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 35.6±8.2 years and major 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.³ 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.\textsuperscript{17}

There was considerable evidence of raised cardiovascular risks with different blood groups and higher BP was considered as the 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 groups such as group A, group B and group O had a higher risk of hypertension development.\textsuperscript{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.\textsuperscript{20}

However, blood group types were non-modified risk factor of HT. This knowledge of the blood groups relation with blood pressure might helpful for the initial detection of familial hypertension. Young population who was at higher risk of hypertension should be screen earlier comparing to other population, so that possible preventive measures applied for reducing the hypertension burden and its harmful consequence. 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 bases of the prevalence of hypertension in B blood group (8.7\%) in a study conducted by Chandra and Gupta\textsuperscript{2} in 2012. Using this value as reference value and keeping it in formula [\text{Sample size (n) =} z^2pq/d^2 \text{ where } p= prevalence, Z=1.96, q=100-p, d=allowable error (20\% of p), n=4\times 8.7\times91.3/3.0276=1049.4252]. Sample size where came to 1050. Keeping in mind an approximately level of 20\% dropouts and non-respondents, the sample size was increase 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 obtain 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 obtain by finger prick in aseptic condition and ABO and Rhesus blood group was determine by using anti-sera by slide method. According to JNC VIII guidelines blood pressure measurements were classified as:\textsuperscript{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 keep 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 analyse in most common age group of 25–35 years (n=666).

Table 1: Age and gender wise distribution of all participants

<table>
<thead>
<tr>
<th>Age group (Years)</th>
<th>Gender</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male (%)</td>
<td>Female (%)</td>
</tr>
<tr>
<td>25 – 30</td>
<td>271 (35.8)</td>
<td>194 (43.7)</td>
</tr>
<tr>
<td>31 – 35</td>
<td>141 (18.7)</td>
<td>60 (13.5)</td>
</tr>
<tr>
<td>36 – 40</td>
<td>71 (9.9)</td>
<td>104 (23.4)</td>
</tr>
<tr>
<td>41 – 45</td>
<td>114 (15.1)</td>
<td>29 (6.5)</td>
</tr>
<tr>
<td>46 – 50</td>
<td>159 (21.0)</td>
<td>57 (12.8)</td>
</tr>
<tr>
<td>Total</td>
<td>756 (100)</td>
<td>444 (100)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>ABO blood group</th>
<th>Male (%)</th>
<th>Female (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A group</td>
<td>103 (25.0)</td>
<td>58 (22.8)</td>
<td>161 (24.2)</td>
</tr>
<tr>
<td>B group</td>
<td>149 (36.2)</td>
<td>108 (42.5)</td>
<td>257 (38.6)</td>
</tr>
<tr>
<td>O group</td>
<td>120 (29.1)</td>
<td>70 (27.6)</td>
<td>190 (28.5)</td>
</tr>
<tr>
<td>AB group</td>
<td>40 (9.7)</td>
<td>18 (7.1)</td>
<td>58 (8.7)</td>
</tr>
<tr>
<td>Total</td>
<td>412 (100.0)</td>
<td>254 (100.0)</td>
<td>666 (100.0)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>ABO Blood group</th>
<th>Normal n (%)</th>
<th>Pre-Hypertension n (%)</th>
<th>Hypertension n (%)</th>
<th>Total n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>34 (23.6)</td>
<td>125 (28.3)</td>
<td>2 (2.5)</td>
<td>161 (24.2)</td>
</tr>
<tr>
<td>B</td>
<td>47 (32.6)</td>
<td>144 (32.7)</td>
<td>66 (18.1)</td>
<td>257 (38.6)</td>
</tr>
<tr>
<td>O</td>
<td>46 (31.9)</td>
<td>135 (30.6)</td>
<td>9 (11.1)</td>
<td>190 (28.5)</td>
</tr>
<tr>
<td>AB</td>
<td>17 (11.8)</td>
<td>37 (8.4)</td>
<td>4 (4.9)</td>
<td>58 (8.7)</td>
</tr>
<tr>
<td>Total</td>
<td>144 (100.0)</td>
<td>441 (100.0)</td>
<td>81 (100.0)</td>
<td>666 (100.0)</td>
</tr>
</tbody>
</table>

Chi Square test = 75.776; df = 6; p value <0.001

Discussion

Hypertension was an iceberg disease, as majority of the patients who suffer 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 members and that the influences were 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 2). However, in Tamil Nadu, Kondam et al 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 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 al 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.
ABO blood group and blood pressure was statistically significant (p<0.05). Similarly, Chandra et al, Sachev, Bhattacharya et al and Sayed et al had found higher prevalence of hypertension in blood group B. While in Himachal Pradesh, Nishi et al found that in hypertensive patients, majority had blood group O and few had group AB. In Pakistan also, Jawed et al had found 53% subjects of blood group O as pre-hypertensive.

In Rajasthan, Sachev 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 al had found that AB blood group children had less chances of getting hypertension.

In Tamil Nadu, Kondam et al determined ABO blood groups had no relation with essential HT, in other words, it was genetically not related. Similarly Kaur et al 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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