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Study on Incidence and predictors of Acute Renal Failure in Falciparum Malaria

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ABSTRACT

Aims: The aim of present study was to determine the incidence and predictor of Acute Renal Failure in Falciparum Malaria

Materials and Methods: This serial random prospective study was carried out in the patients admitted with diagnosis of P. falciparum malaria for a year and total cases were included for the study and grouped on the basis of presence or absence of Acute renal failure (ARF).

Results: out of total 107 patients there was 78 patients in non ARF group and 29 in ARF group thus an incidence of development of ARF calculated as 27.1%, further logistic regression expressed presence of anemia and lack of supportive treatment predicts development of ARF among patients of falciparum malaria.

Conclusions: The study found a prevalence of 27.1 % ARF among falciparum malaria and presence of anaemia and lack of supportive treatment are significant risk factors for development of ARF.

INTRODUCTION

Malaria is a highly prevalent in Jharkhand [1], and falciparum malaria is associated with Severe form of malaria and often associated with acute kidney injury, leading to acute renal failure (ARF).[Mishra2008] The overall prevalence of ARF in falciparum malaria is about 1%, with the mortality rate up to 45% [2]. The incidence of malarial ARF seems to be high in Eastern India, as malaria is endemic in the Indian subcontinent [1].

Indian data suggests incidence of ARF between 13% to 17.8%. [3] and various clinical and laboratory findings like Jaundice, anemia, hypoalbuminemia, hyponatremia, hyperkalemia, acidosis, leukocytosis, elevated transaminases (SGOT and SGPT) and cerebral malaria, are found to be significantly associated with ARF [4]. However predictors of high mortality was implicated to Low hemoglobin, oligo/anuria on admission, hyperbilirubinemia, cerebral malaria, disseminated intravascular coagulation, and high serum creatinine. Jaundice is the most common association with malarial ARF (MARF), occurring in more than 75% of cases [5]. Anemia occurs in at least 70% of patients and is reported as being severe in 40%. It typically is hemolytic, although blood loss may also contribute. A recent report suggests the hemophagocytic syndrome as the cause of severe anemia in a Japanese patient who acquired falciparum infection during a visit to the tropics [6].

We plan this study with objective of identifying the prevalence and factors associated with ARF among severe falciparum malaria patients admitted to RIMS, Ranchi, Jharkhand.

AIMS AND OBJECTIVES

The aims of our study were to find out the incidence of ARF in cases of P. falciparum malaria and to search for clinical predictors of acute renal failure in falciparum malaria.

MATERIALS AND METHODS

This serial random prospective study was carried out in the patients admitted in the Department of Medicine of Rajendra Institute of Medical Sciences, Ranchi with diagnosis of P. falciparum malaria from December 2014 to November 2015.This study was approved by the Ethical Committee of Rajendra Institute of Medical Sciences, Ranchi. The sample consisted of definitive cases of P. falciparum malaria along with features suggestive of acute renal failure. The inclusion criteria were both gender and age above 15 years. Cases of p. falciparum malaria was defined as presence of asexual parasitemia in peripheral blood smear. However cases with negative peripheral blood smear for P. falciparum parasitemia with clinical features strongly suggestive of malaria, along with positive rapid test for P. falciparum were also included for this study.

Acute renal failure were defined as WHO criteria ie cases with urine output <400 ml in 24 hours in adults failing to improve after rehydration and with serum creatinine>265μmol/lit (3 mg/dl).

The Exclusion criteria was pre-existing acute or chronic renal disease evident from history, relevant investigation or presence of oliguria or anuria prior to onset of fever, recent incidence of hypovolemia, shock or presence of any known cause of acute renal failure other than falciparum malaria. Finally a total of 107 such consenting patients were included for the study

Statistical Analysis: Data from 107 subjects were analyzed using SPSS 10.0 for Windows version (SPSS Inc, Chicago, IL). Pearson's $\chi2$ test, and independent t test was used to compare the group differences in sample characteristics between patients without ARF and with ARF. Logistic regression analysis was carried out using backward conditional method. The level of significance was kept at .05 (2-tailed).

RESULTS

In the present study 107 cases of falciparum malaria were studied and following findings emerged. Mean age of the sample was 35.05 years (SD 14.81) years, there was 78 patients in non ARF group and 29 in ARF group. Among the non ARF group 61.5% were male and 38.5 % were females; whereas among ARF group 48.3% were male and 51.7% were females. (table -1)

There was significantly higher habitants from rural background suffering from ARF following malaria, also spleenomegaly and anaemia was significant clinical finding among ARF subgroup. (table -1)

Development of ARF among Falciparum malaria was found to be 27.1 % in this study. (table -2)

Logistic regression analysis was carried out using backward conditional method with socioeconomic status (good vs poor), habitat (rural vs urban), splenomegaly (present vs absent), anemia (present vs absent) and treatment (antimalarial with other medication vs antimalarial only). Anemia (B=1.06) and treatment with antimalarial with other medication (22.59) could significantly predict acute renal failure, and explained 32.7% of variance (Nagelkerke R2=0.327). They could correctly predict only 8 of 21 cases (27.6%) of acute renal failure.

DISCUSSION:

The age, gender and socio economic class, or caste were not different among the patients of falciparum malaria whether they develop ARF or not,   [Table 1]. Predominantly significantly higher incidence of ARF among rural habitant patients (82.8% affected rural versus 17.2% urban ARF patients) reflects multifactorial disadvantages to rural population, including preexisting nutritional deficit like anaemia, delay in treatment seeking .

Among all measured clinical variables only anaemia were found to be significantly higher in ARF group, suggests significant clinical condition may be predicting to ARF. The finding of significant association of anaemia is in concordance to earlier studies [7].

Spleenomegaly is negatively associated with ARF and in accordance to earlier studies [7] which found Four factors which were negatively associated ARF: a hemoglobin level >10 g/dl, having living in a malaria endemic area, no oliguria on the day of admission and splenomegaly.

In a study [8] parasite sequestration and immune activation were found to be the pathogenesis of acute kidney injury in severe falciparum malaria.

Prevalence: WE found a prevalence of 27.1 % ARF among diagnosed cases of falciparum malaria. This is higher the most of the other Indian studies which reports   the incidence of ARF between 13% to (17.8%) 48% [3, 9-14] however this study was estimated prevalence of ARF among patients of Fever, in contrast to ours study where sample was diagnosed as falciparum malaria. ARF is known to carries a high mortality of approximately 15%–45%. [15]

Several hypotheses including mechanical obstruction caused by cytoadherence and sequestration of infected erythrocytes, immune-mediated glomerular pathology, release of cytokines, reactive oxygen intermediates, and nitric oxide by activated mononuclear cells, and alterations in the renal and systemic hemodynamics have been proposed as the mechanisms for renal failure in falciparum malaria. [16-20]

There are very less studies predicting ARF among patients of falciparum malaria, however we found presence of anaemia and treatment with or without other medication along with antimalarial are importantly significant variables

CONCLUSION

 The study found a prevalence of 27.1 % ARF among diagnosed cases of falciparum malaria and presence of anaemia and lack of supportive treatment are significant risk variables for development of ARF.

Table 1. Age and sex of the sample and socio occupational distribution and clinical profile.

Variable		Non-ARF (n = 78) (%)	ARF (n = 29) (%)	t/X^2	df	p
Mean Age ± SD(in years)		34.51 ± 14.15	36.48 ± 16.6	.610		.544
Gender	Male	48 (61.5)	14 (48.3)	1.53	1	.27
	Female	30 (38.5)	15 (51.7)			
Socio occupational class	Avg	45 (57.7)	11 (37.9)	4.69*	2	0.08
	Poor	30 (38.5)	18 (62.1)			
	Good	3 (3.8)	0 (0)			
Habitant	Urban	31 (39.7)	5 (17.2)	4.79	1	0.03#
	Rural	47 (60.3)	24 (82.8)			
Caste	Non Tribal	63 (80.8)	23 (79.3)	0.03	1	1
	Tribal	15 (19.2)	6 (20.7)			
Fever	Yes	77 (98.7)	28 (96.6)	0.54*	1	0.47
	No	1 (1.3)	1 (3.4)			
Vomiting	Yes	19 (24.4)	7 (24.1)	0.001	1	1
	No	59 (75.6)	22 (75.9)			
Spleenomegaly	Yes	48 (61.5)	11 (37.9)	4.76	1	0.048#
	No	30 (38.5)	18 (62.1)			
Hepatomegaly	Yes	49 (62.8)	18 (62.1)	0.005	1	1
	No	29 (37.2)	11 (37.9)			
Unconsciousness	Yes	62 (79.5)	18 (62.1)	3.4	1	0.08
	No	16 (20.5)	11 (37.9)			
Jaundice	Yes	55 (70.5)	16 (55.2)	2.23	1	0.17
	No	23 (29.5)	13 (44.8)			
Anaemia	Yes	50 (64.1)	12 (41.4)	4.48	1	0.047#
	No	28 (35.9)	17 (58.6)			

* Fisher's exact test used   **# p < 0.05**

Table 2: percentage of ARF among falciparum malaria

Total patients of Falciparum malaria	Number of ARF among falciparum malaria	Percentage of ARF among falciparum malaria
107	29	27.1%

Table 3: Logistic regression analysis (backward conditional method) showing predictors of acute renal failure (N=107)

Predictors	Regression coefficients		exp B	95% CI	
	B	SE		Lower	Upper
Constant	-1.83**	0.38	0.16		
Anemia:Present vs Absent	1.06*	0.51	2.90	1.07	7.85
Treatment: Antimalarial with other medication vs Antimalarial only	22.59	13.91×10 03	6.51 ×10 9	-	-

*p<.05, **p<.001; Model x2=27.28, p<.001; Nagelkerke R2=0.327

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