

Relation of Blood Group to Malaria in Two New Medical Colleges of Odisha - An Ongoing Study

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ABSTRACT

BACKGROUND

Numerous associations have been reported between the ABO blood group system and some disease conditions such as skin cancer, schistosomiasis, onchocerciasis, and HIV infection. There are many reports on the association of ABO blood groups with susceptibility, resistance, and severity of malaria infection especially in relation to *P. falciparum* infection. Individuals with blood group "A" have been found to be highly susceptible to falciparum malaria whereas blood group "O" is said to confer protection against complicated cases. Low parasitaemia and uncomplicated *P. falciparum* malaria cases among blood group "O" individuals have been observed. Balangir and Baripada are malaria endemic areas of the state of Odisha. Several researchers have studied the relationship between ABO blood types and malaria susceptibility but with contradictory results. However, most of these studies are retrospective. Hence, BB Medical College, Bolangir and PRM Medical College, Baripada, being new government medical colleges, the 1st semester students, most of whom are not from these endemic regions nor have stayed under these conditions, were screened for malaria for a two-year period after determining their blood group for correlation.

METHODS

This is a prospective study, conducted at PRM Medical College & Hospital, Baripada and Bhima Bhoi Medical College, Bolangir, Odisha. The first-year students admitted to these two medical colleges were taken up for study after taking informed consent. Their blood group type in relation to ABO and Rh were ascertained by agglutination method. Then they were followed up for a period of two years for malaria by screening all cases developing fever by both immunologic methods and observing malaria parasites microscopically.

RESULTS

Out of 180 students who agreed to enrol for the study, 74 (41.11%) had blood group O, 65 (36.11%) had blood group B, 32 (17.77%) had blood group A and 9 (5%) were AB. 169 (93.8%) were Rh positive and only 11 (6.1%) were Rh negative. Out of those enrolled, 10 students were excluded from follow up as they were local students and suspected to be resistant to malaria. During a follow up period of two years, only 34 students developed malaria of which 18 were blood group O, 14 were blood group B and 2 were of blood group A.

CONCLUSIONS

Even though the medical colleges were located in malaria endemic areas, only 34 students enrolled in the study suffered from it over a period of two years. This low incidence could be due to hygienic conditions in the new medical colleges provided to the medicos. There was no casualty due to the disease.

KEYWORDS

Blood Group, Malaria, New Medical Colleges, Endemic Area

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BACKGROUND

The clinical outcome of malaria in endemic areas is influenced by erythrocyte polymorphisms including the ABO blood groups. Studies have reported association of ABO blood group to resistance, susceptibility, and severity of *P. falciparum* malaria infection. Individuals with blood group "A" have been found to be highly susceptible to falciparum malaria whereas blood group "O" is said to confer protection against complicated cases.^{1,2}

ABO blood group refers to a system of carbohydrate antigens expressed on human erythrocytes and other human cells. The "A" and "B" antigens on erythrocytes are disaccharides.³ All erythrocytes possess an "H" disaccharide on their surfaces (except the rare Bombay phenotype, which has no ABO antigens). Individuals with blood groups "A" and "B" have the "A" and "B" antigens, respectively, together with the "H" antigen. Blood group "AB" individuals have both "A" and "B" antigens together with the "H." Blood group "O" individuals, however, have neither "A" nor "B" antigens but "H" differences in blood group antigen expression can increase or decrease host susceptibility to many infections. Blood groups can play a direct role in infection by serving as receptors and/or coreceptors for microorganisms, parasites, and viruses. In addition, many blood group antigens facilitate intracellular uptake, signal transduction, or adhesion through the organization of membrane microdomains. Several blood groups can modify the innate immune response to infection. Several distinct phenotypes associated with increased host resistance to malaria are overrepresented in populations living in areas where malaria is endemic, as a result of evolutionary pressures.⁴ Baripada and Bolangir are malaria endemic areas of the state of Odisha.

Several researchers have studied the relationship between ABO blood types and malaria susceptibility but with contradictory results. In a study in east China, 90 (90.91%) of the patients were positive for *Plasmodium falciparum*, 8 (8.08%) were infected with *Plasmodium vivax*, and only 1 (1.01%) was infected with *Plasmodium malariae* and the most common blood group among the participants was group O (38.38%) followed by blood groups A, B, and AB, with 32.32%, 22.22%, and 7.07% cases, respectively. There was no significant relationship between the prevalence of malaria and ABO blood types ($P > 0.05$). In the blood group O, the prevalence of haemolytic-uremic syndrome and cerebral malaria was 13.16% and 5.25%, respectively, which was lower than that of the other three blood types ($P > 0.05$). The blood group O was the most common blood type. Due to the small sample size of data, there was no significant association between ABO blood types and malaria infection.⁵ A study from Nigeria showed no significant association between ABO blood groups and malaria.⁶ Bedu-Addo et al. showed a clear protective effect of blood group O against malaria in primipara.⁷ Research in Gabon reported a significant association between blood group A and severe malaria.⁸ However the study from Odisha concludes that blood group 'O' is associated with reduced and 'B' blood group with increased risk of development of severe malaria

in Odisha, India. Meta-analysis also supports the protective nature of blood group 'O' from severe falciparum infection.⁹ Another study by Gupta et al have similar conclusions of association but that 'A' blood group is more susceptible to have malaria infection and risk of cerebral malaria and DIC in malaria is also more in 'A' group individuals.¹⁰

We wanted to study the incidence of malaria in relation to blood group in medical students admitted to two new medical colleges of Odisha located in endemic regions.

METHODS

This is a prospective study. Blood group of a sample population which stayed under similar conditions, was determined and was followed for development of malaria. BB Medical College, Bolangir, and PRM Medical College, Baripada, being two new government medical colleges, the 1st semester students, most of whom are not from this endemic region and stay under similar conditions, were followed for a period of two years for development of malaria. Apart from research this was of health benefit for the students. As a 1st step to this prospective study, their blood group was ascertained, and database maintained for-

1. Providing a referendum for blood group of the students as a mark of identity.
2. Database for donor pool.
3. For follow up for malaria.

Inclusion Criteria

All students who gave consent to undergo study.

Exclusion Criteria

Students belonging to the local region.

Informed consent was taken from the 1st semester MBBS students. Their ABO and Rh blood groups were ascertained by the agglutination method. A drop each of anti A, anti B and anti D (for Rh) anti sera were taken in different slides. A drop of saline diluted blood was added to each of anti A and anti B, and a drop of direct blood to anti D. They were thoroughly mixed by agitation and observed for clumping to develop which was usually immediate. In case of a waiting period of 5-10 minutes, the preparation was kept covered to prevent drying. Any discrepancy to naked eye was clarified by observation under a microscope.

Then they were followed for development of malaria both clinically and haematologically. The local students were excluded from follow up due to suspected resistance.

RESULTS

Out of 180 students who agreed to enrol for the study, 74(41.11%) had blood group O, 65(36.11%) had blood group B, 32(17.77%) had blood group A and 9(5%) were

AB. 169(93.8%) were Rh positive and only 11(6.1%) were Rh negative. Out of those enrolled, 10 students were excluded from study as they were local students and suspected to be resistant to malaria. During a follow up period of one year, 34 students developed malaria of which 18 were blood group O, 14 were blood group B and 2 was of blood group A. 20 students out of 34 tested positive for *P. falciparum*, whereas the rest 14 tested positive for *P. vivax*. 16 out of 20 students who tested positive for *P. falciparum* were of blood group O, 2 had blood group A and the other two had blood group B. 6 of cases infected with *P. falciparum* developed severe complications, two each belonging to blood group O, A and B. However, all cases recovered without any sequelae. The extremely small number however precluded statistical analysis.

DISCUSSION

Adherence of *P. falciparum* parasitized erythrocytes to the endothelium of blood vessels is key to the pathogenesis of complicated disease.^{2,11} Antigens of blood groups A and B have been suggested to play important roles in cytoadherence.¹² Due to the absence of A and B antigens on the surface of blood group O erythrocytes, cytoadherence, and hence resetting and sequestration, is reduced in individuals with blood group O.¹³ It has been observed that blood group O individuals are less likely to suffer from complicated falciparum malaria.^{14,15}

Gajjar et al describe the frequency of D antigen in their study (95.4%) and north Indian donors (93.6%) was significantly higher than in the Caucasians (85%) and lower than in the Chinese (99%).¹⁶ The distribution of ABO groups is similar to those described for Indian populations. Previous studies have proceeded retrospectively i.e. found out the blood group of malaria patients but the potential confounding factors like distribution of different blood group types in the population cannot be ruled out. Hence this prospective study was designed which in the first stage reflected that most cases were of *P. falciparum* as well as most of the students who suffered also had O blood group possibly signifying the absence of severe complications, however the small no. of cases precluded robust statistical analysis. But even in this endemic area, a meagre number of students developed malaria, without casualty, may be due to stringent hygiene.

CONCLUSIONS

The distribution of blood groups O, B, A and AB in the medical students of 1st semester is 41.11, 36.11, 17.77 and 5 percent respectively of which 93.8% are Rh positive. Though studying in a medical college in a malaria endemic area only 34 out of 170 students developed malaria over a period of two years out of which 20 cases were of *P. falciparum*. Significant complication was not observed in

most of the cases which reflects on the hygienic living conditions and treatment facility provided to the medicos. This study shall be continued for these students till the end of their course as well as for subsequent batches of medical students.

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