



STUDY OF ACUTE RENAL FAILURE IN MALARIA IN SOUTHERN RAJASTHAN

General Medicine

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ABSTRACT

Objective: To analyze the incidence, clinical feature, and outcome of Acute renal failure in malaria.

Background: Wide spectrum of kidney and kidney-related disorders, ranging from urinary abnormalities like proteinuria (< 1 gm/24 hour) to kidney failure, can be caused by plasmodium falciparum. Falciparum malaria causes more frequently renal failure. Renal failure incidence by falciparum is variable between 1-4%.^{2,3} Renal failure is uncommon in vivax malaria.

Methods: It is an observational cross-sectional study of 266 cases of malaria through biochemical and hematological analysis of the blood of patients suffering from malaria infections between Jan 2018 to July 2022.

Results: Out of 266 cases of malaria in the age group 14-80 years, acute renal failure was seen in 20 cases (7.5%). Out of 20 renal failure cases, the maximum cases were 15 (75%) caused by plasmodium falciparum then, 3 (15%) cases by plasmodium vivax, and 2 (10%) cases by mix (PF & PV). The presenting feature were fever (75%), jaundice (20%), and splenomegaly (20%). The probable contributing factors for renal failure were hyperbilirubinemia 9 (45%), hemolysis 9 (45%) hypotension 1 (5%), and oliguria present in 8 (40%). Haemodialysis is required in 7 (35%) patients. Mortality was noted in 5% (1/20) of patients.

Conclusions: Acute renal failure is caused more commonly by plasmodium falciparum than plasmodium vivax malaria. Acute tubular necrosis due to renal ischemia is the dominant pathogenic mechanism. The malarial parasites are commonly associated with jaundice, hemolysis, thrombocytopenia, and hypotension. The prognosis of renal failure is better in P. vivax than in P. falciparum.

KEYWORDS

Acute renal failure (ARF), Malaria, Plasmodium Falciparum, Plasmodium Vivax

INTRODUCTION

Malaria is caused by the apicomplexan parasite Plasmodium spp., is one important parasitic diseases globally, with approximately 219(154-289) million clinical cases, vast majority 81% were in the African region and 6.6(4.9-8.4) lacs deaths during year 2010 worldwide¹. Of the 5 human infectious species, the major parasites are Plasmodium vivax and P. falciparum, followed by P. malarie, P. ovale is rare and P. knowlesi causing negligible cases. The burden of malaria continues to worsen that leading to a devastating impact on economic improvement and human health. The major cause of malaria associated morbidity and mortality is caused by plasmodium falciparum (PF) worldwide. Approximately 90% of cases particularly in sub-Saharan Africa are caused by falciparum malaria (FM) while in SEAR (South-East Asia Region) it causes about 53% cases¹. Despite worldwide initiatives, the challenges for the management and eradication of the disease are emerging drug resistance in Plasmodium and paucity of information about exact underlying mechanisms. A wide spectrum of renal and renal related disorders, ranging from urinary abnormalities, and proteinuria (<1 gm/24hrs) to renal failure are caused by malaria. Renal failure occurs more frequently in falciparum malaria. The reported incidence of renal failure in falciparum malaria is highly variable between 1-4%^{2,3}. However, renal failure in association with P. vivax malaria is uncommonly reported.

MATERIALS AND METHODS

It is an observational cross sectional study of 266 cases of malaria through biochemical and hematological analysis of the blood of patients suffering from malaria infections between Jan 2017 to April 2022.

The laboratory data included thick and thin blood film for the malarial parasite. The paracheck test (rapid diagnostic kit test) and CBC examination were carried out in patients who showed negative blood films for malarial parasites. Total and differential leukocyte count, hemoglobin, biochemical assay (urea, creatinine, sodium, potassium, glucose, s.protein, albumin, globulin, bilirubin, SGOT, SGPT, and uric acid), and urine examination were carried out in all patients. Coagulation profile, platelet count, and LDH were studied as and when required.

All patients were followed during hospital stay or 4-6 weeks after discharge from the hospital. The complications of malaria were

recorded in individual patients during hospitalization.

Inclusion Criteria

1. Participants of either sex, aged 14-80 years.
2. With a diagnosis of severe/non-severe malaria confirmed by PBF or RDT.
3. Malaria patients who have not received antimalarials before sample collection.
4. Those willing to provide written informed consent and comply with protocol requirements.

Exclusion Criteria

1. Malaria patients with a history of significant systemic diseases like autoimmune disorders, psychiatric illness and bleeding disorders etc. as judged by history and physical examination.
2. Patients with a diagnosis of any other infectious disease.

RESULTS

- Out of 266 cases of malaria in the age group 14-80 years, acute renal failure was seen in 20 cases (7.5%). Out of 20 ARF cases, maximum cases 15 (75%) were caused by plasmodium falciparum, then 3 (15%) cases by plasmodium vivax, and 2 (10%) cases by mix (PF & PV). (table-1 & figure-1)
- The presenting features were fever (75%), jaundice (20%), and splenomegaly (20%).
- The probable contributing factors for RF were hypotension-one (5%), hyperbilirubinemia-nine (45%), hemolysis-nine (45%), and oliguria was present in 40% (table-2).
- Dialysis was required in 7(35%) patients. Mortality was there in 5% (1/20) of patients, who was plasmodium falciparum positive with thalamic infarct and not on haemodialysis.

Table - 1 Distribution Of Malaria Cases According To Serum Creatinine

S.Creatinine* (mg/dl)	Type of Malaria						Total	
	Mix		PF		PV			
	No	%	No	%	No	%	No	%
≤1.5	7	2.63	170	63.90	69	25.94	246	92.48
1.5-3	1	0.37	10	3.75	2	0.75	13	4.88
>3	1	0.37	5	1.88	1	0.37	7	2.63

Total	9	3.38	185	69.54	72	27.06	266	100
χ^2	4.66							
P	0.32							

* If more than one reading were available, highest reading was taken

Table - 2 Clinical Features Of Renal Failure In Malaria

CLINICAL SIGN/SYMPTOMS	NO OF CASES (%)
Fever	15(75%)
Jaundice	4(20%)
Hypotension	1(5%)
Splenomegaly	4(20%)
Thrombocytopenia	6(30%)
Hyperbilirubinemia	9(45%)
Hemolysis	9(45%)
Oliguria	8(40%)
Sepsis	5(25%)

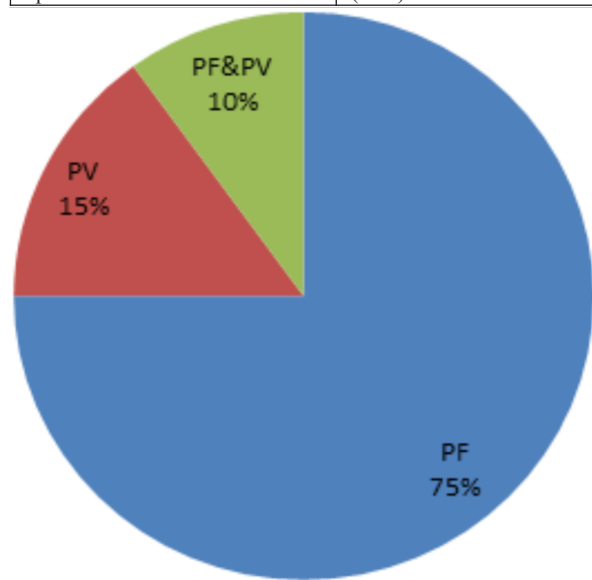


Figure -1 Acute Renal Failure Caused By Malarial Species - 75% Plasmodium Falciparum, 15% Plasmodium Vivax, And 10% mix (PF & PV).

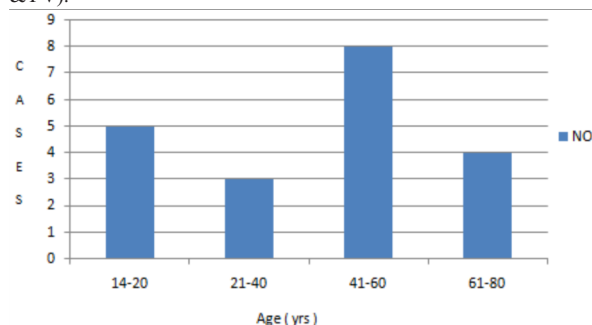


Figure-2 Out Of 20 ARF Cases, The Maximum Number Of Cases 8 (40%) Were Found In Age Groups Of 41-60 Years And Minimum Number Of Cases 3 (15%) Were In Age Groups Of 21-40 Years.

DISCUSSION

Malaria causes numerous haematological alterations of which anaemia and thrombocytopenia are the most important. In India where the population has already reduced haemoglobin concentration due to inadequate dietary intake, the burden of other infections especially in children, malaria adds to the already fragile health status of the population. Over the last many years jaundice and renal failure are increasingly being noticed in patients of malaria. Silva GBD Junior et al⁴ reviewed renal involvement in malaria and updated that Clinical manifestations of kidney involvement in malaria include proteinuria, microalbuminuria and urinary casts, reported in 20 to 50% of cases. Nephrotic syndrome has also been described in the infection by P. falciparum, but it is rare. In our study, malarial kidney involvement include proteinuria and urinary cast also. In our study also renal medical disease is also noted in the USG abdomen, oliguria, anuria and

an increase in serum creatinine were also noted. In USG 4 patients were having renal medical disease. But renal failure was mostly noted based on the increase in creatinine value. Ariane Amoura et al⁵ studied malaria, focal and segmental glomerulosclerosis, and collapsing glomerulopathy in 23 patients and concluded in patients of African ancestry, imported Plasmodium infection may be a new causal factor for secondary FSGS, particularly for collapsing glomerulopathy variants in an APOL1 high-risk variant background. In our study out of 20 acute renal failure cases, 15 (75%) cases were caused by P.F. malaria, 3 (15%) cases were caused by P.V. malaria and 2 (10%) cases by mixed malaria.

Table 3 Renal Failure In Malaria Patients

Studies	Renal failure
Manan et al ⁶	19.4%
J Prakash et al ⁷	15.5%
Vipa Thanachartwet et al ⁸	44.7%
Kochar et al ⁹	6.25%
Present study	7.5%

The overall prevalence of renal failure in P.F. Malaria is reported to vary from 1-60%. (Weber et al).¹⁰ In studies conducted by Manan et al⁶, J Prakash et al⁷, Kochar et al⁹ and Vipa Thanachartwet et al⁸ the prevalence of renal failure among malaria patients were 19.4%, 15.5%, 6.25% and 44.7% respectively. Acute renal failure in malaria is usually anuric or oliguric but urine output may be normal or increased, making daily measurement of serum creatinine to be the most important investigation¹¹

There are two major renal syndromes associated with Malaria¹²:

1. "A chronic and progressive glomerulopathy that mainly affects African children, classically complicating quartan malaria" and
2. ARF associated with falciparum malaria in Southeast Asia, India, and sub-Saharan Africa.

The mesangiocapillary glomerulonephritis, with subendothelial immune complex deposits containing IgG, C₃, and malarial antigens are characteristic histopathologic lesion. These deposits typically are seen as small lacunae in silver stained biopsy sections. The disease proceeds to renal failure even after successful eradication of the infection¹³.

Parasitized red cells are sticky that adhere to adjacent healthy erythrocytes, platelets and the capillary endothelium. This results in the formation of rosettes that can impede the microcirculation of internal organs. This occurs with all types of plasmodium but mainly occur with falciparum malaria, where it has been associated with serious sequelae.^{14,15} The endothelial cytoadherence, sequestration, increase whole blood viscosity and capillary lumen obstruction by sticky cell aggregates together contributes to renal ischemia and acute renal failure.^{2,14,15} Hypovolemia, also contribute to RF. The associated endothelial activation leads to the release of several vasoactive cytokines and mediators which leads to decreased systemic vascular resistance and reduction in renal blood flow and lead to renal ischemia.¹⁵

CONCLUSION

Acute renal failure is caused more commonly by plasmodium falciparum than plasmodium vivax malaria. Acute tubular necrosis due to renal ischemia is the dominant pathogenic mechanism. The malarial parasites are commonly associated with jaundice, hemolysis, thrombocytopenia, and hypotension. The prognosis of renal failure is better in P. vivax than in P. falciparum.

ACKNOWLEDGEMENT

We wish to acknowledge the administration, laboratories technicians and staffs of Jhalawar Medical College and PMCH Udaipur (Rajasthan).

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