Prevalence of Hypertensive Status in the Various Abo Blood Groups in the Presence of Periodontal Disease - A Pilot Project in the Western Region of Saudi Arabia

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Authors’ contributions

This work was carried out in collaboration among all authors. Author SS designed the study, wrote the protocol, interpreted the statistical data and drafted the manuscript. Authors MN, KHS, SE, BMA and RA managed the literature searches and data collection and analyses. All authors read and approved the final manuscript.

ABSTRACT

Background: Both periodontal disease and hypertension individually, have been found to be linked to certain blood groups. However, the association of the blood groups to abnormal blood pressure and co-existing periodontal disease has not yet been explored. The objective of this study was to explore a possible association, if any among the three conditions.

Materials and Methods: In this pilot project, a total of 300 patients were screened initially, of which, 270 patients (205 males and 65 females) with mean age range of 34.5 years from various ABO blood groups, with gingivitis / periodontitis were selected and their blood pressure was measured in a standardized manner with a digital automated BP monitor. Patients with any systemic disease or condition or consuming any kind of medications and smokers were excluded from the study. The data thus obtained was statistically analyzed to assess prevalence and associations.
Results: Overall, blood group O (29.26%) reported the highest number of patients with abnormal blood pressure in the presence of periodontal disease followed by B (18.89%) and A (17.03%). No association was found with abnormal blood pressure and blood groups in the individual gingivitis and periodontitis groups. However, a significant association with abnormal blood pressure in males over females in blood group A and B in the gingivitis group and in blood group A in the periodontitis group was observed (P<0.05).

Conclusion: The presence of periodontal disease in certain ABO blood groups may predispose to abnormal blood pressure values or hypertension.

Keywords: ABO blood groups; blood pressure; gingivitis; periodontitis.

1. INTRODUCTION

In 1900, Landsteiner developed the modern system of classification of blood groups into four groups A, B, AB or O [1]. Each of these blood groups are differentiated by the antigen protein molecules found on the surface of red blood cells and antibodies in the blood plasma. Due to variations in the antibodies people have, the blood group may be either Rh positive or Rh negative.

Blood grouping has significant importance in day-to-day medicine; with growing evidence of certain blood groups being more susceptible to certain diseases than others. Several studies have suggested an association between ABO blood groups and various medical conditions [1,2]. One of the most significant disease associations described is the non-O (subjects of group A, B, or AB) versus O subjects’ susceptibility to arterial and venous thromboembolism (VTE) [3]. Studies have also shown that the blood group B among blood donors was more susceptible to hypertension and obesity [4].

With regard to associations of ABO blood groups and dental pathologies, individuals with Group A appear to have lower incidence rates of caries and cavities than others with different blood groups (B, AB, O) [5-8]. The cariogenic ability of saliva and the secretion of ABO antigens preventing bacteria from attaching to the tooth surface are blood groups specific, which notes that many individuals with high-risk caries have low rates of periodontal disease, and individuals with low risk caries have high rates of periodontal disease. Consequently, this suggests a possible existence of a significant and profound relationship between ABO blood groups and periodontal diseases. One possible mechanism by which individuals of a specific blood group have a lower frequency of periodontal disease could be due to increased levels of antibodies against more strains of periodontitis-causing bacteria [5-8].

Weber and Pastern [9] were the first to study the association of ABO blood group with periodontal disease. Kaslick et al. [10] studied the association of aggressive periodontitis and ABO blood group and found significantly less patients with blood group O and more patients with blood group B had aggressive periodontitis. Koregol et al. [11] in a study on 1220 subjects in South India concluded that blood group A formed a significantly higher percentage in the gingivitis group and blood group O formed a higher percentage in the periodontitis group. The blood group AB showed the least percentage of periodontal diseases. The distribution of Rh factor in all groups showed a significantly higher distribution of Rh-positive.

Majority of the researchers [10,12-14] have claimed that different ABO blood groups constitute an increased risk for the development of periodontal and oral diseases; whereas one study [15] failed to find such an association. The prevalence of hypertension has also been linked to ABO blood groups [16] as also periodontal disease, by virtue of the inflammation caused by the periodontal bacteria giving rise to oxidative stress and endothelial dysfunction [17].

Our objective in this study was to find an association, if any, exists between ABO blood groups, abnormal blood pressure and periodontal disease in systemically healthy individuals. Understanding these associations, and their effects, with the seriousness of periodontal diseases might be vital in the early periodontal management of exceptionally susceptible individuals.

2. MATERIALS AND METHODS

This cross-sectional study was reviewed and approved by the Ethical Committee of Ibn Sina National College of medical sciences, Jeddah. This initial pilot project consisted of 300 patients who were screened initially. The final sample
RESULTS

revealed Characteristics of the study sample analysed using SPSSV 19.0 software. Data obtained was tabulated and statistically

Blood Pressure Detection, Evaluation, and Treatment of High Blood Pressure according to the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure [19].

The following patients were excluded from the study sample:

1. patients with any systemic diseases.
2. patients on any kind of medications.
3. patients with any mental or physical disability.
4. patients who were smokers or consuming any similar kind of substances.

Blood group detection was done using blood detecting agents and RH factor kits††. The patient’s blood pressure was measured in the daytime only, by using portable automatic blood pressure monitor ‡‡ , standardizing the procedure, using only the right hand while the patients were in an upright sitting position. An average of 3 readings by 3 different calibrators taken at intervals of 5 minutes each, was considered the final value, making sure the patient was at ease and completely relaxed during each measurement, to eliminate the white coat effect [18]. Values above 120/80mm of Hg were reported as abnormal according to the WHO and the guidelines of the seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure [19].

Data obtained was tabulated and statistically analysed using SPSSV 19.0 software.

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‡‡ Omron Healthcare company ltd, Kyoto, Japan

3. RESULTS

Characteristics of the study sample (Table 1) revealed males comprising 76.21% and females constituting about 23.79% of the study sample. About 40.1% of the study samples belonged to group O, followed by group B (30%) and group A (26.6%), whereas only 3.35% belonged to group AB respectively. Patients with gingivitis comprised of 33.3% of the study sample whereas those with periodontitis formed 66.7%.

67.04% of the study population reported abnormal blood pressure values,(Tables 1 & 2) of which blood group O formed a major percentage of 29.26% followed by group B (18.89%) and A (17%).

Of the 205 males in the study group, 76.59% reported abnormal blood pressure constituting nearly 57% of the study population wherein, blood group O was predominant, constituting nearly 25% of the study population followed by B (16%) and A (14.5%) respectively. (Table 3). On the contrary, 41.54% of the 65 females in the study group reported abnormal blood pressure thereby comprising 10% of the study population with nearly equal distribution in blood groups O, B and A. (2-4%) (Table 3).

62.22% of the 90 patients with gingivitis reported abnormal blood pressure values, thereby comprising 20.74% of the study population. So also, 69.44% of the 180 patients diagnosed with periodontitis reported abnormal blood pressure, comprising 46.3% of the study population (Table 4).

Chi-square tests revealed no significant association between the ABO blood groups and abnormal blood pressure among the study population taken as a whole( P >0.05)(Table 5), as well as among the gingivitis and periodontitis groups of the study population taken separately.(P >0.05) (Table 6).

However, there was a significant association observed in the gingivitis group in blood groups A&B (P<0.05) and in the periodontitis group in blood group A(P<0.05) among males compared to females. (Table 7).

4. DISCUSSION

Worldwide, about 17 million deaths a year are caused by cardiovascular diseases, of which, one-third are caused by complications related to hypertension [20]. In 2008, about 40% of the adults above 25 years had hypertension, which translates to about 1 billion people worldwide. Furthermore, it is expected that in the year 2025, the total number will increase by about 24% in
the developed countries and about 80% in developing countries [21].

Hypertension is considered the leading risk factor for morbidity and mortality in Saudi Arabia according to the Global Burden of Disease Study. A previous study in 2005 revealed that 25.5% of the population had hypertension and, only 44.7% of them were aware of the disease [22]. In addition, there is also an increasing prevalence of periodontal disease [23] in Saudi Arabia, which has in turn, also been linked to hypertension [24,25]. Since both conditions have been linked to ABO blood groups, the objective of the present study was to determine a possible link between the three. To the authors' knowledge, no study of this nature has been carried out so far. The subjects in our study comprised of patients with gingival and periodontal disease and periodontally healthy subjects (no clinical attachment loss and bleeding less than 10%) were excluded.

The ABO blood group and Rh system distributions show marked variation around the world. Some variation may even occur in different areas within the same country [26]. It has been reported that the O blood type is most common in American and Canadian individuals, the B type in Chinese and Indian individuals, and the A type in Eskimos [27]. In the Saudi population, it has been reported that the most common blood group was O (about 51% of the total sample) and the lowest was AB (about 4%) [28,29]. This was in accordance with our study, wherein 40.1% (108 patients) belonged to group O; 26.6% (72 patients) to group A; 30% (81 patients) to group B, and only 3.35% (9 patients) belonged to group AB.

Table 1. Characteristics of the study sample

| Blood groups | N   | %    | Percentage |
|--------------|-----|------|------------|
| A-           | 9   | 72   | 3.35%      | 26.6%    |
| A+           | 63  | 23.42% |
| AB+          | 9   | 9    | 3.35%      | 3.35%    |
| B-           | 28  | 81   | 10.41%     | 30%      |
| B+           | 53  | 19.70% |
| O-           | 30  | 108  | 11.15%     | 40.1%    |
| O+           | 78  | 28.62% |

| Gender       |     |      |            |
|--------------|-----|------|------------|
| Males        | 205 | 75.9%|
| Females      | 65  | 24.1%|

| Disease      |     |      |           |
|--------------|-----|------|-----------|
| Gingivitis   | 90  | 33.3%|
| Periodontitis| 180 | 66.7%|

| Blood Pressure |     |      |            |
|---------------|-----|------|------------|
| Normal        | 89  | 32.96%|
| Abnormal      | 181 | 67.04%|

Table 2. Abnormal blood pressure in the various blood groups

| Blood group | Males | Females | Total | Percentage |
|-------------|-------|---------|-------|------------|
| A-          | 2     | 0       | 5     | 1.85%      | 17.03%    |
| A+          | 7     | 1       | 8     | 1.85%      | 15.19%    |
| AB+         | 1     | 0       | 1     | 1.85%      | 15.19%    |
| B-          | 5     | 0       | 13    | 4.81%      | 18.89%    |
| B+          | 15    | 7       | 51    | 14.07%     | 51.07%    |
| O-          | 8     | 1       | 9     | 8.52%      | 29.26%    |
| O+          | 13    | 5       | 18     | 20.74%     | 20.74%    |
| total       | 51    | 5       | 56    | 67.04%     | 67.04%    |
Table 3. Abnormal blood pressure: (Gender Wise Prevalence)

| Blood groups | Males | Females | Total | Males | Females | Total |
|--------------|-------|---------|-------|-------|---------|-------|
|              | N %   | N %     | N %   | N %   | N %     | N %   |
| A -          | 2 0.74% | 2 0.74% | 4 1.5% | 0 0%  | 1 0.37% | 1 0.37% |
| A+           | 7 2.60% | 29 10.41% | 36 13.01% | 1 0.37% | 4 1.12% | 5 1.49% |
| AB+          | 1 0.37% | 3 0.37% | 4 0.74% | 1 0.37% | 0 0%    | 1 0.37% |
| B -          | 5 1.86% | 7 2.6%  | 12 4.46% | 0 0%  | 1 0.37% | 1 0.37% |
| B+           | 15 5.58% | 16 5.95% | 31 11.52% | 0 0%  | 7 2.6%  | 7 2.6%  |
| O -          | 8 2.97% | 10 3.72% | 18 6.69% | 1 0.37% | 4 1.5%  | 5 1.86% |
| O+           | 13 4.83% | 36 13.01% | 49 17.84% | 2 0.74% | 5 1.86% | 7 2.6%  |
| Total        | 51 18.89% | 103 38.15% | 154 57.04% | 5 1.85% | 22 8.15% | 27 10%  |

Individual gender prevalence

76.59% 41.54%

Table 4. Abnormal blood pressure & gingivitis & periodontitis

| Blood groups | Gingivitis | Periodontitis |
|--------------|------------|--------------|
|              | Males | Females | Total | Males | Females | Total |
|              | N %   | N %     | N %   | N %   | N %     | N %   |
| A -          | 2 0.74% | 0 0%    | 2 0.74% | 2 0.74% | 1 0.37% | 3 0.74% |
| A+           | 7 2.60% | 1 0.37% | 8 2.97% | 29 10.41% | 4 1.12% | 31 2.97% |
| AB+          | 1 0.37% | 1 0.37% | 2 0.74% | 3 0.37% | 0 0% | 1 0.74% |
| B -          | 5 1.86% | 0 0%     | 5 1.86% | 7 2.6%  | 1 0.37% | 8 1.86% |
| B+           | 15 5.58% | 0 0%    | 15 5.58% | 16 5.95% | 7 2.6%  | 23 5.58% |
| O -          | 8 2.97% | 1 0.37% | 9 3.35% | 10 3.72% | 4 1.5%  | 14 3.35% |
| O+           | 13 4.83% | 2 0.74% | 15 5.58% | 36 13.01% | 5 1.86% | 40 5.58% |
| Total        | 51 18.96% | 5 1.86% | 56 20.74% | 103 38.15% | 22 8.15% | 125 46.3% |

Individual disease prevalence

62.22% 69.44%

Table 5. Association between blood groups & abnormal blood pressure among study population

| Blood groups | BP≤120/80 | BP>120/80 | Total | CHISQ | P |
|--------------|-----------|-----------|-------|-------|---|
| A            | 26        | 46        | 72    | 3.2   | 0.3 |
| AB           | 4         | 5         | 9     |       |    |
| B            | 30        | 51        | 81    |       |    |
| O            | 29        | 79        | 108   |       |    |
| Total        | 89        | 181       | 270   |       |    |

Inference- cross tabulation between the different blood groups and the blood pressure showed no significant association (P>0.05)

In addition, there was an overall predominance of gingivitis and periodontitis in blood group O followed by A and B blood groups, which is in accordance with the findings of Gawrzewska [14], who found that individuals with blood group O have greater severity of periodontal disease, whereas individuals with blood group A have greater resistance to periodontal disease. In contrast to the findings of Kaslick et al. [10] who found that periodontitis patients were more likely to have A or B blood groups. In a recent study, Demir et al. [30] investigated the relationship between periodontal disease and ABO blood group. He found a higher percentage of blood type A in patients with gingivitis and a higher percentage of blood type O in patients with periodontitis which is in contrast to the findings of our study wherein both gingivitis and periodontitis had a higher prevalence in blood group O.
Table 6. Association of blood groups with blood pressure among participants with gingivitis & periodontitis

| Disease | Gingivitis | Periodontitis |
|---------|------------|---------------|
|         | Normal < 120/80 | High ≥ 120/80 | Total | CHI | P | Normal < 120/80 | High ≥ 120/80 | Total | CHI | P |
| A       | 10          | 10            | 20    | 4.7 | 0.19 | 16          | 36            | 52    | 5.9 | 0.1 |
| AB      | 4           | 2             | 6     | 0   | 3    | 3           | 0            | 3     | 0   | 0.9 |
| B       | 8           | 20            | 28    | 22  | 31   | 53          |               |       |     |     |
| O       | 12          | 24            | 36    | 17  | 55   | 72          |               |       |     |     |
| Total   | 34          | 56            | 90    | 55  | 125  | 170         |               |       |     |     |

Table 7. Association between gender and hypertension in gingivitis and periodontitis

| Disease | Gingivitis | Periodontitis |
|---------|------------|---------------|
|         | Normal < 120/80 | High ≥ 120/80 | CHI | P | Normal < 120/80 | High ≥ 120/80 | CHI | P |
| A       | Male       | 4           | 9     | 5.4 | 0.05* | 9           | 31            | 5.5 | 0.01* |
|         | Female     | 6           | 1     | 7   | 0.09 | 0            | 3             | 0.7 | 0.6 |
| AB      | Male       | 1           | 1     | 0.3 | 0.1  | 0            | 3             | 0.09 |    |
|         | Female     | 3           | 1     | 0   | 0.09 | 0            | 3             | 0.7 | 0.6 |
| B       | Male       | 4           | 20    | 11.6| 0.01*| 15           | 23            | 0.2 | 0.6 |
|         | Female     | 4           | 0     | 7   | 0.09 | 8            |               |     |     |
| O       | Male       | 8           | 21    | 2.2 | 0.1  | 11           | 46            | 2.2 | 0.09 |
|         | Female     | 4           | 3     | 6   | 0.09 | 9            |               |     |     |

* denotes significance

Our findings are also contrary to a study in a small section of the Saudi population, wherein significant relationships between ABO blood type and severity of periodontitis were determined. Patients with blood group B appeared to be at greater risk of developing more severe forms of periodontitis. The study also concluded that ABO blood groups may constitute a risk factor in the development of periodontal diseases [31].

With regard to the prevalence of abnormal blood pressure in the various blood groups, it was found that overall subjects with blood group O had higher values followed by B and A blood groups. This is in contrast to the reports suggesting that the relative risk for hypertensive patients was found to be higher in blood group B and lowest in blood group AB with no correlation between the genders [31] and also with another study reporting a high prevalence of myocardial infarction and hypertension in blood group A in a certain female Saudi population [32]. In the Saudi Arabian population, these variations in gender have also been reported in periodontal disease prevalence with males higher than females [33] as well as with blood groups, with blood groups B and O being more common in males than females, and blood group AB being found only in males [34]. In addition, the prevalence of hypertension is also higher among males than females [35].

With respect to periodontal disease and hypertension, a marginally higher percentage of periodontitis patients reported with abnormal blood pressure values compared to gingivitis. This is in accordance with studies which have shown that systolic and diastolic pressures are higher among PD patients than in individuals without periodontitis [24,25]. Although till date, no such finding has been reported in Saudi Arabia, a positive linear relationship has been found between systolic BP and severe periodontitis in middle-aged individuals in other studies [25]. Inflammation might provide a potential link between hypertension and periodontitis. Periodontal bacterial infection may also be involved, at least in part, in the development of hypertension. High blood pressure has been suggested to be associated with the imbalance between antioxidant and ROS production. Periodontal disease may contribute to endothelial dysfunction [17,36], which also eventually increases the risk of hypertension.
Even though no significance was found between the blood groups and abnormal blood pressure in the periodontally diseased study population as a whole, there was also none obtained between the abnormal blood pressure values in the gingivitis and periodontitis group taken separately among the various blood groups. Although evidence with regard to links between ABO blood groups and periodontal disease, ABO blood groups and hypertension and periodontal disease and hypertension are available in literature, this is one of the first instances where such a combined comparative association is being explored.

Interestingly however, males showed a significantly higher prevalence of abnormal blood pressure in blood group A & B over females in the gingivitis group and in blood group A in the periodontitis group. Although blood group O reported the highest prevalence of abnormal blood pressure in both gingivitis and periodontitis groups among both males and females, there were no significant gender differences in this blood group suggesting that both males and females in blood group O may be equally at a risk for abnormal values in the presence of gingival or periodontal disease.

Thus, higher abnormal blood pressure values were observed in periodontitis group than the gingivitis group with blood group O being most affected followed by B and A. In our study sample, the prevalence of the blood groups affected by both abnormal blood pressure and periodontal diseases were very nearly similar, thereby suggesting a strong correlation between the ABO blood groups, risk of hypertension and periodontal disease. Although the ABO groups are linked to periodontal disease and hypertension by virtue of the antigens; hypertension and periodontal disease may be potentially linked with regard to the inflammatory response and oxidative stress due to the bacteria in periodontal disease enhancing the risk of hypertension.

One of the major limitations of this study is the sample size which, if much larger, could have probably yielded more significant results. Secondly, the study included subjects from only the Western region of the country. Inclusion of other parts of the country’s population, would possibly display a more broader picture in this association as individual variations do exist among people in different parts of the country. Whether the exclusion of a periodontally healthy group, could be considered a limitation was a matter of debate during the planning of the study. However, it was argued that such an inclusion would not be in keeping with the objective of finding a link between periodontal disease status and abnormal blood pressure in the various blood groups.

5. CONCLUSION

As ABO blood groups are genetically determined and cannot be controlled, periodontal disease and hypertension, which share multiple common risk factors, should be readily controlled in case of assessment of a possible association as it may be suggested that certain ABO blood groups with periodontal disease may increase the risk of hypertension in the population.

In patients with signs and symptoms of poor oral health in specifically prone blood groups, it is reasonable to recommend a medical evaluation (including blood pressure measurement) and comprehensive periodontal examination. Therefore, in the face of two highly prevalent diseases (or cardiovascular risk factors) in the population (hypertension and Periodontal disease), it can be suggested that simple periodontal evaluation should be a new useful tool for assessing cardiovascular risk in the high risk blood groups.

CONSENT

As per international standard or university standard written patient consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

This cross-sectional study was reviewed and approved by the Ethical Committee of Ibn Sina National College of medical sciences, Jeddah.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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