



## Predictors of Mortality Among Patients Admitted with Malaria in a Tertiary Care Hospital of Eastern India

**Dr. Smarajit Banik**

MBBS, MD (Medicine), Assistant Professor, Department of Medicine  
North Bengal Medical College, Sushrutanagar, Darjeeling

**Dr. Saikat Datta**

MBBS, MD (Medicine), Associate Professor, Department of Medicine  
North Bengal Medical College, Sushrutanagar, Darjeeling

### ABSTRACT

**Introduction:** Though primarily a non-fatal disease, malaria can result in mortality in many cases. In 2015, there were roughly 214 million malaria cases and an estimated 438 000 malaria deaths. Therefore, it becomes vital to find out the predictors which may have an effect on the mortality among patients of malaria.

**Objective :** To analyze the effect of predictors on mortality among patients suffering from malaria in a tertiary care hospital of Eastern India

**Methodology :** A hospital based cross sectional study was conducted among 213 patients aged >12 years, with confirmed malaria. Data were collected with the help of a brief structured questionnaire and detailed clinical examination and required routine and special investigations were done. Logistic regression analysis was performed to find out the predictors of mortality.

**Results :** The odds of mortality were found to be higher in the age group < 25 years, females, fever more than 5 days, increased CRP and creatinine, presence of altered sensorium, hypotension, oliguria, hepatitis and in case of mixed species infection

**Conclusion :** The present study has reveals that cerebral malaria, hepatitis and raised CRP level have an impact on the mortality.

**KEYWORDS :** Predictor, mortality, malaria

### Introduction

Malaria is the one of the most wide spread disease of the planet.<sup>1</sup> The World Health Organization estimates about 3.2 billion people – almost half of the world's population – are at risk of malaria. In the Southeastern Asian Region of WHO, 1.2 billion are exposed to the risk of malaria, most of who live in India.<sup>2</sup> In 2015, there were roughly 214 million malaria cases and an estimated 438,000 malaria deaths.<sup>3</sup>

Malaria does not only cut lives short but has a huge socio-economic impact: patients are often bedridden and incapable of carrying out normal activities. This causes considerable loss of income and places a heavy burden on families, health systems and society as a whole.<sup>4,5</sup>

The malaria mortality rate, which takes into account population growth, is estimated to have decreased by 60% globally between 2000 and 2015. Thus, substantial progress has been made towards the target of reducing the malaria burden by 75% by 2015, and of reducing deaths to near zero.<sup>2</sup>

WHO estimates that India accounts for 75% of all malaria cases in South-East Asia. About 95% of the Indian population resides in malaria endemic areas; 80% of malaria reported in the country is confined to areas where 20% of population resides - in tribal, hilly, hard-to-reach or inaccessible areas.<sup>6</sup> The case load, though steady around 2 million cases annually in the late nineties, has shown a declining trend since 2002 and number of reported deaths has been leveling around 1000 per year.<sup>7</sup>

Therefore, it becomes vital to find out the predictors which may have an effect on the mortality among patients of malaria. In this context, a hospital based study was conducted to analyze the effect of predictors on mortality among patients suffering from malaria in a tertiary care hospital of Eastern India

### Methodology

A hospital based cross sectional study was conducted among patients admitted with malaria, between April 2014 and March 2016 in the medicine wards of a tertiary care hospital of eastern India.

Study participants were defined as all patients more than 12 years with malaria, selected on the basis of clinical presentation and subsequent peripheral blood smear (thick and thin films) examination. In clinically suspected but slide negative cases, Rapid Diagnostic Test for malaria was employed to confirm the diagnosis. However, patients having malaria associated with rheumatic fever, pneumonia, presence

of any other active infection or sepsis, tuberculosis, enteric fever were excluded.

Prior to conduction of the study, permission was taken from the Institutional Ethics Committee. Written and informed consent was obtained from all subjects.

Data was collected from the patients and/or their relatives with the help of a brief structured questionnaire concerning signs and symptoms of malaria. In all cases a detailed clinical history and repeated thorough physical examination were carried out which was followed by blood smear and subsequently required routine and special investigations as dictated by the condition and presentation of the patient.

C – Reactive Protein (CRP) was measured using Particle Enhanced Turbidimetric Immunoassay Technique (PETIA) in fully automated analyzer. Serum creatinine was measured by alkaline picrate method.

### Statistical analysis:

The data collected were entered in Microsoft Excel datasheet after checking for consistency. Logistic regression analysis was performed using SPSS 20 to find out the predictors of mortality. In this analysis, death was labeled as 1 and survival as 0. The predictors used in the analysis were age, gender of patient, duration of fever, CRP level, serum creatinine, hypotension, presence of altered sensorium, oliguria, hepatitis and type of malarial parasite.

### RESULTS:

The final analysis included 213 patients; of which 94 had confirmed *Plasmodium vivax*, 89 had infection with *Plasmodium falciparum* and the rest (30) had dual infection. The mean age of the study participants was  $32.2 \pm 14.3$  years; the age of presentation was significantly high among patients suffering from *Pl. falciparum*.

The proportion of mortality in the study population was 11.3%. After adjustment, the odds of mortality were found to be higher in the age group < 25 years, female gender, duration of fever more than 5 days, CRP level more than 3.5mg/dl, serum creatinine more than 1.5 mg/dl, hypotension, presence of altered sensorium, oliguria, hepatitis and in case of dual infection by both *Plasmodium vivax* and *falciparum* malarial parasite.

### DISCUSSION

Malaria, though a non-fatal disease, can become life threatening in many cases. To prevent these deaths, the predictors should be eval-

uated. The present study aims to find out some of the predictors of death in hospitalized patients diagnosed with malaria

Available evidence suggests that given the same exposure, adult men and women are equally susceptible to malaria infection.<sup>8</sup> However, quite similar to the present study, the mortality was found to be higher among females in studies conducted by Kochar et al<sup>9</sup> and Khadanga et al.<sup>10</sup>

In consonance with the findings of the present study, a systematic review found out that the most severe consequences of *P. falciparum* malaria were concentrated in the youngest age groups across all settings.<sup>11</sup> This can be due to the fact that younger adults are more exposed to the environment than their older counterparts.

CRP, an acute phase reactant, can have a pathogenic role as well in malaria. CRP is said to bind to infected erythrocytes and help in their clearance.<sup>12</sup> The present study and a study by Paul et al showed that the patients who died had higher CRP levels compared to survivors.<sup>13</sup>

Renal involvement in malaria varies from mild proteinuria to severe azotaemia associated with metabolic acidosis and death increases three-fold. These may be due to the effect of the parasitised RBC on the microcirculation, hypovolaemic shock, or non-specific effects of inflammation.<sup>14</sup> Quite expectedly, in the present study, the odds of death were higher in patients with compromised renal function (oliguria and creatinine >3.5md/dl)

Altered sensorium in patients with malaria suggests the hallmark of cerebral malaria, which is the most severe neurological manifestation of severe malaria.<sup>15</sup> Without treatment, cerebral malaria is invariably fatal. Even with treatment with intravenous drugs the mortality is considerable.<sup>16</sup>

The odds of mortality were found to be higher among patients suffering from malaria due to mixed species (both *Plasmodium vivax* and *falciparum*). This may be explained by the higher parasitemia in these patients. However a study by Mohapatra et al found contrasting results.<sup>17</sup>

**CONCLUSION**

The present study has reveals that cerebral malaria, malarial hepatitis and acute renal failure are some of the common complications of malaria, which have an impact on the mortality Additionally, CRP level in malaria has a valuable prognostic significance predicting the clinical course of the infection as well as mortality. Hence a patient with malaria must be critically evaluated for all these markers to prevent mortality.

**Table 1: Predictors of death among the study population N=213**

	Alive	Died	Total	AOR (95% CI)
<b>Age group</b>				
≤ 25 years	75 (88.2)	10 (11.8)	85(100)	2.12 (0.57, 7.96)
>25 years	114 (89.1)	14 (10.9)	128(100)	1 (Referent)
<b>Gender of the patient</b>				
Female	45 (72.6)	17 (27.4)	62(100)	3.00 (0.72, 12.53)
Male	124 (82.1)	27 (17.9)	151(100)	1 (Referent)
<b>Duration of fever</b>				
≤ 5 days or less	97 (94.2)	6 (5.8)	103 (100)	0.09 (0.02, 0.45)
> 5 days	92 (83.6)	18 (16.4)	110(100)	1 (Referent)
<b>CRP level</b>				
> 3.5mg/dl	71 (87.7)	10 (12.3)	81(100)	1.03 (0.28, 3.83)
≤3.5mg/dl	118 (89.4)	14 (10.6)	132(100)	1 (Referent)
<b>Serum creatinine</b>				
≤ 1.5 mg/dl	116 (94.3)	7 (5.7)	123(100)	0.36 (0.04, 2.99)
> 1.5 mg/dl	73 (81.1)	17 (18.9)	90(100)	1 (Referent)

<b>Hypotension</b>				
Present	37 (75.5)	12 (24.5)	49(100)	5.30 (1.38, 20.36)
Absent	152 (92.7)	12 (7.3)	164(100)	1 (Referent)
<b>Altered sensorium</b>				
Absent	115 (93.5)	8 (6.5)	123(100)	0.17 (0.04, 0.75)
Present	74 (82.2)	16 (17.8)	90(100)	1 (Referent)
<b>Oliguria</b>				
Absent	126 (93.3)	9 (6.7)	135(100)	0.62 (0.07, 5.11)
Present	63 (80.8)	15 (19.2)	78(100)	1 (Referent)
<b>Hepatitis</b>				
Absent	97 (91.5)	9 (8.5)	106(100)	0.71 (0.17, 2.92)
Present	92 (86.0)	15 (14.0)	107(100)	1 (Referent)
<b>Malaria Parasite</b>				
<i>Plasmodium vivax</i>	94 (100.0)	0 (0.0)	94(100)	0.18 (0.04, 0.75)
<i>Plasmodium falciparum</i>	74 (83.1)	15 (16.9)	89(100)	0.65 (0.07, 0.91)
<i>Plasmodium vivax</i> + <i>Plasmodium falciparum</i>	21 (70.0)	9 (30.0)	30(100)	1 (Referent)
Total	189 (88.7)	24 (11.3)	213(100)	

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