *et al*., 2012). More than 140/90 mm Hg should be considered hypertensive and should get treated.

Hypertension is one of the leading causes of the global burden of disease. Approximately 7.6 million deaths (13-15% of the total) and 92 million disability-adjusted life years worldwide were attributable to high blood pressure in 2002. Hypertension doubles the risk of cardioivascular diseases, including coronary heart disease (CHD), congestive heart failure (CHF), ischemic and hemorrhagic stroke, renal failure, and peripheral arterial disease. It often is associated with additional cardiovascular disease risk factors, and the risk of cardiovascular disease increases with the total burden of risk factors.

Although antihypertensive therapy clearly reduces the risks of cardiovascular and renal disease, large segments of the hypertensive population are either untreated or inadequately treated (Longo *et al*., 2012).

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Table 1. 'Blood Pressure Classification'

Blood Pressure Classification	Systolic, mmHg	Diastolic, mmHg
Normal	<120	and <80
Prehypertension	120-139	or 80-89
Stage 1 hypertension	140-159	or 90-99
Stage 2 hypertension	≥160	or ≥100
Isolated systolic hypertension	≥140	and <90

Source: Adapted from Chobanian *et al*.

A blood group system consists of a group of antigens encoded by alleles at a single gene locus or at gene loci so closely linked that crossing over does not occur or is very rare. An antigen collection consists of antigens that are phenotypically, biochemically, or genetically related, but the genes encoding them have not been identified (Lewis *et al*., 1990).

The chief blood groups are – i/. Classical ABO blood groups.
ii/.Rh blood groups.

ABO blood group systems

Discovery of the ABO system by Landsteiner in 1901 marked the beginning of safe blood transfusion. The ABO antigen, although most important in relation to transfusion, are also expressed on most endothelial and epithelial membranes and are important histocompatibility antigen (Eastlund, 1998). The ABO blood group system was the first system described and remains the most significant in transfusion medicine. A mismatch of ABO may be fatal, whereas a mismatch of other blood groups, initially is harmless. This situiation occurs because anti-A and anti-B antibodies usually are present in the blood of adults lacking the corresponding antigen (Kenneth Karshansky *et al*., 2010). In ABO blood group system the four groups are determined by presence or absence of antigen A(α) and/or antigen B (β) on the red blood cells, and therefore, an individual is either group A, B, AB or O (O denoting the absence of antigen A and antigen B) (Medalie *et al*., 1973; Miller *et al*., 1971; Nance *et al*.,1965). In addition it has been shown that, corresponding to the antigens 'A' and 'B', there are antibodies anti-A (α) and anti-B (β) which occur as agglutinins in the sera of individuals whose red cells lack the corresponding antigen.

Rh blood group system

The Rh (not Rhesus) system is the second most important blood group system in transfusion medicine because antigen-positive RBC's frequently immunise antigen-negative individuals through transfusion and pregnancy. Inheritance of Rh antigens is determined by a complex of two closely linked genes: one encodes the protein carrying D antigen (RhD): the other encodes the protein carrying C or c and E or e antigens (RhCE). RBCs from Rh-positive people have both RhD and RhCE, whereas Rh-negative RBCs have only RhCE (Kenneth Karshansky *et al*., 2010). Thus, individuals are grouped as either Rh 'positive' or Rh 'negative' based upon the presence or absence of the major D antigen on the surface of their red blood cells.

Aims and objectives

1. To evaluate the prevalence of ABO and Rh blood groups among the hypertensive male population in greater Guwahati.
2. To evaluate the prevalence of ABO and Rh blood groups among the hypertensive female population in greater Guwahati.

MATERIALS AND METHODS

This study was carried out in greater Guwahati for a duration of seven months from 1st of July, 2015 to 31st of January, 2016.

i. It was a cross-sectional population based study.
ii. A simple random sampling was done.
iii. The written and informed consent of the subjects was obtained prior to collection of data.

Inclusion criteria

i. All ABO Rh positive blood group subjects were selected.
ii. Only hypertensive patients were selected.
iii. Age group was 35 to 50 years of age.
iv. No family history of hypertension, diabetes mellitus or other co-morbidities.
v. Non-vegetarian males and females with a history of hypertension for more than two years.
vi. Non-pregnant females.

Exclusion criteria

i. All ABO Rh negative blood group subjects were excluded.
ii. Subjects whose age were less than 35 and more than 50 years of age.
iii. Family history of hypertension, diabetes mellitus type-1 or type-2, suffering from renal hypertension or other co-morbidities.
iv. Vegetarian males and females.
v. Pregnant females.

A total of 800 hypertensive patients were selected based on inclusion and exclusion criterias who were residents of greater Guwahati city of Assam which is a state in the north-eastern region of India. This total sample of 800 patients were divided into two groups. One group was having 400 male subjects and the other group was consisted of 400 female subjects. The subjects of both the groups were of 35-50 years of age, having ABO and rhesus positive blood groups and without any familial hypertensive history or other co-morbidities. Their basal blood pressures were determined using palpatory and auscultatory methods. Their blood groups were determined using slide haemagglutination technique.

Subjects from both the groups were tested for the following tests.

Determination of blood groups

Blood group was determined using slide haemagglutination technique. A small quantity (about 1cc) of 1% sodium citrate solution in normal saline was taken in a watch glass. A free flowing sample of blood was obtained by pricking the finger with usual aseptic and antiseptic precautions. A few drops (nearly 4 to 5 drops) of blood were dropped into the watch glass containing the citrate solution. The blood was mixed thoroughly with the citrate solution. A clean glass slide was

taken. A drop of citrate solution was placed on one end of the slide and on the other end was placed a drop of anti-A serum with the help of a labelled dropper. This slide was labelled as anti-A by a glass marking pencil. Similarly a drop of citrate solution and a drop of anti-B serum were taken at the two ends of another slide. This slide was labelled as anti-B. A drop of blood diluted with citrate solution was now added to each of these drops and was mixed with them with separate applicator sticks. After mixing they were left for half an hour for reaction to take place between agglutinin and agglutinogen. At the end of half an hour the slides were examined by naked eye to see if there was any agglutination of red cells in the test samples. If there was any agglutination the red cells appear as isolated coarse clumps of brick red colours due to hemolysis of red cells and liberation of haemoglobin as a result of agglutination.

Interpretation of result by slide haemagglutination technique

Reagents		Interpretation
Anti-A	Anti-B	Group
+	-	A
-	+	B
+	+	AB
-	-	O

Key: '+' = Agglutination, '- = No agglutination.

In the same way Rh-grouping of the blood can be done by using serum containing anti-Rh (usually anti-D) agglutinin.

Determination of blood pressure

The basal blood pressures of the subjects were determined using palpatory method and auscultatory method for blood pressure measurement by using mercury sphygmomanometer.

RESULTS

In the study of male hypertensive population, the following results were found. 179 patients out of 400 hypertensive patients belonged to 'O' Rh positive blood group, so its prevalence is 45%. 139 patients out of 400 hypertensive patients belonged to 'B' Rh positive blood group, so its prevalence is 35%. 73 patients out of 400 hypertensive patients belonged to 'A' Rh positive blood group, so its prevalence is 18%. 9 patients out of 400 hypertensive patients belonged to 'AB' Rh positive blood group, so its prevalence is 2%. (see Table-*2* and Fig-1).

Table 2. This table shows the percentage of prevalence of blood groups in male hypertensives

S. No.	Blood group (ABO – Rh positive)	No. of subjects out of 400 subjects	Percentage (%) of prevalence.
1.	'O'	179	45
2.	'B'	139	35
3.	'A'	73	18
4.	'AB'	9	2

In the study of female hypertensive population, the following results were found

169 patients out of 400 hypertensive patients belonged to 'O' Rh positive blood group, so its prevalence is 42%. 135 patients out of 400 hypertensive patients belonged to 'B' Rh positive blood group, so its prevalence is 34%. 79 patients out of 400 hypertensive patients belonged to 'A' Rh positive blood group, so its prevalence is 20%. 17 patients out of 400 hypertensive patients belonged to 'AB' Rh positive blood group, so its prevalence is 4%. (see Table-3 and Fig-2).

In the study of the total hypertensive population i.e. including both male and female total number of hypertensive subjects, the following results were found. 348 patients out of 800 hypertensive patients belonged to 'O' Rh positive blood group, so its prevalence is 44%. 274 patients out of 800 hypertensive patients belonged to 'B' Rh positive blood group, so its prevalence is 34%.

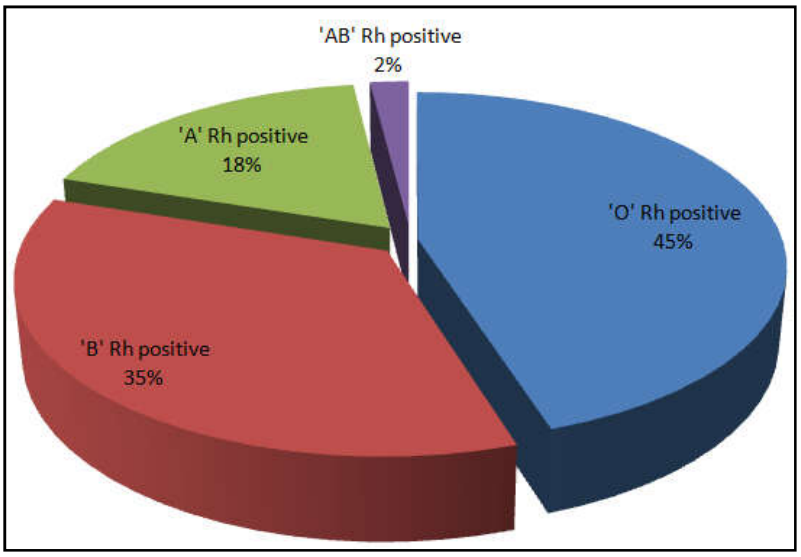

Fig. 1. This figure shows the percentage of ABO and Rh positive blood groups in male hypertensives

152 patients out of 800 hypertensive patients belonged to 'A' Rh positive blood group, so its prevalence is 19%. 26 patients out of 800 hypertensive patients belonged to 'AB' Rh positive blood group, so its prevalence is 3%. (see Table-4 and Fig-3).

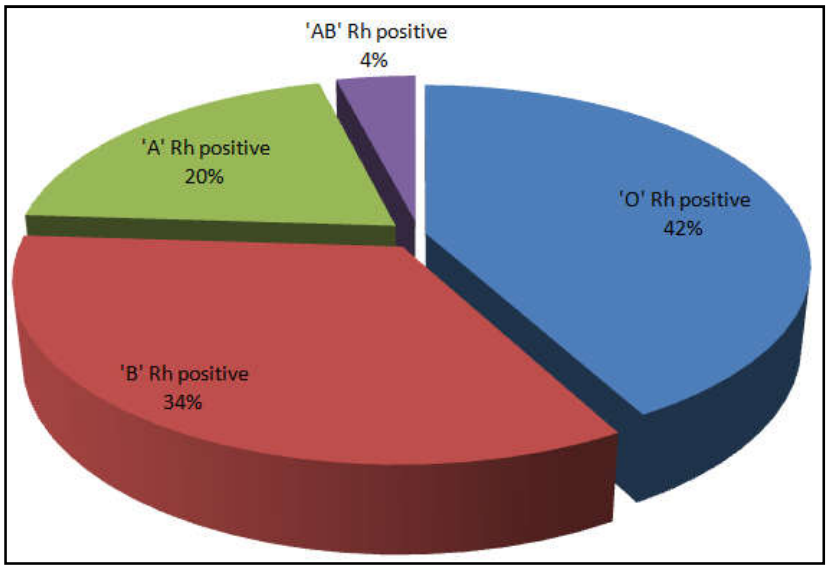

Fig. 2. This figure shows the percentage of ABO and Rh positive blood groups in female hypertensives

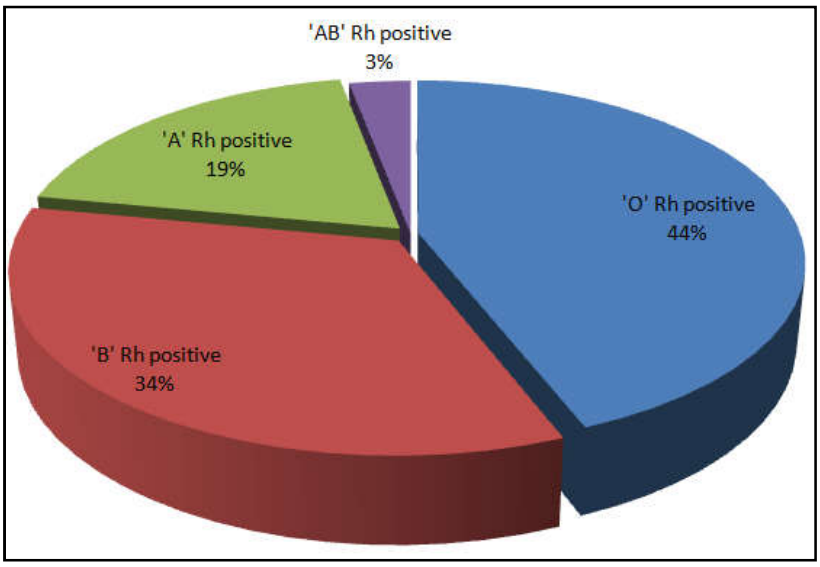

Fig. 3. This figure shows the percentage of ABO and Rh positive blood groups in hypertensives (both males and females are included)

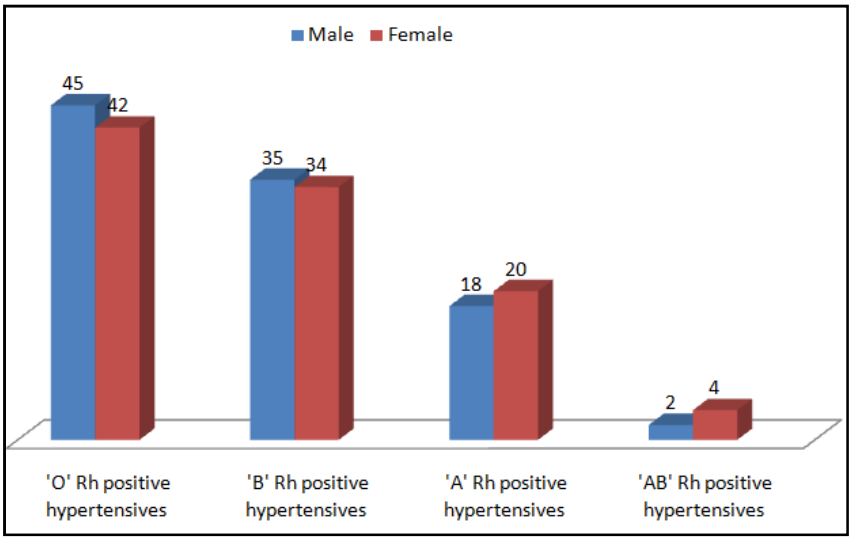

Fig.4. This figure shows the prevalence of ABO and Rh positive blood groups among male and female hypertensives

Table 3. This table shows thepercentage of prevalence of blood groups in female hypertensives

S. No.	Blood group (ABO – Rh positive)	No. of subjects out of 400 subjects	Percentage (%) of prevalence.
1.	'O'	169	42
2.	'B'	135	34
3.	'A'	79	20
4.	'AB'	17	4

Table 4. This table shows thepercentage of prevalence of blood groups in hypertensives (both males and females are included)

S. No.	Blood group (ABO – Rh positive)	No. of subjects out of 800 subjects	Percentage (%) of prevalence.
1.	'O'	348	44
2.	'B'	274	34
3.	'A'	152	19
4.	'AB'	26	3

DISCUSSION

There is some evidence that ABO blood groups may be associated with certain diseases. Gastric cancer has been reported to be more prevalent in individuals with blood group A, peptic ulcer is more often in there with group O (Reid and Bird, 1990). One of the best established blood group associations is that between blood type O of the ABO system and duodenal ulceration (Clark, 1961), although even this has not been confirmed in every investigation (Beaglehole *et al*., 1978). As ischaemic heart disease has a strong association with duodenal ulcer, and as duodenal ulcer has a strong association with blood group O, one would expect to find an excess of O's among ischaemic heart disease patients (Allan and Audrey A. Dawson, 1968). There is a previously reported evidence for genetic mediation of components of the blood pressure control system (Grim *et al*.,). Blood group O is the most common group in India as evident from various studies. More than 60% of the population in India has blood group A and O. The least common group is AB blood group. Similar pattern was also seen in IHD patients. In USA, England, Africa, Australia and Saudi Arabia majority of the people have blood A and O. Sex distribution had no significant association with the blood group. The recent studies have also shown similar results. Although numerous studies have revealed genetic influences on physiological mediators been defined and genetic markers have not been identified (Ambareesha Kondam *et al*., 2012).

The importance of the gene-environment interaction in disease development is unknown, but it may be responsible for the familial aggregation of apparent non genetic disorders. This is confounded by the fact that families share both genes and household environments. It is possible that it is not the presence of a given blood type but rather the absence of the protective effect of other alleles that is responsible for disease development. It is beyond the nature of the current investigation to discriminate between these alternative hypotheses. A significant association was found between the ABO blood group and DBP (Diastolic blood pressure); those carrying the A allele (blood types A or AB) were less likely to have high DBP than those of type B or O. This finding, in conjunction with the lower frequency of the A allele in African derived vs European-derived populations, suggests a potential link between the ABO system and hypertension (Barbara Nemesure *et al*., 2006). The importance of genetic factors in familial aggregation of blood pressure level has been shown repeatedly (Borhani *et al*., 1976; Miall *et al*., 1967; Zinner *et al*., 1971). There is a previously reported evidence for genetic mediation of components of the blood pressure control system (Grim *et al*., 1979). Investigators using the described diagnostic protocol have shown that normotensive first degree relatives of essential hypertensives have significantly higher blood pressure ($p<0.05$) and significantly higher plasma renin activity before and after a saline infusion ($p<0.05$) than age-race-sex matched controls (Grim *et al*., 1979). There may be important physiological differences in individuals predisposed to become hypertensive compared to normotensive individuals and that such differences may be under genetic influence. The practice of searching for disease-blood group association has often been criticized (Wiener, 1977). This is because studies on different populations have often failed to confirm initial reports. It is likely that such inconsistencies are due to vastly different environments in study populations. Increases in blood pressure have been shown to be related to the level of acculturation and dietary differences in primitive people (Page *et al*., 1974).

Changes in blood pressure have been observed in children subjected to marked environmental changes (Beaglehole *et al*., 1978). Dietary factors, particularly sodium and potassium, have been implicated in human hypertension (Beaglehole *et al*., 1978). It is likely that the discovery of blood group association may be dependent on both the population under investigation and its environment; in the case of hypertension, particularly dietary habits. Hereditary influences on blood pressure control mechanisms have been demonstrated under conditions of volume expansion and contraction (Grim *et al.,* 1978). Studies of normotensive black and white subjects revealed that blacks and individuals greater than 40 years of age excreted less sodium following a saline infusion than whites or subjects less than 40 years of age (Luft *et al*., 1979). Previous investigators have reported higher diastolic pressures in subjects with blood group O than in their sibling with other ABO blood types from a study of 5777 members of 1068 Brazilian families. The Brazilian study demonstrated an average increase of 1.7 mm Hg in diastolic blood pressure of persons with blood group O compared to their siblings with other blood types (Nance *et al*., 1965).

Conclusion

This study has shown that the blood group 'O' Rh positive is the most prevalent one followed by 'B' Rh positive which is followed by 'A' Rh positive and lastly by 'AB' Rh positive blood group which is the least prevalent blood group among hypertensive patients in greater Guwahati. The finding of disease-blood group associations emphasizes the fact that there may be significant physiological differences between individuals of different blood types. They may be of clinical interest and help in understanding the interactions of many of the factors affecting the diseases involved. It is unlikely that there exists any selective advantage, however, since most of the diseases involved exhibit their major effects at the end of their productive period (Cavalli-Sforza *et al.,* 1971). In this study the sample size was a limitation as large samples could have provided more reliable significances. Due to the limited

number of the participants, this study was conducted in a measured design, which could also be a limiting factor. There is a prospect of performing a large scale study with ABO and Rh positive as well as ABO and Rh negative blood grouped hypertensive subjects from different parts of the state or the North-Eastern region or the other regions or parts of the country or even internationally as it will give more insight into the relationship between different ABO and Rh positive and negative blood groups with that of hypertension. A further study is needed to evaluate whether blood group is an etiological factor of hypertension. For this, equal number of subjects for each blood group is to be taken and then after that from the equal number of subjects from each blood group the number of hypertensive subjects to be identified. As our study has shown the prevalence of hypertension is more in some particular blood groups than in others so by utilizing this knowledge certain precautions can be taken against hypertension in the individuals belonging to more hypertension susceptible blood groups right from their childhood. Lastly, if we can by our combined efforts can understand the genetics involving ABO and Rh blood groups and hypertension then we may come closer for a permanent treatment of hypertension right in the genetic level in the near future. It will be a boon for our future generations and the world as a whole.

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