

A Cross Sectional Study of Prevalence of ABO and Rh Positive Blood Groups among the Pre-menopausal and Post-menopausal Women in Relation to Hypertension in Kamrup (Metropolitan) District.

Dr. Heemanshu Shekhar Gogoi¹, Dr. (Mrs.) Bonti Bora².

¹(Post Graduate Trainee, Department of Physiology, Gauhati Medical College, India).

²(Professor & Head of the Department, Department of Physiology, Gauhati Medical College, India).

Abstract:- Background: Hypertension is the subsequent elevation of the systemic arterial pressure to a level that places the patients at increased risk for target organ damage More than 140/90mmHg should be considered hypertensive and should get treated.

Materials and methods: This study was done to evaluate and compare the prevalence of ABO and Rh positive blood groups among pre-menopausal and post-menopausal hypertensive women in Kamrup (Metropolitan) district. It was a population-based study, 500 pre-menopausal and 500 post-menopausal hypertensive women 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.

Results: In pre-menopausal hypertensives 'O' Rh positive was most prevalent (44%), followed by 'B' Rh positive (32%), then 'A' Rh positive (19%) and lastly 'AB' Rh positive blood group (5%). Similarly, in post-menopausal hypertensives 'O' Rh positive was most prevalent (46%), followed by 'B' Rh positive (33%), 'A' Rh positive (18%) and lastly 'AB' Rh positive blood group(3%).

Conclusion: This study shows that among ABO and Rh positive blood groups the most prevalent one is 'O' Rh positive, followed by 'B' Rh positive, then 'A' Rh positive and lastly by 'AB' Rh positive blood group among the pre-menopausal and post-menopausal women in relation to hypertension.

Keywords:- Hypertension, ABO blood group, pre-menopausal, post-menopausal, slide haemagglutination technique.

I. Introduction

Life is a gift. But our lives are also not a bed of roses. Life has its own miseries. Hypertension is one of such an unwelcoming event.

Hypertension may be defined as that level of blood pressure at which the institution of therapy reduces blood pressure related morbidity and mortality. Hypertension is the subsequent elevation of the systemic arterial pressure to a level that places the patients at increased risk for target organ damage [1,2,3]. Studies suggest that hypertension increases the risk of cardiovascular disease by 10-fold and cigarette smoking increases the risk by atleast threefold [4]. Hypertension is a major risk factor for coronary heart disease, stroke, congestive heart failure, renal insufficiency, and peripheral vascular disease [5]. Hypertension is a silent killer which leads to adverse cardiovascular events like myocardial infarction, coronary artery disease and stroke.

Recommended criteria for a diagnosis of hypertension are average awake blood pressure $\geq 135/85$ mmHg and asleep blood pressure $\geq 120/75$ mmHg. These levels approximate a clinic blood pressure of 140/90 mmHg [6]. 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. Hypertension doubles the risk of cardiovascular diseases, including coronary heart disease (CHD), congestive heart failure (CHF), ischemic and hemorrhagic stroke, renal failure, and peripheral arterial disease [7].

Menopause is defined as the permanent cessation of menses that occurs after the cessation of ovarian function, is the most identifiable event during this period, the years immediately before and the decades afterward are of much greater clinical significance [8]. The increase in cardiovascular risk for women aged \square 50 years suggests that menopause marks the end of a period of relative protection compared with men [9]. Premenopausal women have lower blood pressure than age matched man. These finding suggests that sex hormones have a prominent role in hypertension [10].

Hypertension is a risk factor for end-organ damage in both women and men, and the risk increases in proportion to the magnitude of blood pressure in both sexes. The risk of cardiovascular disease throughout their lifetimes increases for men and women [8]. Although the risk of death from coronary artery disease is at least three times as great for men as for women before menopause, the relative risk for women increases significantly after menopause. Recent data have indicated that estrogen deficiency significantly increases the risk of cardiovascular disease and that this risk can be reduced by estrogen replacement therapy [11]. Studies have showed that after menopause, loss of the vascular protective effects of estrogens may unmask a population of women prone to hypertension who are at higher risk for cardiovascular morbidity. The effect of menopause on blood pressure, however, may be apparent only in women with a predisposition to hypertension that has yet to be understood.

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 [12].

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

ABO blood group system.

Discovery of the ABO system by Landsteiner in 1901 marked the beginning of safe blood transfusion.

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) [13,14,15]. 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. 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.

II. Aims and Objectives

1. To evaluate the prevalence of ABO and Rh positive blood groups among the pre-menopausal and post-menopausal women in relation to hypertension.
2. To compare the prevalence of ABO and Rh positive blood groups among the pre-menopausal and post-menopausal women in relation to hypertension.

III. Materials and Methods

This cross-sectional population based study was carried out in Kamrup (Metropolitan) district in the state of Assam in the North-Eastern part of India for a duration of eight months from 1st of July, 2015 to 29th of February, 2016.

1. A simple random sampling was done.
2. The written and informed consent of the subjects was obtained prior to collection of data.
3. Background information of all the subjects about their age, education, occupation, number of children, parity, and menopausal status was collected using a detailed questionnaire.

Inclusion criteria:

- i. Only hypertensive ABO Rh positive blood group subjects were selected.
- ii. Age group was 35 to 75 years.
- iii. No family history of hypertension, diabetes mellitus or other co-morbidities.
- iv. Non-vegetarian females with a history of hypertension for more than two years.
- v. Non-pregnant females.
- vi. Both pre-menopausal and post-menopausal females were included in the study.

Exclusion criteria :

- i. Women not belonging to ABO and Rh positive blood group.
- ii. Subjects whose age is less than 35 and more than 75 years of age.

- iii. Family history of hypertension including renal hypertension, diabetes mellitus type-1 or type-2, chronic diseases affecting bone or other co-morbidities.
- iv. Women taking bone altering medications or estrogen replacement therapy.
- v. Vegetarian females.
- vi. Pregnant females.

A total of 1000 female hypertensive patients were selected based on inclusion and exclusion criterias who were residents of Kamrup (Metropolitan) district of Assam, India. Out of these 1000 subjects 500 subjects were pre-menopausal female hypertensive patients and the rest 500 female subjects were post-menopausal female hypertensive patients.

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 agglutininogen.

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 manual mercury sphygmomanometer.

IV. Results

In the study group of the pre-menopausal female hypertensive population the following results were found.

219 patients out of 500 pre-menopausal female hypertensive patients belonged to 'O' Rh positive blood group, so its prevalence is 44%. 160 patients out of 500 hypertensive patients belonged to 'B' Rh positive blood group, so its prevalence is 32%. 94 patients out of 500 hypertensive patients belonged to 'A' Rh positive blood group, so its prevalence is 19%. 27 patients out of 500 hypertensive patients belonged to 'AB' Rh positive blood group, so its prevalence is 5%. (Table-1 and Fig-1).

Table-1: This table shows the percentage of prevalence of ABO and Rh positive blood groups in premenopausal female hypertensive patients.

S. No.	Blood group (ABO – Rh positive)	No. of subjects out of 500 subjects	Percentage (%) of prevalence.
1.	'O'	219	44
2.	'B'	160	32
3.	'A'	94	19
4.	'AB'	27	5

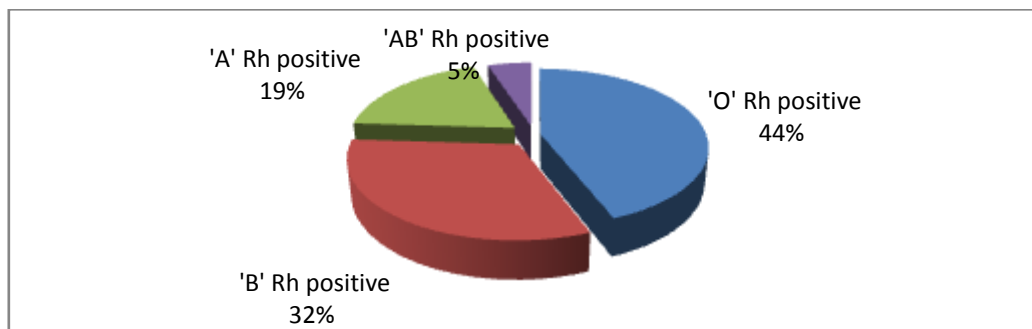


Fig-1: This figure shows the percentage of ABO and Rh positive blood groups in premenopausal female hypertensive patients.

Similarly, in case of the study group of post-menopausal female hypertensive patients also the following results were found.

229 patients out of 500 post-menopausal female hypertensive patients belonged to 'O' Rh positive blood group, so its prevalence is 46%. 164 patients out of 500 hypertensive patients belonged to 'B' Rh positive blood group, so its prevalence is 33%. 91 patients out of 500 hypertensive patients belonged to 'A' Rh positive blood group, so its prevalence is 18%. 16 patients out of 500 hypertensive patients belonged to 'AB' Rh positive blood group, so its prevalence is 3%. (Table-2 and Fig-2).

Table-2: This table shows the percentage of prevalence of ABO and Rh positive blood groups in post-menopausal female hypertensive patients.

S. No.	Blood group (ABO – Rh positive)	No. of subjects out of 500 subjects	Percentage (%) of prevalence
1.	'O'	229	46
2.	'B'	164	33
3.	'A'	91	18
4.	'AB'	16	3

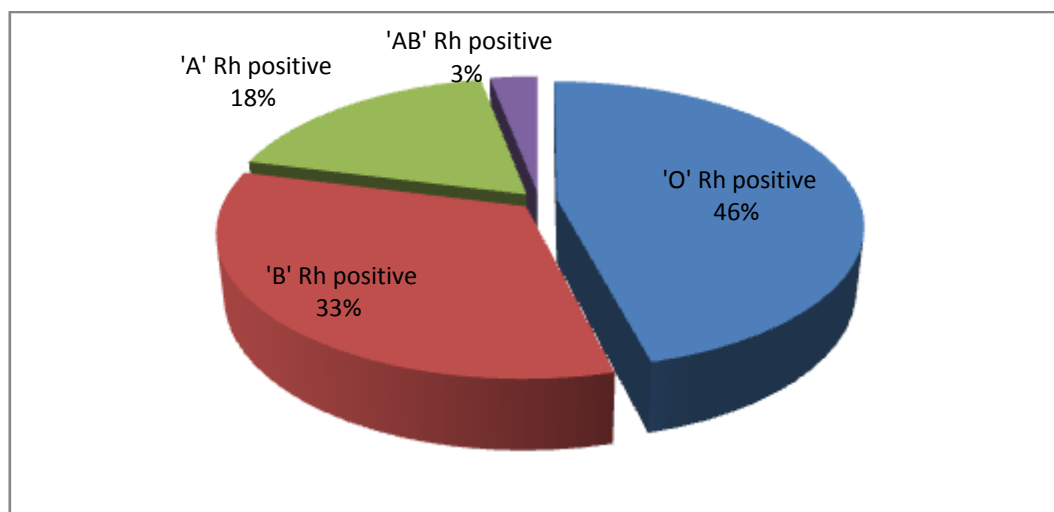


Fig-2: This figure shows the percentage of prevalence of ABO and Rh positive blood groups in post-menopausal female hypertensive patients.

Now, the comparison of the prevalence of the different ABO and Rh positive blood groups among the pre-menopausal and post-menopausal women was done respectively. It is seen that in case of the pre-menopausal female hypertensive patients the prevalence of 'O' Rh positive blood group is 44% and that of post-menopausal female hypertensive patients is 46%. Similarly, in case of 'B' Rh positive blood group the prevalence among the pre-menopausal hypertensive group is 32% and that of post-menopausal hypertensive group is 33%, in case of 'A' Rh positive blood group the prevalence among the pre-menopausal hypertensive group is 19% and that of post-menopausal hypertensive group is 18% and lastly, for 'AB' Rh positive blood group the prevalence among the pre-menopausal hypertensive group is 5% and that of post-menopausal hypertensive group is 3%. Thus, it is seen that there is no difference in the prevalence in the different ABO and Rh blood groups respectively among the pre-menopausal and post-menopausal female hypertensive patients as in both the groups the blood group 'O' Rh positive shows the highest percentage of prevalence, followed by 'B' Rh positive blood group, followed by 'A' Rh positive blood group and least percentage of prevalence by 'AB' Rh positive blood group (Fig-3).

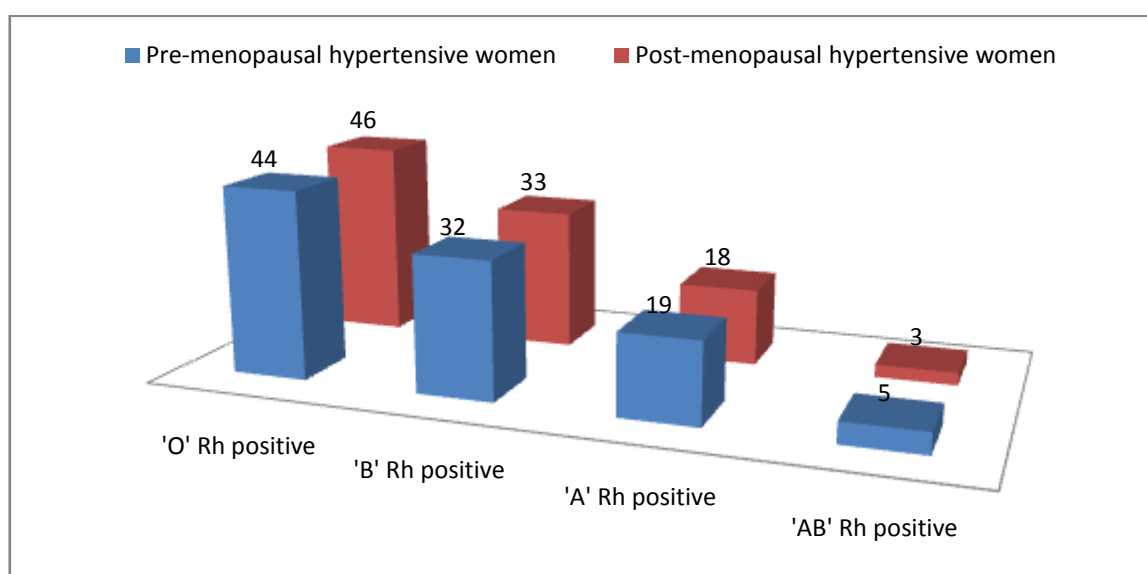


Fig-3: This figure shows the prevalence of ABO and Rh positive blood groups among the pre-menopausal and post-menopausal female hypertensive patients in Kamrup (Metropolitan) district.

V. Discussion

Many studies have revealed possible associations of various diseases with ABO blood group, but reasons for such associations remain controversial. Several researchers suggested evolutionary significance of AB antigen because the frequencies of different ABO blood group types vary across different populations, suggesting that a particular blood type confers a selection advantage (for example, protection against an infectious disease) [16,17]. 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.

Loscortales and Brabin (2006) have reported that ABO blood groups to be one of the host risk factors for placental malaria infections and are also associated with other materno-foetal outcomes [18]. Earlier reports have demonstrated a relationship between blood group and congenital cataract in the Asian race [16,19], blood group B with maxillofacial deformities [20], non-O blood groups with risk of cardiovascular disease [21,22]. 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 [16]. The normal range of von willebrand factor (vWF) antigen level varies among individuals with different ABO blood groups. Individuals with blood group O have the lowest vWF antigen level, followed by group A, the blood group B, and, at last, group AB [23]. Increased susceptibility of hypertension in blood group O may be due to individuals with blood group O have about 25% less factor VIII (F VIII) and von Willebrand factor (vWF) in their plasma [24]. Previous research had proven that low levels of these proteins involved in blood clotting, are a cause of excess bleeding thereby may also increase the risk of both arterial (ischaemic heart disease) and venous (thromboembolic disease) problems [25,26]. One of the best established blood group associations is that between blood type O of the ABO system and duodenal ulceration [27], although even this has not been confirmed in every investigation [28]. 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 [29].

The importance of genetic factors in familial aggregation of blood pressure level has been shown repeatedly [30,31,32]. There is previously reported evidence for genetic mediation of components of the blood pressure control system [33]. 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 [34]. In the British Caucasian population, the frequency of group A is 42%, B is 9%, AB is 3% and O is 46%, but there is racial variation in the frequencies. Blood group O was 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. On the contrary, Sachdev (2011) observed that those carrying the B blood group were more susceptible to hypertension as compared to blood group A and O. Whereas AB blood group had less chance of getting hypertension [35]. Abdollahi et al. (2009) found that prevalence of cardiovascular major risk factors were similar in subjects with different blood groups [36]. Amirzadegan et al. (2005) also reported no correlation between various ABO blood groups and development of coronary artery disease [37]. 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 [38].

Increasing evidence suggests that Hormone Replacement Therapy (HRT) is associated with favorable changes in several cardiovascular risk factors. The benefits of HRT far outweigh the potential hazards of endometrial and breast cancer. Controlled hypertension is not a contraindication to treating postmenopausal women with HRT, and postmenopausal estrogen use has not been shown to elevate blood pressure [39]. A conclusion of the Framingham Study was that women with hypertension should receive estrogens [40]. The specific mechanisms responsible for the increased BP in women following menopause are not clear. Several physiological systems have been implicated in clinical studies. For example, postmenopausal women exhibit increases in plasma renin activity [41,42] and endothelin [43], compared to their premenopausal counterparts. Longitudinal studies have shown that serum androgen levels are increased in postmenopausal women, leading to alterations in estrogen/androgen ratios [44]. In addition, Ward and colleagues reported that hypertension in postmenopausal women, not age-matched men, was associated with elevated excretion of 20-HETE, vasoconstrictor eicosanoids [45]. Markers of oxidative stress are also increased in postmenopausal women [46,47,48], and oxidative stress has been shown to increase BP by reducing the bioavailability of nitric oxide [49]. The incidence of obesity may be as high as 40% in postmenopausal women [50], and increases in body weight have been shown to be associated with increases in BP [51]. Obesity is one component of the cluster of features known as the metabolic syndrome, that also includes insulin resistance, type II diabetes, hyperlipidemia, and hyperleptinemia, that could also impact BP [52]. Rossi and colleagues reported that improvement in endothelial dysfunction and inflammation seen in response to antihypertensive medications was attenuated in postmenopausal women, aged 47-60 years, who exhibited symptoms of the metabolic syndrome [53]. Thus the presence of metabolic syndrome not only may contribute to the hypertension but may affect response to treatment therapies in postmenopausal women. There is also a brief mention of the potential role that depression and psychological well-being may play in contributing to postmenopausal hypertension. Young women with polycystic ovary syndrome (PCOS) who have elevated levels of plasma androgens and normal plasma estradiol levels have increased risk of cardiovascular disease not only when young but also following menopause [54,55], the mechanisms responsible for postmenopausal hypertension are likely multifactorial.

VI. 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 both the pre-menopausal and post-menopausal women in relation to hypertension in Kamrup (Metropolitan) district.

Limited number of participants was a limiting factor in this study. 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 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. There is also a prospect of performing a study evaluating whether blood group is an etiological factor of hypertension

in pre-menopausal and post-menopausal women. 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 this study shows that 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 women belonging to more hypertension susceptible blood groups right from their childhood. Also more studies to be performed in this aspect so that even genetic level anti-hypertensive interventions become possible in the near future and this will certainly and definitely help our future generations in combating against the unwelcoming event known to all as hypertension.

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