

ABO Blood Groups and Malaria: Does it Really Matter?

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ABSTRACT

Background: Malaria is most important parasitic disease affecting humans. The literature relating to malaria and the blood groups are sparse and have mixed response.

Objectives: The study was undertaken to assess the distribution of ABO blood group and their relationship with malaria species and parasite load.

Methods: In 200 malaria positive patients blood group analysis was done. Malaria parasite detection and load estimation was done using quantitative buffy coat (QBC) methodology using a fluorescent microscopy. ABO blood group was determined by agglutination test using antisera.

Results: A total of 200 were included in the study of which 121 cases were positive for plasmodium vivax, 32 cases were positive for plasmodium falciparum and 47 patients had mixed infection. The results of blood groups showed, 63 malaria infected patients with A blood group, 50 with B blood group, 80 with O blood group and 7 with AB blood group. Maximum parasite load was noted in blood group O, followed by group A and B. The most common blood group infected with plasmodium vivax is blood group O, similarly with 3+ and 4+ parasite load is blood group O.

Conclusion: This study suggests significantly higher proportion of O blood group malaria patients infected with plasmodium vivax with higher parasite load.

Keywords: Malarial Parasites, ABO Blood Group, Malaria, Parasite Load

Introduction

Malaria is one of the most important parasitic disease affecting humans. Worldwide annually 8,81,000 deaths are related to malaria alone and in this India contributes a major share of incidence. According to WHO, in South East Asia region, 70% of malaria cases are from India. Karnataka constitutes 28 districts. Out of which Dakshina Kannada contributes 50% of the cases to the state malaria profile. Hence it's a grave health problem that has tormented mankind for countless generations.^[1]

Despite high mortality and morbidity, certain individuals living in malaria endemic regions appear relatively protected compared to those who suffer frequent severe malaria attacks. Resistance to malaria is dependant on the development of an immune response by the host and to a variable extent on certain innate characteristics possessing protective value against infection. These factors include Sickle cell trait and disease, ABO blood type and levels of glucose- 6- dehydrogenase. It is thought that understanding nature of relationship between ABO blood groups and malaria should provide an invaluable scourge in the window and such studies in population of malaria endemic regions will be helpful in elucidating any such relationship.^[2]

There is paucity of hospital based, comparative studies to investigate the relationship between blood group types and malarial infection in our population where malaria is endemic. The objectives of present study were, to assess the distribution of ABO blood groups in malaria patients and its relationship with malaria species and parasite load.

Materials and Methods

The hospital based retrospective review of electronic medical records of malaria patients who attended outpatient or admitted with malaria in a tertiary care teaching hospital in Dakshina Kannada district of Karnataka. Totally 200 malaria positive cases were included in the study. The malaria parasite detection and load estimation was done using QBC methodology using fluorescent microscope. The parasite species was confirmed on peripheral smear. The parasite load on QBC was reported as 1+ (<1 parasite/HPF), 2+ (1-10 parasites / HPF), 3+ (11-100 parasites /HPF) and 4+ (>100 parasites /HPF). Commercial antisera was used for blood group determination (tube method). Data analysis was done by Chi-Square test and p value of < 0.05 was considered as statistically significant.

Result

In our study malaria infection had male preponderance with 73.5% of the cases being males. Malaria affected all age groups and age ranged from 5- 82 years old. Out of 200 malaria positive patients 80 (40%) had blood group O followed by 63 (31.5%), 50 (25%) and 7(3.5%) patients having blood group A, B and AB respectively. (Table 1)(Figure 1).Among 200 patients, irrespective of blood group, Plasmodium vivax infection is seen in 121 (60.5%), P. falciparum in 32(16%) and rest 47 (23.5%) had mixed infection. Plasmodium vivax infected cases most commonly had blood group O (44.6%), with statistical significant relationship ($p = 0.044$) followed by blood group A (30.5%), B (22.5%). Out of total Plasmodium falciparum infected cases most common blood group was blood group A (34.3%). Among the cases having mixed infection, most cases had blood group O (38.2%) followed by 31.9% and 29.7% each of blood group A and B. (Table 1) (Figure2).

In 35% of the cases, parasite load was 2+, followed by 30%, 22.5%, 11.5% with parasite load of 3+, 1+ and 4+

respectively. Out of the cases, that had parasite load of 1+, 38.2% had blood group O, 34% and 25.5% cases had blood groups A and B respectively. Among cases with parasite load of 2+, 37.1 had blood group A, 30%, 25.7% and 7.1% had blood groups O, B and AB respectively. Out of the cases that had parasite load of 3+, 51.6% had blood group O, and 23.3% each of blood group A and B. Parasite load of 4+ was seen in 43.4%, 30.4% and 26% had blood groups O, A and B respectively. There was no statistical significance between blood group frequency and parasite load ($p = 0.321$). (Table 2) (Figure3).

Discussion

Malaria has been known since antiquity. Much new information has emerged since relationship between ABO and malaria was first suggested >40 years ago. The observation by Miller et al that human erythrocytes lacking Duffy blood group antigens are refractory to invasion by Plasmodium vivax parasites indicates usefulness of studying the association of blood groups with malaria. In Indian scenario, the literature relating to malaria and the blood groups are sparse and have mixed results. [3]

Table 1: Distribution of cases

	Blood group	A	B	O	AB	Total
Sex	M	45	38	59	12	147(73.5%)
	F	18	12	21	5	53 (26.5%)
Type	Vivax (V)	37	27	54	3	121(60.3%)
	Falciparum (F)	11	9	8	4	32 (16%)
	Mixed (M)	15	1	18	0	47(23.5%)
		63(31.5%)	50 (25%)	80 (40%)	7 (3.5%)	200 (100%)

Table 2: Parasite load vs blood group type

Blood group		A	B	O	AB	Total
Parasite load in QBC	1+	16 (34%)	12 (25.5%)	18 (38.2%)	1(2.1%)	47 (23.5%)
	2+	26 (37.1%)	18 (25.7%)	21 (30%)	5 (7.1%)	70 (35%)
	3+	14 (23.3%)	14 (23.3%)	31 (51.6%)	1 (1.6%)	60 (30%)
	4+	7 (30.4%)	6 (26%)	10 (43.4%)	-	23 (11.5%)

Table 3: Correlation of prevalence of malaria in different blood group

Workers	A (%)	B (%)	O (%)	AB (%)
Singh et al (2015)	16.08	21.95	25.86	13.04
Gayathri et al (2013)	16.09	40.09	34.16	8.78
Deepa et al (2011)	22	42	35	1

Workers	A (%)	B (%)	O (%)	AB (%)
Otajevo et al (2013)	34.6	23.1	38.4	3.9
Sule Hussain et al (2014)	32.3	35.3	17.7	24.2
Tewodros et al (2011)	23.5	21.9	51.3	3.3
Present study	31.5	25	40	3.5

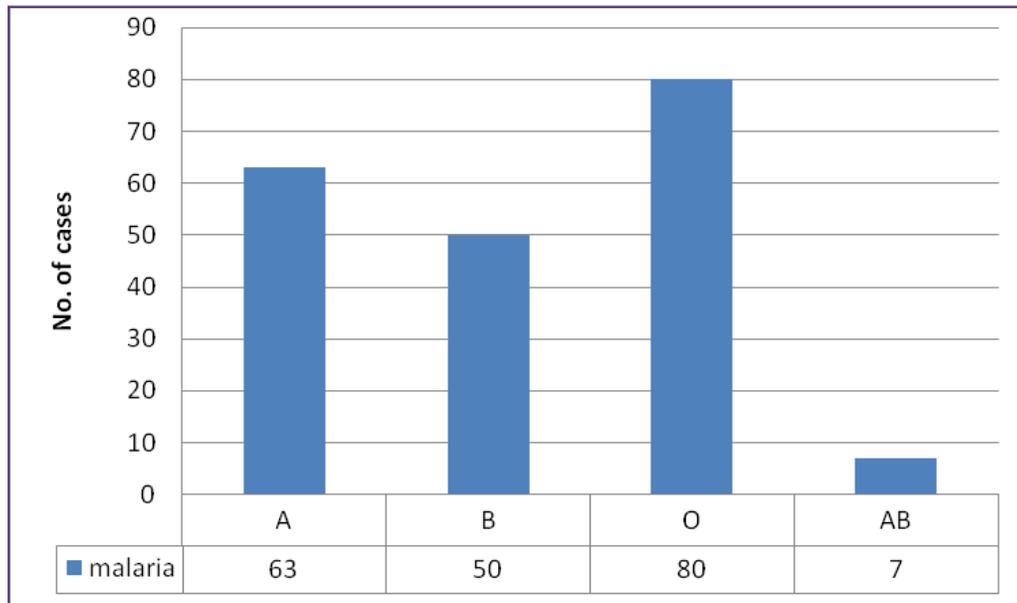


Fig. 1: Distribution of total cases according to blood groups

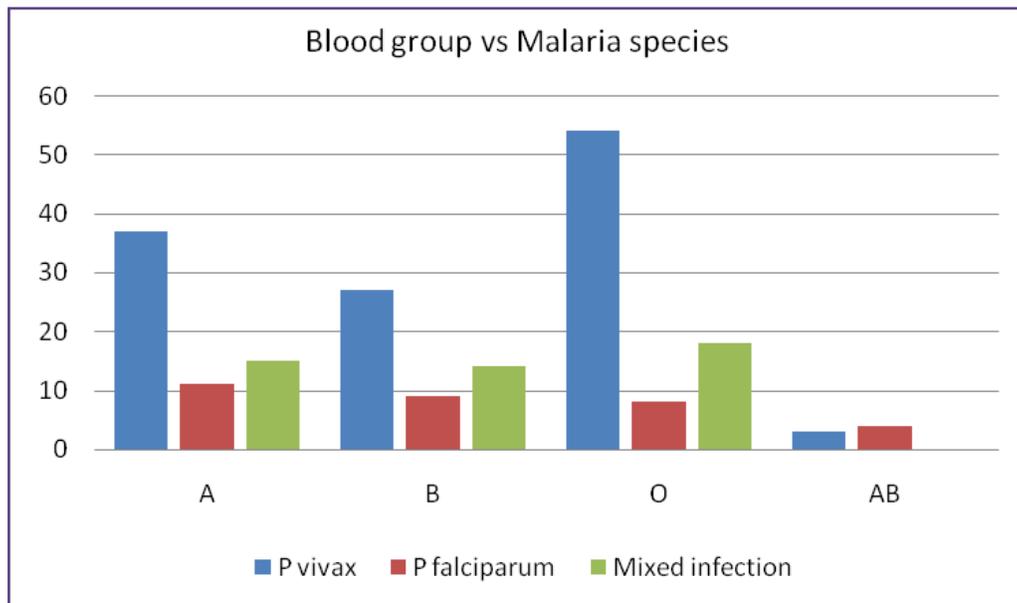


Fig. 2: Association between blood group and malaria species

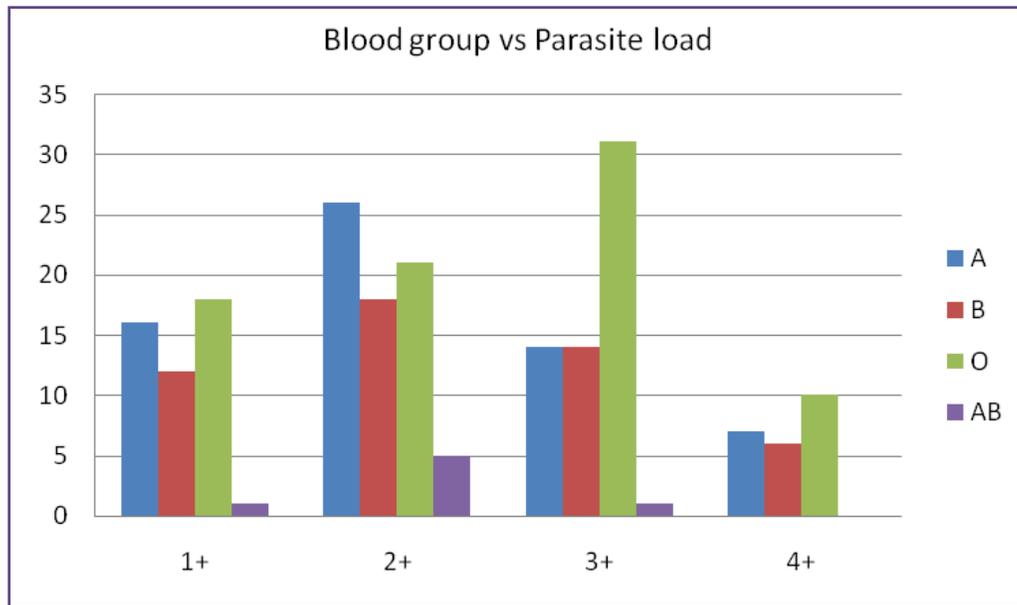


Fig. 3: Association of blood group and parasite load

In this study, high percentage of O blood group (40%) phenotype was observed among the study participants followed by A (31.5%), B (25%) and AB (3.5%). This agrees with some previous studies that also reported high prevalence of blood group O phenotype in tropical regions where malaria is rampant. ^[4]

As regards to correlation there are some differences from other reports. High incidence of malaria in O blood group was found in the study of Singh et al, Tewodros et al, and Otejevvo et al. ^[2,4,5] Gayatri et al, Sule Hussain et al and Deepa et al however reported higher incidence in B blood group 40.97 %, 35.3% and 42% respectively.^[3,6,7] (Table 3)

According to the study conducted by our blood bank, most common blood group in our population is O, followed by B and A. Hence, highest number of malaria cases in blood group O, could be explained by the fact that blood group O is the most prevalent blood group in our population and South India. ^[8,9]

In this study, higher proportion of individuals with blood group A and B, were found to be infected with *P. falciparum*. This is also consistent with previous reports. ^[4,10,11] Several mechanisms relate to these associations including affinity for anopheles species, impairment of merozoite penetration of RBCs, as well as cytoadherence, endothelial activation and rosetting activity. ^[4]

Conclusion

This study lends further credence to earlier related studies that in any given population, the highest number of subjects

belongs to group O, while the least number belong to AB. The highest parasitemia rate was observed among group O. There was significant statistical relationship between blood group O being infected with *P vivax* ($p=0.044$) species. Since, blood group O is prevalent blood group in our population, this ostensibly implies that all ABO blood groups are equally at risk and therefore available malaria prophylactic and therapeutic strategies should be directed at individuals of all groups.

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