Original Article

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Systemic Complication of Falciparum Malaria in Tertiary Care Hospital at Mysore: A Clinical Study

J Inbanathan[1], D K Suneetha[1], G Harsha[2], Martin George[2], M S Shashank[2]

[1]Associate Professor, Department of Medicine, Mysore Medical College & Research Institute, Mysore, Karnataka, India, [2]Junior Resident, Department of Medicine, Mysore Medical College & Research Institute, Mysore, Karnataka, India

Abstract

Introduction: Malaria is the most important parasitic disease of man. The human disease is a protozoan infection of red blood cells transmitted by the bite of a blood-feeding female anopheles mosquito. Malaria is one of the leading causes of morbidity and mortality worldwide, with over 100 million cases and at least a million deaths a year. It is estimated that over 40% of all deaths from malaria in the country are due to *Plasmodium falciparum* infection.

Materials and Methods: It is a retrospective study conducted on patients admitted to K R Hospital, Mysore, was conducted in January 2013 to January 2015, a total of 50 patients were admitted during this period. As per inclusion criteria and exclusion criteria, cases are included and excluded and a pre-structured proforma was used and data were entered. The study is approved by the Institutional Ethical Committee.

Results: Most of the cases are young, males are more than female (2:1), and most cases were referred from endemic areas. Total case fatality rate is 14%. Cerebral malaria is the most common cause of death. Early diagnosis and prompt treatment will reduce the morbidity and mortality associated with falciparum malaria.

Conclusion: Community participation is the key for the success of any health program. It is necessary to involve the community at large and create awareness about the problems of falciparum malaria.

Key words: Cerebral malaria, Community participation, Health program, Falciparum malaria

INTRODUCTION

Malaria is the most important parasitic disease of man. The human disease is a protozoan infection of red blood cells transmitted by the bite of a blood-feeding female anopheles mosquito. Malaria is one of the leading causes of morbidity and mortality worldwide, with over 100 million cases and at least a million deaths a year.[1,2] Most of these deaths are in the poorest regions of the world. Because malaria is a highly complex disease caused by plasmodium species, the diversity of research to prevent and treat it is probably greater than for any other disease.[3]

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At present, about 100 countries in the world are considered endemic, almost half of which are in Sub-Saharan Africa. More than 2.4 million of world's population is still at risk. Malaria is thought to kill between 1.1 and 7 million people worldwide each year. However, the problem is even more in rural and remote areas, where patients have restricted access to adequate treatment.[4,5]

In India, about 70% of the infections are reported to be due to *Plasmodium vivax*; 21-30% due to *Plasmodium falciparum* and 4-8% due to mixed infection. *Plasmodium malariae* infections are <1% and are reported from Tumkur and Hassan districts of Karnataka.[6]

Epidemiology

The transmission of malaria requires interaction of epidemiological factors:

1. The human host (intermediate host)
2. Malarial parasite (agent)
3. The anopheles mosquito (vector)
4. Environment (physical, biological, and socioeconomic).

Corresponding Author: Dr. J Inbanathan, Department of Medicine, Mysore Medical College and Research Institute, Mysore - 570 001, Karnataka, India. Phone: +91-9448051826. E-mail: jinathan2008@gmail.com

Life Cycle

The malaria parasite undergoes 2 cycles of development.

1. The human or asexual cycle (endogenous/schizogony)
   a. Exoerythrocytic or hepatic phase
   b. Erythrocytic phase.
2. The mosquito or sexual cycle (exogenous/sporogony). Man is the intermediate host, and mosquito is the definitive host.

Clinical Features

It varies from asymptomatic parasitemia to fulminant lethal malaria. The first symptoms of malaria are non-specific and start with a headache, muscular ache, vague abdominal discomfort, lethargy, lassitude, and dysphoria often precede fever by up to 2 days. It is followed by chills, rigors, arthralgia, pain abdomen, diarrhea, cough, and cold in some cases. Other clinical features are jaundice, hepatomegaly, splenomegaly, and anemia.

The typical attack comprises of three stages:

Cold stage, hot stage, sweating stage.

The febrile paroxysm synchronizes with erythrocytic schizogony of the malarial parasite.

MATERIALS AND METHODS

All the cases of *P. falciparum* malaria, diagnosed either by peripheral smear or by quantitative buffy coat method, admitted to K R Hospital during the study period were screened thoroughly. Among them, 50 cases with systemic complications proposed by the WHO were taken for the study. Cases were selected on the basis of the simple random sampling method. A detailed history and thorough clinical examination was done as per the proforma and were investigated further.

Inclusion Criteria

All cases of *P. falciparum* malaria, with following systemic complications as per WHO, were included in the study.

1. Cerebral malaria
2. Generalized convulsions
3. Severe anemia
4. Hypoglycemia
5. Fluid and electrolyte disturbances
6. Metabolic acidosis
7. Jaundice
8. Algid malaria
9. Hemoglobinuria
10. Acute respiratory distress syndrome
11. Acute renal failure
12. Abnormal spontaneous bleeding
13. Hyperpyrexia.

Exclusion Criteria

Patients below 12 years of age were excluded.

RESULTS

In the present study total case fatality rate is 14%. The case fatality rate is highest in hemoglobinuria (100%) followed by 33.3% in algid malaria, 27.7% in cerebral malaria and 16.6% in jaundice. The majority of the deaths are males (71.4%) and between the age group of 31-40 years (42.8%).

The present study include more number of male subjects and are age between 21 and 40 years as shown in Table 1, and most cases between July to December as shown in Table 2. In present studymajority of subjects are presented to us with anemia, jaundice and cerebral malaria as shown in Table 3, all these are statistically significant.

In present study showed case fatality is more for hemoglobinuria (100%) but most subjects presented with cerebral malaria having case fatality rate of 27.7% as shown in Table 4.

In present study majority subjects are between 21 and 40 year but case fatality is more for older (>50) year and younger (<20 year) subjects and also those with cerebral malaria has more chances of mortality. Mortality is more in male subjects and mortality increases as the length of hospital stay increase as shown in Table 5.

DISCUSSION

Malaria still continues to be a major health problem in this part of the state. Although there has been a decline in the

Table 1: The age and sex distribution of the cases

Age group (years)	Male (%)	Female (%)	Total (%)
13-20	3 (9.1)	2 (11.8)	5 (10)
21-30	13 (39.4)	4 (23.5)	17 (34)
31-40	10 (30.3)	6 (35.3)	16 (32)
41-50	4 (12.1)	2 (11.8)	6 (12)
51-60	2 (6.1)	2 (11.8)	4 (8)
>60	1 (3.0)	1 (5.8)	2 (4)
Total	33 (100)	17 (100)	50 (100)

Mean age=34.4 years; SD= ±13 years. SD: Standard deviation

Table 2: The seasonal occurrence of the cases

Month	Number (%)
January-March (I)	8 (16)
April-June (II)	10 (20)
July-September (III)	18 (36)
October-December (IV)	14 (28)
Total	50 (100)

Table 3: Various complications

Complications	Male (%)	Female (%)	Total (%)	*P* value	Inference
Jaundice	13 (54.1)	11 (45.9)	24 (48)	<0.05	S
Severe anemia	15 (68.1)	7 (31.9)	22 (44)	<0.05	S
Cerebral malaria	12 (66.6)	6 (33.4)	18 (36)	<0.05	S
Algid malaria	2 (66.6)	1 (33:4)	3 (6)	<0.05	S
Renal failure	2 (100)	0 (0)	2 (4)	<0.05	S
Hemoglobinuria	1 (100)	0 (0)	1 (2)	<0.05	S
Hypoglycemia	3 (75)	1 (25)	4 (8)	<0.05	S
Generalized convulsions	3 (100)	0 (0)	3 (6)	<0.05	S

S: Significant

Table 4: The CFR of various complications

Complications	Cases	Number of expired*	CFR (%)
Cerebral malaria	18	5	27.7
Algid malaria	3	1	33.3
Hemoglobinuria	1	1	100
Jaundice	24	4	16.6
Severe anemia	22	2	9

*Intermixed, CFR: Case fatality rates

Table 5: The case fatality rates and percentage of total expired in various patient parameters

Parameters	Recovered n_1=43	Expired (%) n_2=7	Total n=50	CFR (%)
Age (years)				
13-20	4	1 (14.2)	5	20
21-30	16	1 (14.2)	17	5.8
31-40	13	3 (42.8)	16	18.7
41-50	5	1 (14.2)	6	16.6
51-60	3	1 (14.2)	4	25
>60	2	-	2	-
Sex				
Male	28	5 (71.4)	33	15.1
Female	15	2 (28.5)	17	11.7
Duration of symptoms (days)				
1-5	25	-	25	-
5-10	18	1 (14.3)	19	5.2
10-15	-	6 (85.7)	6	100
Complications*				
Jaundice	20	4 (57.1)	24	16.6
Severe anemia	20	2 (28.5)	22	9
Cerebral malaria	13	5 (71.4)	18	27.7
Algid malaria	2	1 (14.2)	3	33.3
Hemoglobinuria	-	1 (14.2)	1	100
Hyperbilirubinemia				
Conjugated	11	3 (42.8)	14	21.4
Unconjugated	8	2 (28.5)	10	20

*Intermixed, CFR: Case fatality rates

total number of cases, *P. falciparum* has registered a significant increase. It causes the most severe form of malaria and is known for its protean manifestations, variety of complications and high mortality. Development of complications is more common in patients suffering from *P. falciparum*.

In the present study, 50 cases of falciparum malaria with systemic complications were studied; the following data were compared with standard studies.

Table 6: The comparison of clinical features in various studies

Clinical features	Present study (%)	Hazra *et al.* (%)	Chishti *et al.* (%)	Murthy *et al.* (%)
Fever	100	100	100	98.1
Paroxysms	40	40	-	-
Headache	84	100	-	-
Bodyache	76	-	-	-
Nausea/vomiting	52	60	-	-
Pallor	60	80	76.56	-
Jaundice	48	40	29.6	27.21
Hepatomegaly	40	80	37.5	-
Splenomegaly	48	40	37.5	-
Altered sensorium	36	8.33	59.38	48
Abdominal pain	6	10	-	-
Loose stools	2	10	10.9	-
Cough and cold	8	53.33	-	-
Respiratory distress	-	6.6	6.25	-
Convulsions	6	8.33	14.06	-
Spontaneous bleeding	-	3.33	12.5	4.43
Decreased urine output	4	5	26.56	6.96
Edema	-	-	-	-
Black color urine	2	3.33	-	-
Hypotension	6	-	-	18.35

In the present study, age, sex distribution, and seasonal variation are comparable to Harris *et al.*, Shukla *et al.*, Chishti *et al.*, and Murthy *et al.*

Clinical Features

In the present study, fever was encountered in all the patients (100%). This was also the most common symptom observed in Chishti *et al.*(100%), Hazra *et al.* (100%), and Murthy *et al.* (98%). However, typical paroxysms were observed only in 40% cases, which is a deviation from the frequent description of common classical paroxysms. This finding is consistent with Hazra *et al.* where paroxysms were seen only in 40% of the cases (Table 6).

Jaundice was seen in 48% of the cases in the present study, as compared to 40% in Hazra *et al.*, 29.6% in Chishti *et al.*, and 27.2% in Murthy *et al.*

In the present study, generalized convulsions were seen in 6% of the cases as compared to 8.33% in Hazra *et al.* and 14.06% in Chishti *et al.*

Table 7: Comparison of complications seen in various studies

Complications	Present study (2004)	Murthy *et al.* (2000)	Chishti *et al.* (2000)	Harris *et al.* (2001)	Hazra *et al.* (1998)	Kochar *et al.* (1997)
Jaundice	48	40.5	29.69	41	40	11.47
Cerebral malaria	36	48	59.38	30	8.33	25.75
Severe anemia	44	74.68	76.56	33	-	5.83
Acute renal failure	4	24.68	26.56	7	5	2.07
Algid malaria	6	18.35	-	-	-	5.26
Bleeding manifestations	-	4.43	12.5	-	3.33	9.58
ARDS	-	11.39	6.25	-	6.6	-
Hypoglycemia	8	8.22	-	-	-	-
Generalized convulsions	6	-	14.06	-	8.33	-
Hemoglobinuria	2	-	-	-	3.33	7.89

ARDS: Acute respiratory distress syndrome

Table 8: Case fatality rates in various studies

Study	CFR (%)
Present study	14
Murthy *et al.*	20.25
Chishti *et al.*	12.5
Harris *et al.*	10

CFR: Case fatality rates

Altered sensorium was seen in 36% of the cases in the present study as compared to 8.33% in Hazra *et al.*, 48% in Murthy *et al.*, and 59.38% in Chishti *et al.* All the patients who presented with altered sensorium were found to have cerebral malaria.

In the present study, pallor was seen in 60% of the cases as compared to 76.56% in Chishti *et al.* and 80% in Hazra *et al.*

Hepatomegaly was seen in 40% of cases in the present study as compared to 37.5% in Chishti *et al.* and 80% in Hazra *et al.*

Splenomegaly was seen in only 48% of the cases in the present study in contradiction to the common description of splenomegaly in 85% to 100% of all malaria cases by Marshal *et al.* This finding, in the present study, is consistent with Hazra *et al.* where splenomegaly was found in only 40% of the cases.

Complications

Intravascular hemolysis of parasitized and non-parasitized red blood cells has been considered as an important factor for the causation of mild to moderate jaundice, which is predominantly unconjugated. Hemolysis alone can never cause severe jaundice or predominantly conjugated hyperbilirubinemia with an increase in liver enzyme levels (Table 7).

Case Fatality Rate (CFR)

In the present study:

- Total CFR was 14% as compared to 20.25% in Murthy *et al.*, 12.5% in Chishti *et al.*, and 10% in Harris *et al.* (Table 8).
- The CFR was highest in hemoglobinuria (100%) followed by 33.3% in algid malaria, 27.7% in cerebral malaria, and 16.6% in jaundice.
- The majority of the deaths were contributed from males (71.4%) and between the age group of 31-40 years (42.8%).
- The mean duration of illness before admission among those who died was significantly longer than that among who recovered. They constituted 85.7% of total deaths.
- CFR was high (28.5%) in patients with more than one complication, and they contributed to the majority (85.7%) of the deaths. Multiorgan dysfunction is a major cause of mortality in falciparum malaria.
- Conjugated hyperbilirubinemia constituted more (42.8%) for total deaths when compared to unconjugated hyperbilirubinemia (28.5%).
- The level of serum bilirubin, aspartate aminotransferase, alanine transaminase, mean duration of illness was significantly higher in patients who died when compared to patients who recovered. Similar findings were seen with Murthy *et al.* study.
- The level of Glasgow coma scale was significantly lower in patients who died when compared to patients who recovered. Similar findings were seen in Murthy *et al.* study.

CONCLUSION

Many cases of falciparum malaria were referred from endemic areas with protean manifestations and varied complications. The most common complication observed here was Jaundice, more commonly due to malarial hepatitis than hemolysis. The presence of hepatitis in falciparum malaria indicates more severe illness with a higher incidence of complications and poor prognosis (increased CFR).

Total CFR was 14%. It was directly proportional to the number of complications in a patient and duration of symptoms before admission. Cerebral malaria was

the most common cause of death. Early diagnosis and prompt treatment will reduce the morbidity and mortality associated with falciparum malaria.

There is a need to create more awareness about complications of falciparum malaria among doctors in peripheral health centers to institute prompt and early therapy. Proper preventive measures should be taken to contain the disease, mainly focusing on lower socioeconomic class and people involved with agricultural practices, during monsoon and post-monsoon season. Community participation is the key for the success of any health program. It is necessary to involve the community at large and create awareness about the problems of falciparum malaria.

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