



Original Research Article

Relationship between ABO Blood Groups and Severity of Malaria in the Population of North Karnataka Region: A Cross-Sectional Study

Tanmay Bhat¹, Ruqia Asna Rabah², Srinivas Kudva³

¹Assistant Professor, ³Junior Resident, Department of Medicine, K.S.Hegde Medical Academy, Mangalore.

²Senior Specialist, Department of Medicine, District Hospital, Gulbarga.

Corresponding Author: Ruqia Asna Rabah

Received: 11/06/2014

Revised: 05/07/2014

Accepted: 08/07/2014

ABSTRACT

BACKGROUND: Malaria is one of the major public health problems in the developing countries. The ABO blood group system is arguably the best known, and yet the most functionally mysterious, genetic polymorphism in humans. In clinical practice, ABO is the most important system for blood group compatibility. This study shows the severity of malaria in different groups of patients with different blood groups.

AIM: The aim of the study is to study the relationship between ABO blood groups and severity of malaria.

MATERIALS AND METHODS: The study was carried out on 100 patients with fever, peripheral smear & quantitative buffy coat positive for malarial parasite admitted to B.L.D.E.A's Shri B.M.Patil Medical College, Hospital and Research Center. Bijapur, between November 2007 to September 2009.

Various complications of malaria were noted and were correlated with ABO blood groups and whether any particular complication occurred more frequently in any particular blood group.

OBSERVATION: Of the 100 malaria cases, 30 cases belonged to blood group A, out of which 15 patients (50%) had complications and 15(50%) with no complications. Out of total 24 O blood group cases, 10(41.66%) had complications and 14(58.33%) were in uncomplicated group. Out of 33 cases which belonged to blood group B, 8 patients (24.24%) had complications and 25 patients (75.75%) had no complications. The association between blood group and malaria has statistical significance.

CONCLUSION: Patients with blood group A had more complications of malaria than other blood groups. Thus blood group A is prone to develop complications while blood group B seems to offer a kind of protection for complications as least number of complications was seen in those individuals.

KEY WORDS: ABO blood group, Malaria, North Karnataka.

INTRODUCTION

Malaria is probably one of the oldest diseases known to mankind that has had profound impact on our history. It has been responsible for the decline of nations and crushing military defeats, often having caused more casualties than the weapons

themselves. [1] It continues to be a huge social, economical and health problem, particularly in the tropical countries.

Every year 300 million to 500 million people suffer from this disease (90% of them in sub-Saharan Africa, two thirds of the remaining cases occur in six countries-

India, Brazil, Sri Lanka, Vietnam, Colombia and Solomon Islands). [2] About 1.5 million to 3 million people die of malaria every year. Malaria ranks third among the major infectious diseases in causing deaths- after pneumococcal acute respiratory infections and tuberculosis. It accounts for 2.6 percent of the total disease burden of the world. It is responsible for the loss of more than 35 million disability-adjusted life-years each year. [3]

Malaria was nearly eradicated from most parts of the world by the early 60's, owing largely to anti malarial campaigns worldwide under the guidance of the World Health Organization. Severe malaria is almost exclusively caused by *P. falciparum* infection and usually arises 6–14 days after infection. [4] Severe malaria can progress extremely rapidly and cause death within hours or days. In the most severe cases of the disease fatality rates can exceed 20%, even with intensive care and treatment. [5]

ABO is the most important system for blood group compatibility. In the century since their discovery, ABO antigen associations with infections and other diseases have been the subject of hundreds of publications. [6] Much new information has emerged since a relationship between ABO and malaria was first suggested more than 40 years ago. There is hypothesis that *Plasmodium falciparum* malaria has shaped the distribution of ABO blood groups in humans. Human and *P. falciparum* coevolution has shaped the proportions of ABO antigens observed in humans across geographic regions. [7] However, the distribution of ABO has also been influenced by other events including the migration of peoples with founder effects, population splitting from wars and famine, and various other reasons. Review highlights the reduced cytoadherence of *P. falciparum* among group O individuals, survival after infection is known to depend

on a highly complex interaction between both host and parasite genes. Indeed, the full extent of the selective pressure exerted by *P. falciparum* on the human genome has yet to be realized, and new examples of host survival genes continue to be discovered. [8]

The ratio of group O to A is higher in geographic regions where malaria is currently, or was previously, endemic. An especially high prevalence of group O coupled with a low prevalence of group A is found throughout subSaharan Africa, where *P. falciparum* persists to this day. In the Western hemisphere, the distribution of group A and group O generally matches malaria's tropical distribution. From the tropical regions of Central and South America southward, the indigenous peoples are almost exclusively group O. In Asia, the prevalence of group O rises among peoples who live closer to the equator. Group O is the most common blood group in Turkey and Persia. [9,10] In contrast, group A is the predominant blood group in the colder regions of the Earth, where malaria has not been endemic. Thus, if survival from malaria is associated with group O, and mortality is associated with group A, then the worldwide distribution of ABO groups is consistent with selective pressure from malaria. [11,12]

MATERIALS AND METHOD

In this study 100 patients with fever, peripheral smear & quantitative buffy coat positive for malarial parasite admitted to B.L.D.E.A's Shri B.M.Patil Medical College, Hospital and Research Center Bijapur, between November 2007 to September 2009 were selected.

Various complications of malaria were noted and were correlated with ABO blood groups and whether any particular complication occurred more frequently in any particular blood group.

Statistical Analysis

Diagrammatic representation

Proper statistical tests i.e. chi square test

Inclusion Criteria

a) All patients with history of fever, peripheral smear study & QBC test positive for malarial parasite.

Exclusion Criteria

Cases who have undergone treatment before giving a blood sample

Study design

The study group consisted of 100 cases of malaria. Both thick and thin smears were prepared and examined for malaria parasite. Quantitative buffy coat study will be done to confirm the presence of malaria parasite. ABO blood grouping to be done using the slide agglutination method at the time of admission and relationship between ABO blood groups and malaria (both complicated and uncomplicated) will be studied. Complications of malaria were studied with respect to various ABO blood groups and to look whether complications occurred with increased and decreased frequency in any particular blood group.

The patient will be regularly looked for signs & symptoms of uncomplicated and complicated malaria during the hospital stay. Patients will be followed up till the patient

clinically improves & malarial parasites gets cleared off from the peripheral smear during the course of anti malarial treatment.

OBSERVATION AND RESULTS

Table no.1. Blood groups and complications in all patients

Blood Group	Complicated	Uncomplicated	Total
A	15	15	30
O	10	14	24
B	8	25	33
Total	33	54	100

Of the 100 malaria cases, 30 cases belonged to blood group A, out of which 15 patients (50%) had complications and 15(50%) with no complications. Out of total 24 O blood group cases, 10(41.66%) had complications and 14(58.33%) were in uncomplicated group. Out of 33 cases which belonged to blood group B, 8 patients (24.24%) had complications and 25 patients (75.75%) had no complications. The association between blood group and malaria has statistical significance.

Conclusion: Since Chi Square calculated value is greater than tabled value (5.99) at 5% level of significance. That is an association between the said attributes.

Table no.2. Association between blood group and type of complications

Blood Group	Anemia	Jaundice	Cerebral Malaria	Renal failure	Total
A	6	7	8	2	21
O	3	7	5	0	15
B	3	5	2	0	10
Total	12	19	15	2	47

33 complicated malaria patients were studied. Among patients with A blood group, 6 had severe anemia, 7 had jaundice and 8 had cerebral malaria. Among patients with O blood group 3 had severe anemia, 7 had jaundice and 5 had cerebral malaria. Among patients with B blood group, 3 had severe anemia, 5 had jaundice, 2 had cerebral malaria.

Patients with A blood group had more complications when compared to other

blood groups while patients with B blood group had least number of complications in all groups. But the association between blood groups and types of complications was not significant.

Conclusion: Since Chi Square calculated value is smaller than tabled value (5.99) at 5% level of significance. That is no association between the said attributes.

Table no.3. Relation between blood groups and complications in general

Blood Group	Number	Percent
A	15	45.4
O	10	30.2
B	8	24.4
AB	0	0
Total	33	100

Out of 33 complicated cases, 45.4% of patients belonged to blood group A, 30.2% of patients belonged to blood group O and 24.4% of them were of blood group B. Maximum number of complicated cases belonged to group A.

Table no.4. Relation between severe anemia and blood groups

Blood Group	Severe anemia	Percent
A	6	50
O	3	25
B	3	25
Total	12	100

Out of 12 severe anemia cases, 50% of them belonged to A blood group, 25% of them were of O blood group and 25% were of B blood group. Maximum number of patients belonged to A blood group.

Table no.5. Relation between jaundice and blood groups

Blood Group	Jaundice	Percent
A	7	37
O	7	37
B	5	26
Total	19	100

Out of total 19 jaundice patients, 37% of them were of A blood group, 37% belonged to O blood group and 26% of them belonged to B blood group. Least number of jaundice patients was in B blood group.

Table no. 6. Relation between cerebral malaria cases and blood groups

Blood Group	Number	Percent
A	8	53
O	5	33
B	2	14
Total	15	100

Out of 15 total cerebral malaria cases, 53% of them belonged to A blood group, 33% were of O blood group and 14% were of B

blood group. Maximum number of cases was seen in A blood group with least number in B blood group.

DISCUSSION

Of the 100 malaria cases, 30 cases belonged to blood group A, out of which 15(50%) had complications and 15(50%) with no complications. Out of 33 cases which belonged to blood group B, 24% had complications and 76% had no complications. Similar results were obtained with falciparum cases as well.

Of the 46 falciparum cases, 21 belonged to blood group A of which 14 cases(67%) had complications and 7(33%) did not have any complications. Out of 13 patients with B blood group, 5(38.4%) had complications and 8(61.5%) did not have any complications.

In accordance with our study, Lell et al studied complicated malaria cases and found that among all group A individuals, 71% had severe malaria and only 29% had uncomplicated malaria. In contrast to our study, among all group O cases 46% had severe malaria and 54% had uncomplicated malaria. [13]

Chowdhuri et al in Bulletin of World Health Organisation has mentioned patients with blood group A were found to have more complications in the form of cerebral malaria, severe anemia, jaundice and renal failure. [14]

Pathirana et al studied 243 malaria cases and found that the proportion of blood group A in uncomplicated cases was 25%, but was 33% in severe cases. The distribution of ABO groups was highly statistically different in severe malaria syndromes compared with uncomplicated malaria or the control population. [15]

Since this association is statistically significant, our study shows blood group A patients are susceptible to develop

complications of malaria in accordance with Lell et al study.

Also our study shows a kind of protection for complications in blood group B patients suffering from malaria which is not in accordance with Fischer et al who reported favourable outcomes for blood group O.

33 patients were having complicated malaria of which 45% belonged to A blood group. Fischer et al in his study found similar results with 32% of complicated cases belonging to A blood group and 9% to AB blood group. This study again proved the fact that complications occur more frequently in blood group A individuals. ^[16]

Our study showed maximum number of complications like severe anemia, jaundice, cerebral malaria and renal failure in blood group A individuals. But this association between blood groups and type of complications was not statistically significant.

The present study confirms the concept that blood group A individuals with malaria are susceptible to complications than other blood groups. Hence an association exists between ABO blood groups and complications of malaria in general. However an association between ABO blood groups and type of complications was not significant in our study.

CONCLUSION

The present study showed significant association between ABO blood groups and complications in malaria. Patients with blood group A were having more complications compared to the other blood groups. Hence the patients with blood group A may need stringent monitoring in hospital setup to avoid any overt complications. Also our study shows a kind of resistance to complications in patients with B blood group. This might provide a survival

advantage for patients with blood group B in malaria.

ACKNOWLEDGEMENTS

With privilege and respect I like to express my gratitude and indebtedness to my Guide Dr. M.S. Mullimani, Professor and Unit IV chief. Sri.B.M.Patil Medical College Bijapur, Dr. M.S. Biradar, Professor of Medicine and dean of Sri. B.M.Patil Medical College Bijapur and to all the patients without whose co-operation this study would be incomplete.

REFERENCES

1. A brochure for malaria medical officers : A.P. Ray, M.V.V.L. Narasimham, N.L. Kalra, Indian Society for malaria and other communicable diseases, New Delhi, July 1992.
2. Malaria Report of a scientific group of Indian College of Physicians N.P. Misra (ed); Technical Report Series II, Indian College of Physicians, Bombay 1996.
3. Severe and complicated malaria, World Health Organization malaria action programme, Transactions of the Royal Society of Tropical medicine and Hygiene, Vol. 80 Supplement 1986.
4. Malaria in Park's text book of preventive and social medicine, K. Park, Bhanarasidas Bhanot Publishers, Fifteenth Ed., 1997; pp 188-202
5. Trampuz A, Jereb M, Muzlovic I, Prabhu R (2003). "Clinical review: Severe malaria". *Crit Care* 7 (4): 315–23.
6. Kain K, Harrington M, Tennyson S, Keystone J (1998). "Imported malaria: prospective analysis of problems in diagnosis and management". *Clin Infect Dis* 27 (1): 142–9.
7. Dilip R Karnad. *Malaria. API textbook of internal medicine, 2003; (7):104-109.*
8. New Perspectives - Malaria Diagnosis : Report of a joint WHO/USAID informal consultation 25–27 october 1999 p 11
9. Ogasawara K, Bannai M, Saitou N, et al (1996). "Extensive polymorphism of

- ABO blood group gene: three major lineages of the alleles for the common ABO phenotypes". Human Genetics 97 (6): 777–83.*
10. Moulds JM and Moulds JJ. Blood group associations with parasites, bacteria, and viruses. *Transfusion Med Rev* 2000; 14:302–311.
 11. Frattali A and Spitalnik S L. Blood Group Antigens as Receptors for Pathogens. In Blancher A, Klein J, Socha WW (Eds.). *Molecular Biology and Evolution of Blood Group and MHC Antigens in Primates* 1997; Heidelberg Springer pp. 268–304.
 12. J. Alexandra Rowe , Ian G. Handel, Mahamadou A. Thera et al. Blood group O protects against severe *Plasmodium falciparum* malaria through the mechanism of reduced rosetting. *PNAS*. 2007;104:7471-17476.
 13. Lell B, May J, Schmidt-Ott RJ, et al. The role of red blood cell polymorphisms in resistance and susceptibility to malaria. *Clin Infect Dis* 1999; 28:794–799.
 14. Chowdhuri and gupta. *Bulletin of the World Health Organisation*. 1980;58(6):913-915
 15. Pathirana SL, Alles HK, Bandara S, et al. ABO-blood-group types and protection against severe *Plasmodium falciparum* malaria. *Ann Trop Med Parasitol* 2005; 99:119–124.
 16. Fischer PR and Boone P. Short report: Severe malaria associated with blood group. *Am J Trop Med Hyg* 1998; 58:122–123.

How to cite this article: Bhat T, Rabah RA, Kudva S. Relationship between ABO blood groups and severity of malaria in the population of north Karnataka region: a cross-sectional study. *Int J Health Sci Res*. 2014;4(8):72-77.

International Journal of Health Sciences & Research (IJHSR)

Publish your work in this journal

The International Journal of Health Sciences & Research is a multidisciplinary indexed open access double-blind peer-reviewed international journal that publishes original research articles from all areas of health sciences and allied branches. This monthly journal is characterised by rapid publication of reviews, original research and case reports across all the fields of health sciences. The details of journal are available on its official website (www.ijhsr.org).

Submit your manuscript by email: editor.ijhsr@gmail.com OR editor.ijhsr@yahoo.com