THE CORRELATION OF MALARIA WITH ABO BLOOD GROUP

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Abstracts: **Background:** Many studies have shown that susceptibility to several infectious diseases is related to the patient's blood group. Since malaria is a major problem in India, it would be useful to know whether there is any relationship between blood group and infection. **Objectives:** To assess the distribution of ABO blood group and its correlation with malaria. **Methods:** 100 patients of both sexes suspected malaria attending opd and inpatient department of medicine,Civil hospital,Rajkot were recruited as cases and 100 blood donor healthy subjects as controls. For species identification thick and thin blood smears were prepared. ABO blood grouping was done by slide method. **Result:** Cases of P.vivax (65%) was more than P.falciparum (35%). The age group affected most was 21-40 years (60%) and >60 years (8%) age group was affected least. Males (70%) were affected more than females (30%). Malaria cases were seen maximally with blood group 'B' (45%) followed by 'A' (33%), 'O' (15%) and 'AB' (7%). **Conclusion:** Maximum no. of malaria patients had 'B' blood group. This suggests that the person having blood group 'B' are more prone to malarial infection. Blood group 'O' confers protection to severe disease.

Key Words: Malaria, Host susceptibility, ABO blood group.

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Introduction:

Malaria is an infection caused by protozoan parasites of the genus Plasmodium and transmitted by the bite of infected Anopheles mosquitoes. Out of the four species (Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae) that infect humans, Plasmodium falciparum is the principal cause of severe clinical manifestations[1].

Malaria remains a major health problem in India. The National Vector Borne Disease Control Programme (NVBDCP), India, has reported that 1.8 million cases of malaria and 1,000 malaria-related deaths occur annually[1]. According to the latest estimates, released in December 2014, there were about 198 million cases of malaria in 2013 (with an uncertainty range of 124 million to 283 million) and an estimated 584 000 deaths (with an uncertainty range of 367 000 to 755 000). Malaria mortality rates have fallen by 47% globally since 2000, and by 54% in the WHO African Region[2].

The ABO blood groups consist of A, B and H carbohydrate antigens which can regulate protein activities during infection and antibodies against these antigens[3]. ABO blood grouping is based on the presence or absence of A and B blood group antigens on the surface of red blood cells (RBC) derived from inherited gene. In clinical practice, ABO is the most important system for blood group compatibility and ABO antigen associations with infections. The relationship between ABO and malaria was first suggested 40 years ago[4].

A number of studies were conducted to investigate the association between ABO blood group system and some disease conditions. Some of these studies reported significant associations, suggesting that ABO blood groups have an impact on infection status of the individuals possessing a particular ABO blood group[3]. Some reports found unexpected associations, such as the susceptibility of group A individuals to salivary or gastric cancers[5].

Cyto-adherence and rosetting are important components of several possible pathogenic mechanisms attributed to the cause of severe malarial infection[1]. Rosetting is characterized by the binding of P.falciparum infected RBCs to uninfected RBCs to form clusters of cells that are thought to contribute to the pathology of falciparum malaria by obstructing blood flow in small blood vessels[6]. An association between 'O' blood group and lower rosetting capacity has been demonstrated. However, rosetting capacities of blood group 'A', 'B' or 'AB' have remained controversial[1]. RBCs of blood group 'O' do not express tri-saccharide, and rosettes formed by infected 'O' blood group RBCs are smaller and

easily disrupted compared to blood groups A, B or AB[1].

Material and Methods:

A cross-sectional study was conducted at P.D.U. Medical College and Civil hospital, Rajkot to assess the association of ABO blood group antigens with malaria during May to August 2015. This study was approved by the institutional ethics committee (IEC) and an informed consent was obtained from the study participants. A total 100 patients of both sexes suspected malaria attending outpatient department and inpatient department of medicine, Civil hospital, Rajkot were recruited in this study as cases and 100 blood donor healthy subjects were taken as controls. Patient with mixed plasmodium infection, other associated illness(pneumonia, meningitis), associated hematological disorders (genetic disorders, haemoglobinopathies), peripheral smear negative for malarial parasites, history of blood transfusion or blood donation and pregnancy were excluded from the study. Thick and Thin blood smears were prepared using fresh blood sample and stained with Field's stain. Species identification was reported after examining smear dually confirmed by pathologist in Central Clinical Laboratory. ABO blood grouping was done by slide method by using antisera-A, antisera-B, antisera-D and this method is based on principle of agglutination.

Result: Following observations were made from the study.

Table-1 shows distribution of malaria according to species of malarial parasites of which cases of P. vivax were more than P.falciparum. Amongst 100 cases, 35 patients had P.falciparum malaria and 65 patients had P.vivax malaria.

Table-2 shows prevalence of malaria by age of which 21-40 years age group (60%) was affected most followed by 41-60 years (20%), 1-20 years (12%) and >60 years age group (8%) was affected least. Malaria can occur in all the age groups.

Table-3 shows prevalence of malaria by sex of which males were affected more than females. Out of 100 malaria cases 70 were males and 30 were females. The male to female ratio was 2.33:1.

Table: 1 Distribution of malaria according to species of malarial parasites

Parasite	Number of Cases	Percentage of Cases
P. Falciparum	35	35 %
P. Vivax	65	65 %
Total	**100**	**100 %**

Table: 2 Prevalence of malaria by age

Age (years)	P. Falciparum no. and %	P. Vivax no. and %	Total no. and %
1-20	7(20.0000)	5(7.6923)	12(12)
21-40	15(42.8571)	45(69.2307)	60(60)
41-60	8(22.8571)	12(18.4615)	20(20)
>60	5(14.2857)	3(4.6153)	8(8)
Total	**35(100)**	**65(100)**	**100(100)**

Table: 3 Prevalence of malaria by sex

Sex	P. Falciparum no. and %	P. Vivax no. and %	Total no. and %
Male	25(71.4285)	45(69.2307)	70(70)
Female	10(28.5714)	20(30.7692)	30(30)
Total	**35(100)**	**65(100)**	**100(100)**

Table: 4 Distribution of ABO blood groups in malaria cases and controls

Blood Group	Malaria Cases no. and %	Controls no. and %
A	33(33)	11(11)
B	45(45)	35(35)
O	15(15)	48(48)
AB	7(7)	6(6)
Total	**100(100)**	**100(100)**

Table-4 shows distribution of ABO blood groups in malaria cases and controls. Out of 100 malaria cases, 33 had 'A' blood group, 45 had 'B' blood group, 15 had 'O' blood group and 7 had 'AB' blood group. Malaria cases were seen maximally with 'B' blood group (45%) and least affected blood group

was 'AB' (7%). Out of 100 controls, 11 had 'A' blood group, 35 had 'B' blood group, 48 had 'O' blood group and 6 had 'AB' blood group. Blood group 'O' (48%) was maximally found among controls and 'AB' blood group (6%) was found least among controls.

Discussion:

The present study showed that P.vivax malaria (65%) was found more than P.falciparum malaria (35%). The result of the present study was consistent with the study done by Jadhav et al[7] at New Mumbai, there were 62.17% P.vivax, 37.69 % P.falciparum and 0.04% mixed cases of malaria. Similar findings were also found in the study done by Erhart et al[8] in Western Thailand, there were 59% P.vivax, 38% P.falciparum and 3% mixed & other malaria cases. While in the study done by Smita and Harish Chandra[9] at Dehradun, Uttarakhand**,** 69.8% P.vivax, 27.5% P.falciparum and 2.7% mixed infection cases were observed. The prevalence of malaria according to species is different in different regions. In our region P.vivax is more common than P.falciparum.

The age group affected by malaria maximally was 21-40 years (60%) followed by 41-60 years (20%), 1-20 years (12%) and >60 years (8%) age group was affected least. Malaria can occur in all the age groups. Similar findings were seen in the study done by Gayathri B.N et al[10] which showed all age groups were affected.

The number of males (70%) affected in present study were more than females (30%). The male to female ratio is 2.33:1. Similar findings were also found in the study done by Erhart et al[8], 69% males and 31% females were affected. The male to female ratio was 2.23:1. In the study done by Lathia et al[11], 61% males and 39% females were affected. The male to female ratio was 1.56:1. The result of the present study was consistent with the study done by Haroon et al[12], 75% males and 25% females were affected. The male to female ratio was 3:1. In the study done by Madiya et al[13], 62.86% males and 37.14% females were affected. The male to female ratio was 1.69:1. Similar findings were also found in the study done by Madhu gupta and A.N.Rai Chowdhuri[14] and Gayathri B.N et al[10].

The distribution of ABO blood groups in 100 malaria cases showed that patients with 'B' blood group (45%) were affected more than 'A' (33%),'O' (15%) and 'AB' (7%) blood group patients. The result of the present study was consistent with the study done by Aditya K Panda et al[1] which showed that patients with blood group 'B' have a four-fold increased risk of developing severe infection and 'O' blood group was significantly associated with a decreased risk of severe malaria. Similar findings were also found in the study done by Madhu gupta and A.N.Rai Chowdhuri[14] which showed that out of 476 malaria patients, 138 (29%) had 'A' blood group, 199 (41.8%) had 'B' blood group, 106 (22.2%) had 'O' blood group and 33 (7%) had 'AB' blood group.

As suggested by Russell, the genetic make up of individuals may cause a considerable variation in their reaction to malarial infection, and blood groups are merely an expression of genetic constitution. Qualitative and/or quantitative variation in structure and chemical composition of the receptor sites on the erythrocytic membrane of the various groups may play an important role in determining susceptibility. The variation may also be ascribed to the feeding habits of the vector species[14].

In the study done by Gayathri B.N et al[10], out of 205 malaria patients, 84 had 'B' blood group, 33 had 'A' blood group, 70 had 'O' blood group and 18 had 'AB' blood group. There is a strong association between rosette formation and ABO blood group, with group A and group B RBCs forming rosettes more than group O cells[10]. Previous work had shown that resetting parasites form larger, stronger rosettes in non-O blood groups (A, B or AB) than in group O RBCs[6]. These could be the reason of lesser susceptibility of 'O' blood group individuals to severe malaria infection. The adherence of parasitized RBCs to other cells is central to the Pathophysiology of severe malaria syndromes including cerebral malaria, respiratory failure, multiorganfailure, and death[10].

The distribution of ABO blood groups in 100 controls showed that 48 (48%) had 'O' blood group, 35 (35%) had 'B' blood group, 11 (11%) had 'A' blood group and 6 (6%) had 'AB' blood group. The result of the present study was consistent with

the study done by Aditya K Panda et al[1] which showed that out of 174 blood samples examined in healthy controls, 74 (42%), 36 (21%), 50 (29%) and 14 (8%) individuals were from O,A, B, and AB blood group, respectively. Similar findings were also found in the study done by Hailu Tadesse and Kebede Tadesse[4] which showed that the distribution of ABO phenotypes among 200 blood donors was O (60%), A (26%), B (12.5%) and AB (1.5%).

Conclusion:

The present study shows that maximum no. of malaria patients had 'B' blood group followed by 'A', 'O' and 'AB' blood group. This suggests that the person having blood group 'B' are more prone to malarial infection. Blood group 'O' confers protection to severe disease. The study also did not consider factors like iron status of the host, place of residence of the study population which could affect the nature of P.falciparum infection among the study population. Further, in-depth studies are needed to clearly assess the role of ABO blood groups in severe malaria cases to minimize mortality and morbidity of malaria in endemic areas.

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