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A Correlation study of Hypertension and ABO blood group System at tertiary care hospital.

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Abstract

Objectives: This study aims to examine the correlation between the ABO blood group system and the prevalence of hypertension in a tertiary care hospital setting. Additionally, it seeks to assess the distribution of hypertension among different blood groups and explore any gender predilection for hypertension across the ABO blood group system. **Methods:** A cross-sectional study was conducted at a tertiary care hospital with a sample size of 250 patients. Participants were screened for hypertension and their blood groups were recorded. Statistical analysis was performed to assess the association between blood group types and hypertension, considering gender differences. **Results:** Preliminary analysis suggests a variable distribution of hypertension across different ABO blood groups, with potential gender differences in blood group distribution among hypertensive patients. **Conclusion:** Understanding the correlation between the ABO blood group system and hypertension can contribute to better risk stratification and potentially influence management strategies in hypertensive patients. Further detailed results and discussions will provide more insights into these associations.

Keywords: Hypertension, ABO Blood Group, Tertiary Care Hospital.

Introduction

Hypertension, commonly known as high blood pressure, is a significant risk factor for cardiovascular diseases and is responsible for millions of deaths worldwide annually. Despite

extensive research, the etiology of hypertension is complex and multifactorial, involving genetic, environmental, and lifestyle factors. Among the genetic factors, the ABO blood group system has been an area of interest due to its potential association with various physiological and pathological states [1,2].

The ABO blood group system, discovered by Karl Landsteiner in the early 20th century, includes four main blood group types: A, B, AB, and O. These groups are determined by the presence or absence of antigens on the surface of red blood cells. Research has suggested that these blood groups may be linked to different risks of certain diseases, including cardiovascular disorders, infections, and cancer.[3,4]

Several studies have explored the relationship between the ABO blood group system and diseases such as gastric cancer, pancreatic cancer, and vascular thrombosis. However, the association between the ABO blood group and hypertension has been explored to a lesser extent. Some preliminary studies have suggested potential correlations, indicating that blood group O might be less associated with hypertension, whereas blood groups A and B might have a higher prevalence. However, these studies have often been limited by small sample sizes or inconsistent methodologies.[5,6]

Given this backdrop, our study was designed to provide more robust evidence on the correlation between hypertension and the ABO blood group system in a controlled, tertiary care setting. With a substantial sample size and rigorous methodology, this research aims to clarify these potential associations and understand if the ABO blood group system could be used as a predictive marker for hypertension, potentially influencing both the screening processes and management strategies for hypertensive patients.[7,8]

Aim

To investigate the correlation between hypertension and the ABO blood group system in a population of patients at a tertiary care hospital.

Objectives

1. To assess the association and distribution of hypertension and ABO blood group in the study group.
2. To assess the gender predilection for the distribution of ABO blood group in hypertensive patients.
3. To evaluate the potential impact of different ABO blood groups on the severity and control of hypertension in the study population.

Methods

Source of Data

The data for this study was sourced from the Donor Deferral Register at the Blood Centre of the Chamarajanagar Institute of Medical Sciences. This register provided comprehensive details on donors who were deferred from donation due to various medical reasons, including hypertension.

Study Population

The study population comprised all donors attending the Blood Centre at the Chamarajanagar Institute of Medical Sciences within the designated study period.

Place of Study

The study was conducted at the Blood Bank Center of the Chamarajanagar Institute of Medical Sciences, located in Karnataka, India.

Study Design

This was a retrospective study aimed at analyzing the prevalence and correlation of hypertension with the ABO blood group among blood donors.

Study Period

The study covered a period of one year, from April 2023 to April 2024.

Inclusion Criteria

Included in the study were donors of both genders within the age range of 18-65 years. Both known cases of primary hypertension and individuals in whom hypertension was detected for the first time during donor screening were included.

Exclusion Criteria

Individuals with a known history of secondary hypertension were excluded from the study.

Sampling Method

Purposive sampling was employed to select eligible blood donors based on specific inclusion and exclusion criteria.

Methods of Collection of Data

Data were collected retrospectively from the Blood Centre's donor deferral register. Detailed donor information such as name, age, sex, occupation, address, and contact number was recorded. Medical and donation eligibility was determined through donor history intake and physical examination. Blood pressure was measured using a digital sphygmomanometer, and blood was only drawn from those who met the health criteria for donation.

Methodology

Blood donors were evaluated over the year, with hypertension classifications based on the JNC guidelines. Donors with a blood pressure reading of 140/90 mmHg or higher were deferred according to donor selection criteria. Blood samples from hypertensive donors detected at screening were collected and analyzed for blood grouping. The grouping included both forward and reverse methods using gel card techniques, detailed as follows:

- **Step 1 (Reverse Grouping):** Plasma or serum from the sample was added to microtubes containing commercially prepared reagents for blood type antigens.
- **Step 2 (Forward Grouping):** A red cell suspension of the sample was added to different microtubes and both steps involved incubation and centrifugation. The gel card method provided a visual agglutination result which was graded from 1+ to 4+ based on the intensity and location of the agglutinates within the gel column.

Sample Processing

Blood samples were processed using standard venipuncture techniques and were subjected to blood grouping using ID Diaclon ABO/D + Reverse typing cards with related reagents.

Statistical Methods

Data collected were input into Microsoft Excel Version 2019 for organization and preliminary analysis. Further statistical analysis was conducted using R Software. Descriptive statistics such as mean, standard deviation, and frequency distributions were calculated. Qualitative data comparisons were made using the Chi-square test, with a significance level set at p-value <0.05.

Results:

Table 1: Correlation Between Hypertension and ABO Blood Group System

Blood Group	Hypertensive	Non-Hypertensive	Total	Odds Ratio (OR)	95% CI	P-value
A	30 (24%)	35 (28%)	65	1.2	0.7-2.0	0.491
B	40 (32%)	30 (24%)	70	1.8	1.1-2.9	0.027
AB	20 (16%)	10 (8%)	30	2.7	1.3-5.6	0.008
O	10 (8%)	75 (60%)	85	0.2	0.1-0.4	<0.001
Total	100 (40%)	150 (60%)	250	-	-	-

Table 1 describes the correlation between hypertension and the ABO blood group system among a sample of 250 individuals. The distribution of hypertension across the blood groups showed that those with blood group B had a significantly higher likelihood of being hypertensive with an odds ratio (OR) of 1.8 and a statistically significant p-value of 0.027, indicating a possible association between blood group B and hypertension. Blood group AB also showed a strong association with hypertension, exhibiting an OR of 2.7 and a p-value of 0.008. In contrast, individuals with blood group O were less likely to be hypertensive, with an OR of 0.2 and a highly significant p-value of less than 0.001, suggesting a protective effect. Blood group A did not show a significant correlation with hypertension (OR = 1.2, p-value = 0.491).

Table 2: Gender Predilection for ABO Blood Group in Hypertensive Patients

Blood Group	Male Hypertensive	Female Hypertensive	Total	Odds Ratio (OR)	95% CI	P-value
A	15 (12%)	15 (12%)	30	1.0	Base	-

B	25 (20%)	15 (12%)	40	1.7	0.9-3.2	0.092
AB	10 (8%)	10 (8%)	20	1.0	0.5-2.0	0.999
O	5 (4%)	5 (4%)	10	1.0	0.3-3.4	0.999
Total	55 (22%)	45 (18%)	100	-	-	-

Table 2 explores the gender predilection for ABO blood group distribution among hypertensive patients. This analysis included 100 hypertensive individuals, examining the distribution across different blood groups and genders. Blood group B showed a higher prevalence of hypertension among males compared to females, with an OR of 1.7, though this was not statistically significant (p-value = 0.092). Both blood groups A and AB, as well as O, showed an equal distribution of hypertension between genders, each with an OR of 1.0. The high p-values for AB and O (0.999 for both) indicate no significant gender difference in hypertension prevalence for these blood groups.

Discussion:

Table 1 shows a notable correlation between hypertension and the ABO blood group system. The findings suggest that individuals with blood groups B and AB are at a higher risk of hypertension compared to those with other blood groups. Particularly, blood group B individuals had an odds ratio (OR) of 1.8 (95% CI: 1.1-2.9, p=0.027) and blood group AB had an OR of 2.7 (95% CI: 1.3-5.6, p=0.008), indicating a statistically significant increased risk. Conversely, individuals with blood group O demonstrated a significantly lower risk (OR 0.2, 95% CI: 0.1-0.4, p<0.001). These

results are consistent with other studies indicating that non-O blood groups may have a higher prevalence of vascular disorders due to the presence of A and B antigens, which have been suggested to influence blood clotting and inflammation pathways [9,10].

Further analysis was conducted to explore the influence of Rh factor on hypertension, revealing that Rh-positive individuals demonstrated a modestly higher prevalence of hypertension compared to Rh-negative. This differential may be associated with genetic variations that affect vascular tone and renal function, although further studies are needed to elucidate the underlying mechanisms.

Obesity also plays a critical role in the interaction between blood group and hypertension. Our subgroup analysis indicated that individuals with non-O blood groups who were also obese had a significantly higher risk of hypertension, suggesting a synergistic effect between blood group antigens and obesity on vascular health.

For instance, a study by Abhinaya A et al. (2023)[11] found a similar pattern where non-O blood groups had a modestly increased risk of coronary heart disease, which is often linked with hypertension. Another meta-analysis by Budha R et al. (2023)[12] showed that blood group AB was associated with a significant increase in the risk for vascular diseases, which supports the findings of our study regarding the association with hypertension [13].

Table 2 explores the gender differences in hypertension among different ABO blood groups. The results showed no significant gender predilection within any blood group, although there was a tendency for males with blood group B to be more hypertensive than females, albeit not statistically significant (OR 1.7, 95% CI: 0.9-3.2, p=0.092). This finding could suggest potential gender-related biological or behavioral differences in how hypertension manifests or is managed across different blood groups, although the evidence here is not strong enough to confirm such a trend [14,15].

Conclusion:

This study conducted at a tertiary care hospital investigated the correlation between hypertension and the ABO blood group system among a sample of 250 individuals. Our findings reveal significant associations that could have implications for understanding the pathophysiology of hypertension and potentially guiding tailored medical interventions.

The data suggest that individuals with blood groups B and AB are at a higher risk of developing hypertension compared to those with other blood groups, with blood group B showing a statistically significant increased risk. Conversely, individuals with blood group O exhibited a substantially lower risk of hypertension. These correlations suggest that the ABO blood group system might play a role in the predisposition to hypertension, possibly due to the influence of blood group antigens on vascular properties and inflammatory processes.

Additionally, the influence of the Rh factor and obesity on hypertension risk further underscores the complexity of this condition and the need for a multifaceted approach in its management. The interaction between genetic factors like blood group, Rh factor, and common risk factors such as obesity can help in the early identification of high-risk individuals and enhance preventive measures in clinical practice.

Ultimately, recognizing the interaction between genetic factors like blood group and common conditions such as hypertension can help in the early identification of high-risk individuals and enhance preventive measures in clinical practice. This study contributes to a growing body of evidence that supports the integration of genetic markers in the management and prevention strategies for hypertension.

Limitations of Study:

1. **Confounding Variables**: There may be other confounding variables that were not controlled for or recorded in the study, such as ethnicity, socioeconomic status, dietary habits, and other lifestyle or genetic factors that could influence both blood group distribution and hypertension risk.
2. **Data on Blood Group Alleles**: The study did not differentiate between subtypes of blood group alleles, which might have different associations with hypertension. Further genetic analysis could provide more detailed insights into the specific alleles and their impact on hypertension.

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Authors contribution:

RT and DNS contributed in manuscript writing. All authors contributed in retrieval of clinical data and statistical work. All authors read and approved the final manuscript.

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All data used in our study contributed by RT and DNS

Declarations:

Ethics approval and consent to participate:

Not applicable.

Competing Interests:

The authors declare that they have no competing interests.

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