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An Observational Study on Complications and Outcome of Malaria in Intensive Care Unit of Rural Teritary Care Hospital

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Abstract: ***Background: Malaria is still a major worldwide health issue. Drug resistant strains of malaria keep spreading and now affect practically every country on the planet[1, 2]. The study was conducted to describe the complications and to determine outcome in malaria cases admitted to intensive care unit of a rural tertiary care hospital. Methods: All the study patients were assessed for the demographic and clinical presentation by the principal investigator using pre structured proforma. Detailed investigation reports were collected from study population like complete blood count, peripheral smear, serum lactate dehydrogenase, serum bilirubin levels, serum urea and creatinine, peripheral blood smear for malarial parasite and malarial antigen test. Data was analysed using Statistical Package for the Social Sciences (SPSS). Descriptive statistics, chi square test, p value and independent sample t - test were done appropriately. p - value <0.05 was considered statistically significant. Conclusion: The bulk of the cases in the current study were males and were in the age group of 31 to 40 years. Notably, peripheral smear for malaria parasite and malarial antigen tests, were used to confirm the diagnosis of malarial infection in 70% and 30% of cases, respectively. In terms of complications caused by malaria, 58 % of cases had one complication, followed by 26 % of cases with 3 complications, 12% of cases with 2 complications, and 4% of cases with 4 complications. In this study, all patients were treated with Artesunate, doxycycline resulting in 100% recovery. Plasmodium falciparum was found to have varied course of illness ranging from single complication in 46% of patients to all four complications in 4% of patients and Plasmodium falciparum was always one of the causative organisms among the mixed parasitic infections. Hence, all cases of malaria with Plasmodium falciparum or multiple parasite infections needs to be identified early and treatment should be started promptly.***

Keywords: Malaria, Plasmodium, Complications, Icu

1. Background

Malaria is still a major worldwide health issue. Each year, an estimated 300–500 million individuals worldwide get malaria, resulting in 1.5–2.7 million fatalities[1, 2]. Malaria is projected to affect 10000–30000 travelers from industrialised nations each year. Further more, drug - resistant strains of malaria keep spreading and now affect practically every country on the planet. Drug - resistant plasmodia are becoming more common among tourists[3].

Malaria is caused by Plasmodium genus, obligate intraerythrocytic protozoa. People can be infected with one (or more) of the four parasitic species: Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, and Plasmodium malariae. A thorough travel history should always be taken while evaluating malaria cases. Malaria morbidity and death rise as a result of delayed diagnosis and treatment[4.] Plasmodium vivax and Plasmodium falciparum are the most frequent malaria strains. Travelers to areas where Plasmodium falciparum is endemic may have more aggressive forms of the infection, as this strain causes the majority of severe cases[5]. Malaria is more likely to spread in locations where there is a lot of poverty, close contact to animals, rural areas, and poor sanitation[5]. Plasmodium falciparum infection causes the majority of deaths, with roughly 1%of cases resulting in life - threatening brain, renal, hepatic, and hematologic failure. . Organ dysfunction in severe malaria is thought to be caused by a combination of microcirculatory blockage, cytokine activation, and nitric oxide - mediated alterations in vascular tone[6 - 8]. Approximately 13% of all intensive care unit (ICU) admissions in the hospital are due to severe falciparum malaria. Malaria, on the other hand, is not well recognised as a cause of multiple organ failure syndrome in critical care literature. With this in view, this study was conducted to describe the complications and to determine outcome in malaria cases, admitted to intensive care unit of Pes Medical college hospital.

2. Methods

Study Design:
The present study was conducted as a observational study, to find out the clinical profile, complications of malaria cases and to assess the factors determining the duration of stay in ICU of a rural tertiary care hospital.

Study Area:

This study was conducted in the department of General Medicine, PES Institute of Medical Sciences & Research (PESIMSR), a tertiary care teaching hospital located in Kuppam, AndhraPradesh.

Study Population:
Patients with malaria admitted to ICU during the study period were included.

Study period:
The study was conducted from January 2020 to july 2021

Inclusion criteria:
Patients aged more than18years
Patients of both sexes
Patients with malaria infection with positive peripheral blood smear for any of the plasmodium species or/and positive malarial antigen test

Exclusion criteria:
Patients with preexisting liver disease, kidney disease, Hypertension, Diabetes, Dengue and [7]Pregnancy were excluded.

Sample size
All the cases who presented with malaria infection during the study period were included in the study. A total of 50 patients with malaria infection were included after assessing the inclusion and exclusion criteria.

3. Results

Among 50 adult patients with malaria, 30% of them were in the age group of 31 - 40 years, 28% of the participants were between 41 - 50 years of age. In the age range of 51 - 60 years 22% of the patients were recorded with malaria while 20% of the study population was between18 - 30 years of age

Among all the participants, 54% of them were male and 46% were female patients with malarial disease.

On assessing the symptoms at the time of presentation[8] fever was present in all the study subjects, whereas respiratory distress was found among 58% of the study patients and high coloured urine was found among 54% of the cases with malaria. Headache was present among18%of the cases at the time of presentation to the hospital.

On examination altered sensorium was recorded in 14% of the cases, hypotension was observed in 32% of the cases with malaria while icterus was seen in 54% of the malarial cases. Clinical hepatomegaly and Clinical splenomegaly were found to be evident among 62%of the cases and 52% of the cases respectively.

Study participants had Leukocytosis, hemoglobin was found to be reduced (<12g%) in 60% of the cases and 16% of the cases had thrombocytopenia (<10^5). Red blood cell count was decreased among 48% of the cases with malaria On peripheral smear, 54% of the participants had normocytic normochromic anemia with leukocytosis and 46% of the participants had normal study on peripheral smear.

Among the 50 cases studied 46%, 38%, 14% and 2% of the cases were found to have Plasmodium falciparum, multiple species, Plasmodium ovale and Plasmodium vivax of malarial parasite respectively.

The length of hospital ICU stay was ≤7days for 30% of the patients, 8 - 14 days for 56% of the patients and more than14 days for 14% of the patients in this study.

In this study all malaria cases who were hospitalized in ICU recovered 100%.

The mean duration of ICU stay for single complication cases was 6.4±2.9days while the mean duration of hospital stay in ICU among multiple complication cases was11.2±4.6days. The difference in mean duration of ICU stay between single complication and multiple complication was found to be statistically significant with p value noted to be <0.0001.

Table 1: Association between malarial parasite species vs complications of malaria

Species of malarial Parasites	Single complication and percentage (N=29)	Multiple complications and percentage (N=21)	Total and percentage	P value
P. ovale	05 (10)	02 (04)	07 (14)	0.0203*
P. falciparum	18 (36)	05 (10)	23 (46)	
P. vivax	01 (02)	00 (00)	01 (02)	
Multiple parasites	05 (10)	14 (28)	19 (38)	
Total	29 (58)	21 (42)	50 (100)	

*Significant

Out of the 46% of cases with P. falciparum infection 36% of them had single complication and 10% of the cases had multiple complications.

Among14% of the patients with P ovale 10% of the cases had single complication whereas 4%of the cases had multiple complications.

All 2% of the P vivax cases had single complication, whereas among 38% of the cases with multiple parasite infection 28% of them had multiple complication and 10% of the cases had single complication.

The association between malarial parasite species and the complications was found to be statistically significant with p valueof 0.0203.

Table 2: Mean duration of stay in ICU based on complication

Parameter	Single Complication (N=29)	Multiple Complications (N=21)	P value
Mean duration of stay in ICU (in days)	6.4±2.9	11.2±4.6	<0.0001*

*Significant

4. Discussion

In the present study 30% of patients were in the age group 31 - 40 years, 28% of patients were in 41 - 50 years, 22% of patients were in 51 - 60 years, 20% of patients were in 18 - 30 years with male predominance (M: F 54: 46%), there by indicating that most patients belonged to age group 31 - 40 years. Since farming is the predominant occupation in rural areas where this study was conducted, people work without

any protective measures against mosquito bite, past dusk.

In the study of , Nilam Kumari Singh et al[10] a cross sectional study showed males 67% were affected more when compared to females 33%. Majority belonged to the age group 40 - 60 years. Fever was present in all patients and the majority of patients presented with complications within 7days. Santos LC et al [11]conducted a retrospective analysis and found that out of 59 cases included in the study, 79.6% were male and 81.3 percent had parasitaemia at the time of admission. Fever was present in all patients, The current study is consistent with their observation.

Table 3: Proportion of cases based on the no. of complications N=50

No. of complications	Frequency	Percentage
Single complication		
Cerebral malaria	1	2
Anemia	14	28
Pulmonary edema	10	20
Shock	4	8
Double complications		
Cerebral malaria with anemia	2	4
Cerebral malaria with pulmonary edema	1	2
Cerebral malaria with shock	3	6
Triple complications		
Cerebral malaria with anemia and pulmonary edema	6	12
Anemia with pulmonary edema and shock	3	6
Cerebral malaria with pulmonary edema and shock	4	8
More than 3 complications		
Cerebral malaria with anemia with pulmonary edema and shock	2	4
Total	50	100

In the present study, respiratory distress which is due to pulmonary edema was seen in 58%of patients. Altered sensorium that can occur in cerebral malaria due to mild cerebral edema was seen in 14% of patients.

In the study of Marks M et al [12] ARDS (31 percent), and altered sensorium (25 percent) were the most common related consequences of malaria. The current study is consistent with their observation.

Raised intracranial pressure as evidenced by papilledema was seen in 4% of patients which occurs due to raised intracranial tension secondary to cerebral edema in cerebral malaria. Headache was seen in 18% of patients which was probably due to either cerebral malaria or due to dehydration or both. High colored urine and icterus were present in 54% of patients which is due to hemolysis resulting in hemoglobinuria and unconjugated hyperbilirubinemia respectively.

Hepatomegaly was seen in 62% of patients which was also confirmed by ultrasound of the abdomen. Hepatomegaly in malaria occurs due to intrahepatic malarial parasite life cycle process and the immune response to the hepatic injury caused by the parasites.

In the studies done by Nilam kumarisingh et al [10], White MS et al[13], Soni P JalalY T [14]. showed splenomegaly was the most common physical sign with 66%, 53%, and 41.6% respectively.

The current study is consistent with their observation. Clinically Palpable spleen in 52% of patients and ultrasound revealed splenomegaly in 56% of patients was noted. Splenomegaly occurs in malaria due to sequestration of red blood cells and due to parasitemia inside, the red blood cells become dysmorphic, triggering the spleen to more actively filter out the infected red blood cells. Leucocytosis was present in all patients which is due to immune response to malarial infection.

Peripheral blood smear showed malarial parasite in 70% of cases and the rest 30% were diagnosed with malaria antigen testing. Hemoglobin was reduced (<8g%) in 60% of patients out of which 54% had a normocytic normochromic anemia in peripheral smear which is due to hemolysis occurring in malaria and the rest 6% had microcytic hypochromic anemia which was probably due to nutritional causes. Serum lactate dehydrogenase, unconjugated bilirubin levels were elevated in those 54% patients due to hemolysis in malaria

Serum urea was elevated in 34% of patients and serum creatinine was mildly elevated in 32% of patients indicating acute kidney injury occurring probably due to one or more of the reasons such as impaired blood flow due to erythrocyte sequestration, agglutination, hypotension and dehydration.

Cerebrospinal fluid analysis revealed mild elevation in cell count (5 - 20) in 8% of patients, mild elevation in protein (50 - 100mg/dl) was seen in 10% of patients due to immune response to the cerebral malaria.

Table 4: Proportion of cases based on species of malarial parasite

Malaria parasite	Frequency	Percentage
P falciparum	23	46
Multiple parasite	19	38
P ovale	7	14
P vivax	1	2
Total	50	100

Among the study participants 46%, 38%, 14% and 2% of the cases were found to have Plasmodium falciparum, multiple species, Plasmodium ovale and Plasmodium vivax of malarial parasite respectively, there by indicating that falciparum was the most common causative species and all patients infected with more than one species were found to have been infected with falciparum as well. In the study of Beg MA et al [15] P. vivax (51.8%), P. falciparum (46.5%), P. vivax plus P. falciparum (1.3%), and P. malariae (1.3%) were the parasite species that caused the malaria. The current study is consistent with their observation

5. Conclusion

The bulk of the cases in the current study were males and fall within the age range of 31 to 40 years. Notably, peripheral smear and malarial antigen tests, detected malarial infection in 70% and 30% of cases, respectively.

Among the study participants 46%, 38%, 14%and 2% of the cases were found to have Plasmodium falciparum, multiple species, Plasmodium ovale and Plasmodium vivax of malarial parasite respectively. In terms of complications caused by malaria, 58 % of cases had one complication, followed by 26 % of cases with triple complications, 12% of cases with double complications, and 4% of cases with four complications. All patients were treated with Artesunate, Doxycycline and supportive treatment in intensive care unit with 100% recovery. Plasmodium falciparum was found to have varied course of illness ranging from single complication in 46% of patients to all four complications in 4% of patients and Plasmodium falciparum was always one of the causative organisms among the mixed parasitic infections. Hence, we infer that all cases of malaria with Plasmodium falciparum or multiple parasite infections needs to be identified early and treatment should be started promptly for the best possible outcome.

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