



ISSN Print: 2394-7500  
ISSN Online: 2394-5869  
Impact Factor: 5.2  
IJAR 2019; 5(12): 112-114  
www.allresearchjournal.com  
Received: 18-10-2019  
Accepted: 22-11-2019

**Dr. Nikhil Gupta**

Senior Resident, Gandhi  
Medical College, Bhopal,  
Madhya Pradesh, India

**Chandra Prakash Chourase**

Assistant Professor, Gandhi  
Medical College, Bhopal,  
Madhya Pradesh, India

## Prevalence of acute kidney injury in malaria: A prospective study

Dr. Nikhil Gupta and Chandra Prakash Chourase

### Abstract

**Background:** Indian sub-continent harbours a global threat in the form of epicenter of multidrug resistant *Plasmodium falciparum*. Kidney involvement is relatively frequent in infections by *P. falciparum* and *P. malariae*, but has also been described in the infection by *P. vivax*.

**Aims and Objectives:** To find out the prevalence of AKI in malaria patients.

**Materials and Methods:** Hundred malaria positive patients were studied in the department of medicine, Hamidia hospital and Gandhi Medical College Bhopal from March 2015 to August 2016. Detailed history regarding other systemic diseases and routine investigations including PS for mp, was performed. Malaria was differentiated on the basis of the different parasite present in the blood. Serum creatinine was measured and eGFR was estimated. AKI was defined using the KDIGO criteria.

**Results:** Incidence of AKI among the patients with falciparum malaria was 5 (10.86%). Incidence of AKI among the severe cases of falciparum malaria (n=22) was 40.90% (n=9). Incidence of AKI among the patients with P vivax malaria was 7.69% (n=3).

**Conclusion:** Incidence of AKI in patients with severe form of falciparum malaria is high. Even, P vivax infection can also lead to the development of AKI in some cases. Serum creatinine measurement is recommended to diagnose AKI in malaria patients.

**Keywords:** Acute kidney injury, complications, falciparum malaria

### Introduction

Malaria is endemic in Asia, Africa and Latin America. According to the World Health Organization, its incidence varies from 200 to 300 million new cases annually, with 200,000 to 600,000 deaths<sup>[1]</sup>.

Four species of *Plasmodium* cause malaria in humans. These are *P. falciparum*, *P. vivax*, *P. malariae* and *P. Ovale*. *P. falciparum* is responsible for most of the deaths and most of the severe complications such as<sup>[2]</sup> cerebral malaria, anaemia and renal failure<sup>[3]</sup>.

Kidney disease in malaria is primarily due to erythrocyte abnormalities. Parasitized red cells tend to adhere to healthy erythrocytes, blood platelets and capillary endothelium, leading to formation of rosettes and clumps, which impair microcirculation and these events, are probable contributing factors for kidney injury, in association with hemodynamic instability, including hypovolemia and shock<sup>[4]</sup>.

Incidence of AKI among the patients with Malaria in Indian population is lacking. The aim of this study was to determine the incidence of AKI in patients with malaria and its type and its severity.

### Materials and Methods

The present study conducted in the department of medicine, Hamidia hospital and Gandhi Medical College Bhopal from March 2015 to August 2016.

All Malaria positive cases admitted in medical ward and were willing to participate were enrolled in the study. Patient referred from hospitals after giving treatment like I/V fluids and with other associated co-morbid conditions like COPD acute exacerbation, DKA, CRF, etc. were excluded from the present study.

Detailed history regarding other systemic diseases was taken. Routine investigations including PS for mp, degree of parasitemia, and malarial antigen test along with the estimation of, Serum sodium, potassium and ABG were performed. Malaria was

**Correspondence Author:**

**Dr. Nikhil Gupta**

Assistant Professor, Gandhi  
Medical College, Bhopal,  
Madhya Pradesh, India

differentiated on the basis of the different parasite present in the blood. Ultrasonography and CT head were performed whenever needed.

Acute kidney injury was identified using KDIGO criteria. A baseline creatinine level was estimated and eGFR was calculated using the four-variable modification of diet in renal disease (MDRD) formula.

All the data analysis was performed using IBM SPSS ver. 20 software. Data were expressed as percentage and number. Incidence was expressed as percentage and who calculated from the total population.

## Results

In present study *P. falciparum* (46%) was more prevalent as compared to *P. vivax* (39%), however, 15% patients had mixed infection of both the species.

Malaria was more prevalent in male population (61%) as compared to females (39%). Both *P. vivax* (n=26) and *P. falciparum* (n=25) were more prevalent in males. Malaria [both *P. falciparum* (n=17) and *P. vivax* (n=13)] was more prevalent in young age group (21-30 years).

All the cases of *P. vivax* malaria were uncomplicated (n=39) whereas, out of 46 cases of *P. falciparum*, 24 were uncomplicated and 22 were of severe cases.

Overall incidence of AKI among the patients with *falciparum* malaria including all the stages defined by KDIGO was 5 (10.86%). Incidence of AKI among the severe cases (n=22) was 40.90% (n=9). Incidence of AKI among the patients with *P. vivax* malaria was 7.69% (n=3).

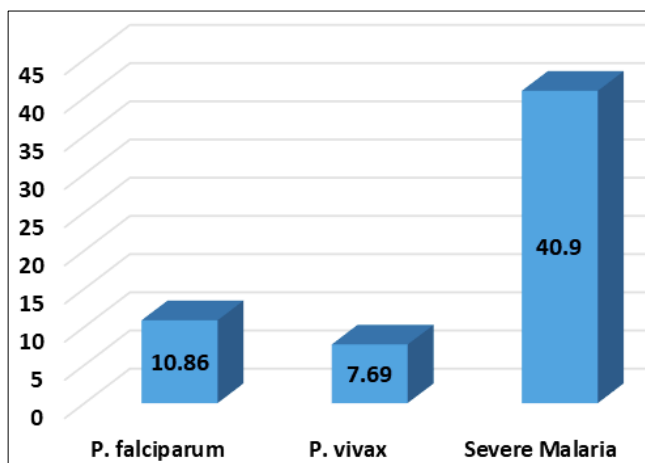


Fig 1: Showing incidence of AKI in malaria

## Discussion

Malaria was the first parasitic infection to be clearly associated with glomerular diseases in tropical areas [5]. Severe malaria can cause disease in glomeruli, tubules and in the interstitial region. AKI is reported in the infection by different *Plasmodium* species (*P. falciparum*, *P. vivax*, *P. malariae* and *P. ovale*), and can worsen due to low hydration and fluid loss caused by vomiting, pyrexia, sweating and dehydration. In present study we tried to find out of the incidence of AKI among the patients with malaria. We have also evaluated the incidence of AKI among the different malaria type. It was revealed that severity was the malaria is an important culprit for increasing the incidence of AKI in malaria patients.

In our series, *falciparum* malaria was more prevalent as compared to *P. vivax* and mixed malaria. Malaria was more prevalent in male subjects. Out of 46 *P. falciparum* positive

patients, majority were males were (54.35%) and females were (45.65%). This finding was supported by Das *et al.* where author [6], showed less incidence of *P. falciparum* malaria in females, this may be due to that fact attributed to female subjects spending more time in house, full cloths and having less frequent visits to endemic area. In the current study male predominance was seen not only in *Plasmodium falciparum* but also in *P. vivax* infection where 66.67% were males and 33.33% were females and in mixed infection, 10 patient were males (66.67%) and 5 patient (33.3%) were females.

In the current study, admitted malaria positive patients were divided into uncomplicated and severe malaria wherein proportion of severe malaria was 28%. It was more associated with *Plasmodium falciparum* and mixed infection. In contrast to no severe cases of *P. vivax*, 47.83% of total *P. falciparum* cases and 40% of total mixed infection were severe. This finding is very well established by Das *et al.* (2014) [6], which reported 15% mortality due to severe *falciparum* malaria. Maitland *et al.* [7], also reported severe malarial infection associated with *falciparum* malaria. Jasmin H. *et al.* [8], also reported that *P. falciparum* is the species which is most commonly associated with the severe and complicated forms of this disease. In the present study association of *P. falciparum* malaria with severity was significant. However in the present study the reason for higher incidence of severity with mixed infection could not be ascertained.

AKI is a known complication of malaria. In present study, incidence of malaria in patients with *P. falciparum* was 10.86%. In some regions of the globe, malaria is responsible for a significant part of patients admitted with AKI (more than 10% of cases) [9].

*P. falciparum* causes the most severe form of malaria and is responsible for most cases of AKI [10]. In present study incidence of AKI in severe cases of *P. falciparum* was 40.90%. Previous reports have found the incidence of around 40% of patients with severe disease by *P. falciparum* in endemic regions, contributing to high mortality rate, around 75% of cases [11-13].

AKI due to *P. vivax* infection is not common, although recent studies in endemic areas have evidenced *P. vivax* infection in 16% of malaria-associated AKI, and histologic findings (among 15 patients who have undergone biopsies) included acute tubular necrosis, cortical necrosis, tubulointerstitial nephritis and crescentic glomerulonephritis [14]. In line with that in present study, incidence of AKI in patients with *P. vivax* infection was 7.69% which was only in 3 patients out of 39.

Cross sectional nature and small sample size were the main limitations of the present study. A large randomized clinical trial involving the control group is need to provide strength to the present study findings.

## Conclusion

*P. falciparum* malaria was more prevalent in present study with male preponderance affecting very young patients. *P. falciparum* malaria is found to be cause of severe malaria.

Incidence of AKI is high in *P. falciparum* malaria mainly those with the severe form of *P. falciparum*. AKI can also occur among the patients with *P. vivax*. Early detection and intervention of AKI among the malaria patients can decrease the damage to kidney.

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