

## **A STUDY TO DETERMINE IF ANY PARTICULAR BLOOD GROUP CONFERS SOME DEGREE OF PROTECTION TO SEVERE MALARIAL COMPLICATION.**

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### **ABSTRACT**

*Dakshina Kannada was relatively free from malaria until early 1990 with only sporadic case reports. But since 1990, with a sudden spurt in industrialisation and construction activities, malaria has made a dramatic comeback. There are various studies that show a relationship between blood group and malarial infection. However no studies have been done in the region of Dakshina Kannada In view of the above we conducted a study to determine if any particular blood group confers some degree of protection against severe malarial complication with the objective to determine if any particular blood group confers some degree of protection to severe malarial complication.*

**Keywords:** *Blood group, Protection, Malaria.*

### **INTRODUCTION**

The resurgence of malaria is a serious public health problem in many parts of the world. It is therefore, important to identify the factors which contribute to susceptibility of hosts. Blood group 'A' patient was found to be more common in malaria cases than in individuals with group 'O'<sup>1</sup>.

Several studies undertaken have been unable to link ABO blood groups to the incidence of malaria and related clinical outcome<sup>2,3</sup>. There is a paucity of hospital based, comparative studies to investigate the relationship between blood groups types and severity of malarial infections.

Plasmodium falciparum rosetting, a parasite virulence phenotype associated with severe malaria, is reduced in blood group O erythrocyte compared with groups A, B and AB<sup>4</sup>.

Both P.falciparum and P.vivax infections provides supporting evidence in favor of an effect of ABO group on disease severity as O group provides advantage over non O groups<sup>5</sup>.

Individuals of blood group A and B are more susceptible to severe malaria infection as compared with individuals of blood group O; however the severity of infection differs due to differential host susceptibility<sup>6</sup>.

In view of the above we conducted a study to determine if any particular blood group confers some degree of protection against severe malarial complication.

### **AIM**

- ❖ To determine if any particular blood group confers some degree of protection to severe malarial complication.

### **OBJECTIVES**

- ❖ To find an association between the blood groups and severity of malaria in malaria positive cases.
- ❖ To establish whether there is a relationship between A,B,O blood groups and Malaria

### **MATERIALS AND METHODS**

The study was a prospective study conducted on 200 consenting patients presenting with smear positive malaria admitted at Kasturba Medical College and the affiliated hospitals in Mangalore between the period October 1<sup>st</sup> 2013 to August 1<sup>st</sup> 2015 after obtaining ethical clearance from the institution. Control size of 200 random cases visiting Wenlock Hospital, Mangalore blood bank for the same period.

- Diagnosis was based on peripheral smear
- Blood group was determined by forward and reverse method
- Hematological parameters done included hemoglobin , total leukocyte count and platelet count of each patient being done on automated cell counter
- The demographic details of the patients and clinical details were obtained from history
- Association was sought between severity of clinical course (including malaria species) and groups

### **Inclusion Criteria**

Smear positive malaria cases aged above 18 years.

### **Exclusion Criteria**

1. Malaria positive in children

The clinical course between the different groups were compared using the following parameters for severe infection [WHO criteria for severe malaria]<sup>8</sup>

- i. Impaired consciousness
- ii. Prostrations Or Weakness
- iii. Jaundice (Total bilirubin > 2.5mg/dl)
- iv. Cerebral malaria
- v. Convulsions
- vi. Severe Anemia (Hemoglobin<5gm%)
- vii. Renal failure
- viii. Hypoglycemia (blood glucose <40mg/dl)
- ix. Fluid, Electrolyte Imbalance
- x. Circulatory Collapse (ALGID Malaria)
- xi. Hyperpyrexia (Core body temperature>40°C)

- xii. Hyperparasitemia (>5% parasitized erythrocytes)
- xiii. Pulmonary edema and acute respiratory distress syndrome
- xiv. Abnormal bleeding and/or disseminated intravascular coagulation
- xv. Repeated generalized convulsions (> 3 convulsion observed within 24 hours)

## **DEFINITIONS OF MALARIAL SEVERITY USED IN OUR STUDY**

### **Complicated malaria (WHO criteria)**

1. Impaired consciousness (but arousable)
2. Prostration and extreme weakness
3. Jaundice
4. Cerebral malaria (unarousable coma not attributable to any other cause in a patient with *Falciparum* malaria)
5. Generalized convulsions
6. Normocytic Anemia
7. Renal failure
8. Hypoglycemia
9. Fluid, electrolyte, acid base disturbance
10. Pulmonary oedema
11. Circulatory collapse and shock (algid malaria)
12. DIC
13. Hyperpyrexia
14. Hyperparasitemia
15. Malarial haemoglobinuria

### **Mild Malaria:**

Acute febrile illness but no features of severe malaria.

**Moderate Malaria:**

Did not fulfill the criteria of severe malaria.

**Severe malaria:**

1. Those with cerebral malaria ( in coma and unable to localize a painful stimulus)
2. Fully conscious but either prostrated (unable to maintain a sitting posture) or in respiratory distress (abnormally deep breathing with intercostals or subcostal recession)

**Repeated attacks** were taken as two or more attacks of malaria.

**STATISTICAL ANALYSIS**

**The sample size was chosen by the formula**

$$n = \frac{Z^2 pq}{E^2}$$

Z(1.96) = 95% confidence interval

E= available error = 20% (80% power) assuming P= 35% <sup>5</sup>

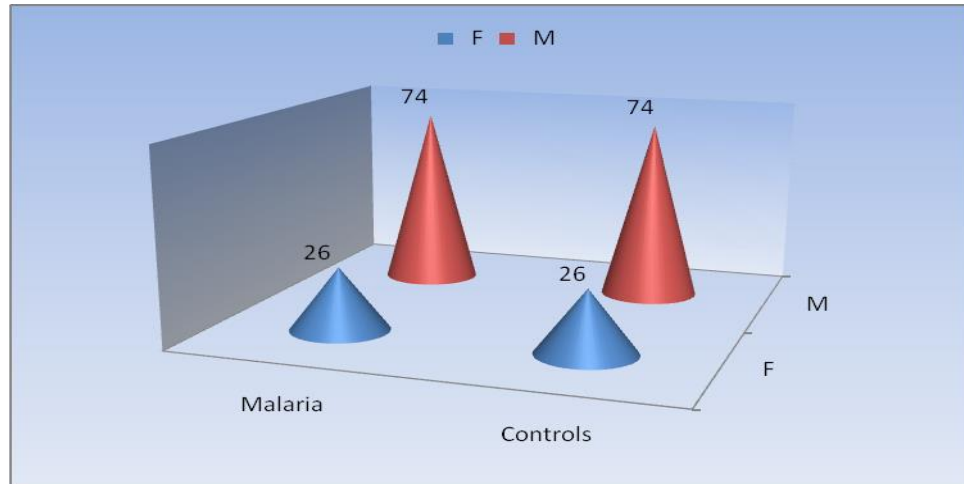
N= 180 with 10% non responsive

N=200

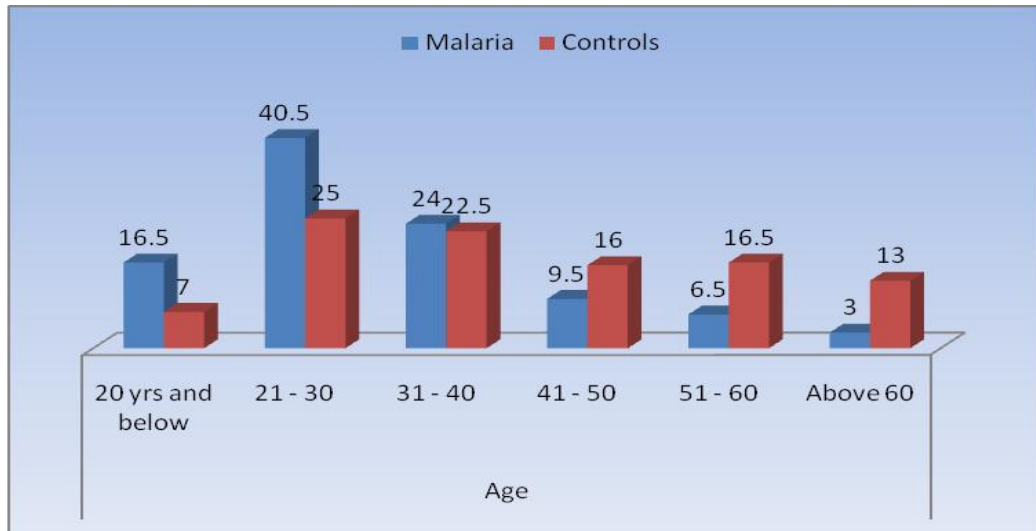
Chi – square test and Fishers exact test were done to find out the association between blood groups & severe Malarial complications. A Statistical package SPSS version 15.0 was used to do Analysis .P<0.05 was considered as significant.

**OBSERVATIONS AND RESULTS**

**Figure 1: Sex distribution**



**Figure 2: Age wise distribution**



**Table 1: Blood Group distribution**

		Group		Total
		Malaria	Controls	
Blood Group				
	A+ve	47	26	36.5
	AB+ve	6.5	7	6.75
	AB-ve	0.5	0.5	0.5
	A-ve	0.5	2.5	1.5
	B+ve	16.5	29	22.75
	B-ve	0.5	1	0.75
	O+ve	25.5	33	29.25
	O-ve	3	1	2
Total		100	100	100

**Table 2: Type of malaria**

	Frequency	Percent
Falciparum	65	32.5
Mixed	19	9.5
Vivax	116	58
Total	200	100

**Table 3: Type of malaria with reference to the age group**

		Malaria Parasite			Total
		Falciparum	Mixed	Vivax	
Age					
	20 yrs and below	6.2	42.1	18.1	16.5
	21 - 30	52.3	21.1	37.1	40.5
	31 - 40	23.1	31.6	23.3	24
	41 - 50	6.2	0.0	12.9	9.5
	51 - 60	10.8	5.3	4.3	6.5
	Above 60	1.5	0.0	4.3	3
Total		100	100	100	100

**Table 4: Complicated versus Uncomplicated**

		Complicated	Uncomplicated	
Age	20 yrs and below	10	18.125	16.5
	21 - 30	25	44.375	40.5
	31 - 40	35	21.25	24
	41 - 50	17.5	7.5	9.5
	51 - 60	12.5	5	6.5
	Above 60	0	3.75	3
Total		100	100	100

**Table 5: Sex distribution with reference to the type of malarial infection**

		Malaria Parasite			Total
		Falciparum	Mixed	Vivax	
Sex	F	18.5	26.3	30.2	26
	M	81.5	73.7	69.8	74
Total		100	100	100	100

**Table 6: Sex distribution with reference to complicated versus uncomplicated malarial infection**

	Complicated/ Uncomplicated		Total
	Complicated	Uncomplicated	
F	15	28.75	26
M	85	71.25	74
	100	100	100

**Table 7 : Blood groups association and malaria**

	Malaria Parasite			Total
	Falciparum	Mixed	Vivax	
A+ve	26.2	57.9	56.9	47
AB+ve	10.8	0.0	5.2	6.5
AB-ve	1.5	0.0	0.0	0.5
A-ve	0.0	0.0	0.9	0.5
B+ve	18.5	15.8	15.5	16.5
B-ve	1.5	0.0	0.0	0.5



O+ve	36.9	26.3	19.0	25.5
O-ve	4.6	0.0	2.6	3
Total	100	100	100	100

**Table 8 : Blood groups association and malarial complication**

	Malaria Parasite		Total
	Complicated	Uncomplicated	
A+ve	35.0	50.0	47
AB+ve	0.0	8.1	6.5
AB-ve	0.0	0.6	0.5
A-ve	0.0	0.6	0.5
B+ve	27.5	13.8	16.5
B-ve	0.0	0.6	0.5
O+ve	35.0	23.1	25.5
O-ve	2.5	3.1	3
Total	100	100	100

**Table 9 : Type of malarial complication**

Jaundice	14
AKI	10
Anaemia	6
Cerebral Malaria	3
Hypotension	2
Convulsion	2
Thrombocytopenia	2

## **DISCUSSION**

Malaria has been emerging as a major national health problem with considerable morbidity and mortality and has long been eluding our efforts for an effective control. It is a well known fact that blood groups are an expression of genetic constitution; in view of this statement we conducted a study to find the influence of blood groups on susceptibility to malaria<sup>7,8</sup>.

### **Sex distribution**

- In the 200 cases studied, more infected cases were found among males (74%)
- Females were affected more with vivax which constituted 40% of all the cases in females where as in the males the malarial infection was predominated by the falciparum parasite which constituted 36% of all the cases of malaria in the ,males. There was no significant difference statistically between the sex ratio between the malarial patients and the controls with a p= 1.000
- The following graph and table show that; among all the males infected with the malarial parasite 66% of males had complicated malaria in comparison to 46% of females had complicated malaria among all the females. There was no significant differences in the sex distribution of the malarial complications with a  $\chi^2=3.144$  and p=.076.

**Aditya K Panda et al**<sup>9</sup>, **Zerihun, Tewodro**<sup>10</sup>**et al** in different studies showed that a higher percentage of males than females were affected by malaria which is comparable with the results of our study

**Tauseef Ahmad et al**<sup>11</sup> in their study has a higher percentage of males 58.7% than females 41.3% which is comparable with the results of our study.

**Jimmy Antony et al**<sup>12</sup> studied 139, out of which 121 cases were males (87.05%) and 18 cases (12.95%) were females , which is comparable with the results of our study.

### **Severity of malaria:**

The following graph and table show type that the highest numbers of complications were seen in the age group 31 – 40 years (25 %) and uncomplicated malaria was seen commoner in the age group 21-30 years (44%), the association was statistically significant with a Fishers exact test p=.015.

In a study by **Dorndorp et al.**<sup>13</sup> which included 4 countries Bangladesh, India, Indonesia, and Myanmar they showed that in severe malaria 53% were aged 21–50 years.

### **Age wise distribution:**

The study group was divided into groups based on age. Malaria was found to be most common in the 21-30 years of age group (40.5%) followed by those between the age group

of 20 years and below. Incidence was less at the older age group i.e. between 51-60 and those who were 60 years and above.

The study by **Gupta and Chowdhuri**<sup>14</sup> found that 62.8% of their cases were in the age group 10 – 30 years; this is comparable with data from this study (61.6%).

**Jimmy Antony et al**<sup>12</sup> studied 139, out of which the majority, 58.99% of cases were in 20-39 years

### **Type of malaria**

- In our study we had Vivax and Falciparum infected patients as well as those with mixed infection. Falciparum infection was seen in 65 patients; Mixed infection was seen in 19 patients and Vivax infection was seen in 116 patients.
- **Tauseef Ahmad et al**<sup>11</sup> in their study showed the occurrence of P. vivax is much higher than P. falciparum 188 (99.47%) and 1 (0.53%) respectively which is comparable with our study.
- **Sedigheh Zaker et al**<sup>15</sup> in their study concluded that showed the occurrence of P. Vivax was the highest when compared to other types.

### **Blood group association and malaria**

- In the control group, the commonest blood group to be found was O+ with a value of 33%. The baseline distribution of blood groups in the normal population was established by taking samples from 200 individuals
- These results are different as compared to the study by Tyagi **S.P**<sup>16</sup> who found blood group B to be the predominant blood group (37.21%) in his study of the distribution of blood groups in Uttar Pradesh.
- Among all the blood groups, malaria commonly occurred in the A+ve blood group (47%) Vivax malaria was the commonest in the A+ve with a value of 56.9%. Falciparum cases were more in the blood group O+ (36.9%). Mixed infection was predominantly seen in patients with blood group A+ve (57.9 %%) , this was statistically significant with a Fishers exact test value of p=.012.

- Out of 200 cases, blood group O+ had maximum number of complications (35%). No association between the complications and the blood group type was seen in our study with the Fishers exact test  $p=.091$
- Blood group A+ve was associated with higher chances of liver failure, O +ve was associated with AKI.

In a study involving 170 children, **Tejinder Singh**<sup>17</sup> found a preponderance of *P. Falciparum* infection. Incidence of malaria was found to be maximum in those with blood group A, A/O ratio being 1.93.

**Singh, Shukla et al**<sup>18</sup> in their study involving ABO groups among malaria cases from district Mandla, Madhya Pradesh found that blood groups A, B & O were equally susceptible to malaria infection but AB group had less number of persons with malarial parasites. A lower frequency of *P. falciparum* was observed among individuals with blood groups A and O.

**Fischer P. R. and Boone P.**<sup>19</sup> studied 489 patients in Zimbabwe in an effort to see if clinically severe malaria was associated with blood group. They found that patients with malaria and blood group A had lower haemoglobin levels and more risk of coma than did infected patients with other blood groups, similar findings were noted in our study

**Aditya K Panda et al**<sup>9</sup> showed in their study that the blood group 'B' was significantly higher in patients with severe malaria, whereas in our study it was group 'A' was more common.

Higher prevalence of blood group 'O' was observed in uncomplicated cases in various studies by **Rowe et al**<sup>20</sup>, **Lell et al**<sup>21</sup> and **Zerihun et al**<sup>7</sup>, similar findings were noted in our study.

## **CONCLUSION**

In our study we concluded that there is an association between the severity of malaria and blood group type, though blood Group A accounts for most cases of malaria, the severity and complications are more in patients with blood group O.

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