

Relation of ABO blood group with blood pressure in 25 – 35 years of age group in normal population of Agra

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Abstract

Introduction: Many studies had shown blood groups associations with different manifestations of cardiovascular diseases, majority of them showed relationship of blood group with coronary artery disease. Since hypertension was multi-factorial, familial occurrence of primary hypertension, recommended that certain genetic factors responsible for hypertension development. The ABO blood group distribution system would provide much valuable information for early detection of susceptible peoples.

Aim: To study the pattern of ABO blood group and its association with the blood pressure in normal population of Agra.

Materials and Methods: A cross-sectional study conducted in normal population of Agra city, who were willing to participate in the study. By using multistage random sampling, total 1200 participants aged 25–50 years selected in this study. ABO blood group relation with blood pressure analysed among commonest age groups of 25–35 years old.

Results: Mean age of the participants in current study was 35.66±8.2 years and majority were 25–35 years old (n=666). Male participants were in majority (63%). Distribution of blood group in decreasing orders were B (38.6%) > O (28.5%) > A (24.2%) > AB (8.7%). Pre-hypertension was present in 66.2% participants and Hypertension in 12.2% participants. There was statistically significant association of ABO blood group with gender and blood pressure.

Conclusion: Blood group B was more commonly present comparing to other blood groups in Agra district. Hypertension had statistically significant relationship with gender and ABO blood group that suggest it might had some genetic basis.

Keywords: ABO blood group, Gender, Hypertension.

Introduction

Hypertension (HT) is a chronic disorder of apprehension due to its involvement in aetiology of CHD (coronary heart disease), stroke and other vascular complication. HT is an Iceberg disease, as it has no clear symptoms for early detection. HT also responsible for major public health challenge to population in socio-economic and epidemiologic transition. Many people suffering from hypertension without any awareness. HT is one of the major risk factors for cardiovascular mortality, which responsible for 20% - 50% of total deaths.¹ As per WHO report in 2008 had found that around 40% of people aged more than 25 years had hypertension.² Worldwide, 7.6 million premature deaths (about 13.5% of the global total) were occurring due to higher blood pressure. Globally around 54% stroke and 47% IHD (ischemic heart disease) were occurring because of high blood pressure.² In India, total prevalence for hypertension was 29.8% (95% CI: 26.7–33).³ Age, gender, genetic factors and ethnicity were non-modifiable risk factors of hypertension.

Genetic factors responsible for HT were non-modifiable factor risk factors, as found by the family history of HT among hypertensive patients. ABO blood group was one of them that requires to be investigate in details. Since hypertension was multifactorial, the ABO antigens might indirectly affecting the arterial pressure. This ABO blood groups pattern was classify by the detection of A and B antigens on membrane of human RBC (red blood cell).⁴ The

antibodies that detected against RBC antigens called agglutinins. These antibodies were present in the individuals' serum whose RBCs had absence of corresponding antigen. ABO group was distributed into four major blood groups A, B, AB and O depending upon detection of these antigens and agglutinins in individuals.^{4,5} The ABO blood group was entirely and inherently heritable, genetically detected at time of conception and became permanent for whole life. Therefore, frequency distribution of ABO blood group following to known pattern was regulated by transmission of gene from one generation to next generation and it differs geographically and racially among human beings.⁶ Primary hypertension in family was recommends that there might be some genetic elements responsible for hypertension development.

Many studies in different areas of India had found that the most predominant blood group was blood group B, and other groups were blood group O, A and AB.^{7–11} While a study conducted by Pramanik et al¹² had found that the blood group A as commonest blood groups, followed by other blood groups O, B and AB in Nepal. Another commonest patterns of blood group sequence of O group > A group > B group > AB group distribution was seen in rural population of south-western Uganda.¹³ This similar distribution pattern of ABO blood groups was also detected in studies conducted among the Bangladesh population, African-American population, Western-Europeans people and Caucasian population of America.^{14–16} Different blood groups had found to be related with different diseases. The

ABO blood groups had also been associated with the causation of haemostasis.¹⁷

There was considerable evidence of raised cardiovascular risks with different blood groups and higher BP was considered as commonest cardiovascular risk factors. The ABO blood-group pattern was one of the genetic patterns that gives the most valuable information regarding the early detection of vulnerable groups. Various studies had found that different antigens of ABO blood group such as group A, group B and group O had a higher risk of hypertension development.^{8,18,19} Though, controversial findings recorded by other study, which did not find any relevant information that suggest the ABO blood group relationship with hypertension.²⁰

However, blood group types were non-modified risk factors of HT. This knowledge of the blood groups relation with blood pressure might be helpful for the initial detection of familial hypertension. Young population who was at higher risk of hypertension should be screened earlier comparing to other population, so that possible preventive measures applied for reducing the hypertension burden and its harmful consequences. With the aim & objectives of determining the pattern of ABO blood group and association of ABO blood group with BP (blood pressure) in normal subjects, a study planned in 25 to 50 years old population of Agra district.

Materials and Methods

In present study, sample size was calculated on the basis of the prevalence of hypertension in B blood group (8.7%) in a study conducted by Chandra and Gupta⁷ in 2012. Using this value as reference value and keeping it in formula [Sample size (n) = z^2pq/d^2 , where p = prevalence, Z=1.96, q=100-p, d=allowable error (20% of p), n=4×8.7×91.3/3.0276=1049.4252]. Sample size where came to 1050. Keeping in mind an approximately level of 20% dropouts and non-respondents, the sample size was increased to 1200. But we have studied 25-35 years age group separately.

Agra district had a population of 44 lacs, out of which 21 lacs residing in urban area and 23 lacs residing in rural area. There were 90 urban wards in Agra. After obtaining

list of all wards of Agra, one ward selected randomly. All the individuals fulfilling the study criteria were included in this study. Using multistage random sampling, 25 to 50 years old participants were selected who gave consent for participation in the study. Those who were not giving consent, who had secondary hypertension, chronic diseases or were pregnant excluded from study.

Blood pressure of all the participants in the study was recorded using mercury sphygmomanometer. Blood pressure of individuals recorded in sitting position after the subject had been rested for at least 5 min. Two measurements of Blood pressure recording over the period of at least 3 min was obtained on left arm in sitting position by using mercury sphygmomanometer. The blood pressure at which the first Korotkoff sound heard would indicate systolic B.P and the pressure when the sound disappears would indicate diastolic B.P. The blood for blood grouping was obtained by finger prick in aseptic condition and ABO and RHESUS blood group was determined by using anti-sera by slide method. According to JNC VIII guidelines blood pressure measurements were classified as:¹ Normal blood pressure (SBP<120 & DBP <80 mmHg), Pre-hypertension (SBP 120–139 or DBP 80–90 mmHg), Hypertension stage 1 (SBP 140 – 159 or DBP 90 – 99 mmHg) and Hypertension stage 2 (SBP ≥ 160 or DBP ≥ 100 mmHg).

All details of participants were kept by the investigator under strict confidentiality. Analysis was also anonymous and removed personal identifiers. Data entered in MS Excel spreadsheet and analysed with the help of software SPSS version 20.0. Descriptive statistics explained by frequency, percentage and cross tabulation. Chi square test applied to check the statistical association and p value less than 0.05 was considered as a statistically significant.

Results

A cross sectional study conducted in normal population of Agra, Majority of participants were in 25–30 years age group (38.8%, n=465) and 31–35 years age (16.8%, n=201). Majority of male and female participants were also 25–30 years old (Table 1). The relationship of ABO blood group with blood pressure were analysed in most common age group of 25–35 years (n=666).

Table 1: Age and gender wise distribution of all participants

Age group (Years)	Gender		Total (%)
	Male (%)	Female (%)	
25 – 30	271 (35.8)	194 (43.7)	465 (38.8)
31 – 35	141 (18.7)	60 (13.5)	201 (16.8)
36 – 40	71 (9.4)	104 (23.4)	175 (14.6)
41 – 45	114 (15.1)	29 (6.5)	143 (11.9)
46 – 50	159 (21.0)	57 (12.8)	216 (18.0)
Total	756 (100)	444 (100)	1200 (100)

Among 666 participants, majority (38.6%) had B blood group (n=257), followed by O blood group (28.5%, n=190), A blood group (24.2%, n=161) and AB blood group (8.7%, n=58). Among males (n=412), majority of participants (36.2%) had blood group B, while among females (n=254) also B blood group (42.5%) was most common. ABO blood group relationship with gender was statistically non-significant in 25 – 35 years age group (P>0.05) (Table 2)

Table 2: Gender & ABO blood group wise cross-tabulation of participants aged 25 – 35 years

ABO blood group	Gender		Total (%)
	Male (%)	Female (%)	
A group	103 (25.0)	58 (22.8)	161 (24.2)
B group	149 (36.2)	108 (42.5)	257 (38.6)
O group	120 (29.1)	70 (27.6)	190 (28.5)
AB group	40 (9.7)	18 (7.1)	58 (8.7)
Total	412 (100.0)	254 (100.0)	666 (100.0)
Chi Square test = 3.325; df = 3; p value 0.344			

Out of 666 participants aged 25 – 35 years, more than two-thirds (66.2%) of the participants were in Pre-hypertension stage (n=441), followed by 21.6% participants had normal blood pressure (n=144) and 12.2% participant were in hypertension stage 1 & 2 (n=81). The relationship between gender and hypertension was statistically

significant ($P < 0.05$). Hypertension and Pre-hypertension both were more common in B blood group (81.5% and 32.7% respectively). Normal BP (32.6%) was also more common in B blood group participants. There was statistically significant difference between ABO blood group and blood pressure among 25 – 35 years old participants ($P < 0.05$). (Table 3)

Table 3: Blood pressure and ABO Blood group wise cross-tabulation of participant

ABO Blood group	Blood Pressure			Total n (%)
	Normal n (%)	Pre-Hypertension n (%)	Hypertension n (%)	
A	34 (23.6)	125 (28.3)	2 (2.5)	161 (24.2)
B	47 (32.6)	144 (32.7)	66 (81.5)	257 (38.6)
O	46 (31.9)	135 (30.6)	9 (11.1)	190 (28.5)
AB	17 (11.8)	37 (8.4)	4 (4.9)	58 (8.7)
Total	144 (100.0)	441 (100.0)	81 (100.0)	666 (100.0)
Chi Square test = 75.776; df = 6; p value < 0.001				

Discussion

Hypertension was an iceberg disease, as majority of the patients who suffers from it remains hidden. There were many evidences that blood pressure levels regulated in part by genetic factors and that the influences were polygenic. HT detection among family had found that genetic factor was important risk factor for HT that was unmodifiable. Reports of increased cardiovascular (CV) risks found in different blood groups and BP increase was considers as a commonest cardio-vascular risk. In current study, average age of the participants was 35.66 ± 8.2 years. This was lower compared to Tabatabaie et al²⁰ where mean age of participants was 52.3 ± 10.1 years. Majority of the participants in the current study were males (63%) with male to female ratio of 1.7:1. Similarly, Tabatabaie et al²⁰ had found more males (52.5%) compared to females. Kaur et al²⁴ also had found more males (50.75%) compared to females (49.25%). However, female participants were in a majority in a study conducted by Teli et al²³ in Puducherry (55.26%).

In current study, distribution of blood group in 25 – 35 years old participant in order of frequency were B (38.6%) >>> O (28.5%) >> A (24.2%) > AB (8.7%) blood group (Table 2). Similar ABO blood group distribution pattern detected by studies conducted in different states of India such as in New Delhi,²¹ Rajasthan,¹⁰ Uttar Pradesh,⁷ Punjab,⁹ Himachal Pradesh,⁸ Uttarakhand²² and Gujarat.¹¹ However, blood group sequence of O (42.11%) > B

(33.33%) > A (17.54%) > AB (7.02%) was seen in Puducherry.²³ While A blood group as commonest, that followed by other blood group O, B and AB in Nepal.¹² The sequence of commonest blood group O > A > B > AB distribution was seen in south-western Uganda.¹³

In this study among males, commonest blood group was B group (36.2%) and among females also, commonest blood group was B group (42.5%). This relation of gender with ABO blood group was statistically non-significant ($P > 0.05$) (Table 2). However in Tamil Nadu, Kondam et al²⁵ had found that in control group, the percentage of females in blood group 'O', 'B' and 'AB' was higher but this was statistically insignificant. In other words, inheritance of ABO blood group was not relate to gender.

In present study among 25–35 years old participants, 66.2% participants had Pre-hypertension and 12.2% had Hypertension stage 1 & 2. Pre-hypertension was more common in both male (76.9%) and female (48.8%) participants, while hypertension was seen in 9.7% male and 16.1% female participants. This relation was statistically significant ($P < 0.05$). However, in a study conducted by Chandra et al¹⁸ they found that the prevalence of hypertension was 21.9%. While in Iran, Tabatabaie et al²⁰ had found that out of 510 studied subjects, 40.8% were hypertensive.

In current study among 25 – 35 years old, Hypertension and Pre-hypertension both were more common in B blood group (81.5% and 32.7% respectively) and relation between

ABO blood group and blood pressure was statistically significant ($P < 0.05$). Similarly, Chandra et al,¹⁸ Sachev,²⁶ Bhattacharya et al²⁷ and Sayed et al²⁸ had found higher prevalence of hypertension in blood group B. While in Himachal Pradesh, Nishi et al⁸ found that in hypertensive patients, majority had blood group O and few had group AB. In Pakistan also, Jawed et al²⁹ had found 53% subjects of blood group O as pre-hypertensive.

In Rajasthan, Sachev²⁶ found positive association of hypertension with the ABO blood group. Those who had blood group B were more prone to hypertension as comparing to A & O blood groups. Although, those had less chance of getting hypertension who carrying AB blood group. This recommended that blood group B might be genetically more prone to HT as comparing to other groups. While in Nigeria, Chuemere et al³⁰ had found that AB blood group children had less chances of getting hypertension.

In Tamil Nadu, Kondam et al²⁵ determined ABO blood groups had no relation with essential HT, in other words, it was genetically not related. Similarly Kaur et al²⁴ had found that in hypertensive group, commonest blood group was B (39.6%), followed by O group (34.6%), A group (20%), and AB group (5.8%). Raised prevalence of HT by 3% was found in blood group B and O, and a decrease in HT prevalence of 4.3% in blood group A and 1.5% in blood group AB that was statistically non associated ($p > 0.05$).

Conclusion

Blood group B was more commonly present comparing to other group in Agra district of Uttar Pradesh. Hypertension had statistically significant relationship with gender and ABO blood group that suggests that it might have some genetic basis.

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References

1. K. Park. Hypertension. In: Preventive and Social Medicine. 24th ed. Jabalpur: M/s Banarasi Bhanot; 2017. p. 391–4.
2. Lawes CMM, Vander Hoorn S, Rodgers A. Global burden of blood-pressure-related disease, 2001. *Lancet* 2008;371(9623):1513–1518.
3. Anchala R, Kannuri NK, Pant H, Khan H, Franco OH, Di Angelantonio E, et al. Hypertension in India: a systematic review and meta-analysis of prevalence, awareness, and control of hypertension. *J Hypertens* [Internet]. 2014;32(6):1170–1177. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4011565/>
4. Barrett KE, Barman SM, Boitano S, Brooks H. Ganong's Review of Medical Physiology, 25/e. 2016;
5. Conteras M, Lubenko A. Immunohaematology: introduction. Psotgraduate Haematol 4th ed Arnold Publ London, U K. 2001;165–81.
6. Mourant AE, Kopec AC, Domaniewska-Sobczak K. Blood groups and diseases. A study of associations of diseases with blood groups and other polymorphisms. Oxford University Press, Walton Street, Oxford OX2 6DP.; 1978.
7. Chandra T, Gupta A. Prevalence of ABO and rhesus blood groups in northern India. *J Blood Disord Transfus* 2012;3:132.
8. Nishi K, Gupta NK, Sharma SC. Study on the incidence of hypertension and migraine in ABO blood groups. *ISCA J Biol Sci* 2012;1(2):12–16.
9. Rahman M, Lodhi Y. Frequency of ABO and Rhesus blood groups in blood donors in Punjab. *Pak J Med Sci* 2004;20(4):315–318.
10. Rajshree B, Raj JY. Distribution of ABO blood group and Rh (D) factor in Western Rajasthan. *Natl J Med Res* 2013;3(1):73–75.
11. Patel P. Frequency and distribution of blood groups in blood donors in western Ahmedabad—a hospital based study. *Blood* 2011.
12. Pramanik T, Pramanik S. Distribution of ABO and Rh blood groups in Nepalese medical students: a report. 2000.
13. Apecu RO, Mulogo EM, Bagenda F, Byamungu A. ABO and Rhesus (D) blood group distribution among blood donors in rural south western Uganda: a retrospective study. *BMC Res Notes* [Internet]. 2016;9:513. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC5178068/>
14. Mollison PL. The genetic basis of the Rh blood group system. *Transfus* 1994;34(6):539–541.
15. Adeyemo OA, Soboyejo OB. Frequency distribution of ABO, RH blood groups and blood genotypes among the cell biology and genetics students of University of Lagos, Nigeria. *Afr J Biotechnol* 2006;5(22).
16. Talukder SI, Das RK. Distribution of ABO and Rh blood groups among blood donors of Dinajpur district of Bangladesh. *Dinajpur Med Col J* 2010;3(2):55–58.
17. Zhang H, Mooney CJ, Reilly MP. ABO Blood Groups and Cardiovascular Diseases. *Int J Vasc Med* [Internet]. 2012;2012:641917. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3485501/>
18. Chandra T, Gupta A. Association and distribution of hypertension, obesity and ABO blood groups in blood donors. *Iran J Pediatr Hematol Oncol* 2012;2(4):140.
19. Platt D, Mühlberg W, Kiehl L, Schmitt-Rüth R. ABO blood group system, age, sex, risk factors and cardiac infarction. *Arch Gerontol Geriatr* 1985;4(3):241–249.
20. Tabatabaie A-H, Ali-Madadi M. Possible association between ABO and Rh (D) blood groups and hypertension. *Pak J Med Res* 2012;28(1):235–237.
21. Agarwal N, Thapliyal RM, Chatterjee K. Blood group phenotype frequencies in blood donors from a tertiary care hospital in north India. *Blood Res* [Internet]. 2013;48(1):51–54. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3625001/>
22. Garg P, Upadhyay S, Chufal SS, Hasan Y, Tayal I. Prevalance of ABO and Rhesus Blood Groups in Blood Donors: A Study from a Tertiary Care Teaching Hospital of Kumaon Region of Uttarakhand. *J Clin Diagn Res* [Internet]. 2014;8(12):FC16–FC19. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4316263/>
23. Teli SS, R D, L P, M SV. Original article Association of ABO and Rh blood groups with blood pressure : A cross sectional study in South Indian population. *Indian J Basic Appl Med Res* 2016;5(3):8–13.
24. Kaur M, Gill K, Bassi R, Kaur D. association of ABO and RH blood groups. *Pak J Physiol* 2016;12(2):11–14.

25. Kondam A, Chandrashekar M, Suresh M, Madhuri BA. A study of incidence of hypertension in ABO and rhesus blood group system. *Int J Biol Med Res* 2012;3(1):1426–1429.
26. Sachdev B. Prevalence of hypertension and associated risk factors among Nomad Tribe groups. *Antrocom Online J Anthr* 2011;7(2):1973–2880.
27. Bhattacharyya S, Ganaraja B, Bhat R. Correlation between the blood groups, BMI and pre-hypertension among medical students. *J Chinese Clin Med* 2010;5(2).
28. El-sayed MK, Amin H. Abo Blood Groups in Correlation With Hyperlipidemia, Diabetes Mellitus Type II, and Essential Hypertension. *Asian J Phramaceutical Clin Res* 2015;8(5):236–243.
29. Jawed S, Zia S, Tariq S. Frequency of different blood groups and its association with BMI and blood pressure among the female medical students of Faisalabad. *J Pak Med Assoc* 2017;67(8):1132–1137.
30. Chuemere AN, Olorunfemi OJ, Nwogu JU, Mmom OF, Agbai EO, Vurey V V. Correlation between Blood group, Hypertension, Obesity, Diabetes, and combination of Prehypertension and Pre-Diabetes in School Aged Children and Adolescents in Port Harcourt. *IOSR J Dent Med Sci* 2015;1(14):83–89.

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