IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 16, Issue 6 Ver. IV (June. 2017), PP 54-60
www.iosrjournals.org

Study on Incidence And Prognosis of Acute Renal Failure in Falciparum Malaria

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Abstract
Introduction: *The word malaria comes from Italian and literally means bad air. It was early known as ague and has been described since antiquity. Malaria continues to pose a major public health threat in India, particularly due to P.falciparum which is prone to complications. The commonly associated complications of severe falciparum malaria are-coma or cerebral malaria, severe anemia, renal failure, pulmonary edema, hypoglycemia, shock and lactic acidosis.**1** We aimed to study the incidence, severity, clinical presentations, prognostic factors, complications and outcome of ARF in P.falciparum malaria cases of RIMS, Jharkhand.*
Materials and methods: *The present study "Study on incidence and treatment outcome of acute renal failure in falciparum malaria" was carried out in the Department of Medicine, Rajendra Institute of Medical Sciences, Ranchi.*
*• **Study Design: -** Prospective observational study*
*• **Sample Size: -** 107*
*• **Study Period: -** Dec 14 to Nov 15*
Result: *- Most of the malaria cases were seen in younger age group between 20-39 years (53.27%). Males outnumbered females in this study (62 versus 45). ARF was found to be more frequent in age group ≥ 60 years (45.45%) females (33.33%), in rural population (29.58%) and in poor socio-economic groups (33.33%). ARF was seen in 29 cases (27.10%) with 3 deaths (10.34%) compared to cases without ARF with 78 cases (72.87%) in which*
2 deaths (2.56) occurred. Overall mortality in patients with Falciparum malaria was 4.67%.
Conclusion: *- Falciparum malaria is a dreaded disease and ARF especially when present with other complications has poor prognosis. More epidemiological studies with complications and prognosis of acute renal failure in Falciparum malaria are required to quantitate the problem. Health education with specific measures for prevention of malaria together with early diagnosis and treatment with identification and referral of malarial ARF can significantly affect mortality, morbidity and reduce the cost of treatment by avoiding haemodialysis in these patients.*
Keywords: - *Falciparum malaria, Arf, Haemodialysis, Jharkhand tribal*

I. Introduction

Malaria is one of the most common & oldest recorded parasitic infections known to mankind. It is caused by a protozoan, known as plasmodium & transmitted by bite of infected Anopheles Mosquito. In 2010; there were an estimated 216 million (149-274 million) cases of malaria worldwide**2**, of which 91% were P. falciparum cases. A vast majority, about 81% were in African region followed by the South-East Asia region (13%) and EastMediterranean (5%). Malaria accounted for 655,000 (537,000-907,000) deaths of which 91% were in African region, followed by East Mediterranean (3%) and South-East Asia region (6%). Malaria affects mainly poor, underserved and marginalized population in remote rural areas which are characterized by inadequate control measures and limited access to health care. Malaria continues to pose a major public health threat in India, particularly due to P. falciparum which is prone to complications. In India about 27% population lives in malaria high transmission (more than 1 case per 1000 population) areas and about 58% in low transmission areas (0-1 case per 1000 population) areas. About 92% of malaria cases and 97% of deaths due to malaria is reported from Northeastern states, Chhattisgarh, Jharkhand, MP, Orissa, AP, Maharashtra, Gujarat, Rajasthan, WB and Karnataka
3. Malaria in man is caused by six distinct species of genus Plasmodium-
1) P.vivax **2)** P.falciparum 3) P.malariae 4)Two morphologically identical sympatric species of P. ovale
5) P.knowlesi

Plasmodium falciparum causes the most severe illness. In person with P. falciparum malaria specially with poor immunity, the irregularly or regularly spaced paroxysm are associated with marked prostration and after 7 to 10 days, a rapid deterioration follows in the patient's condition associated with shock and other complications and even death if untreated such malaria (caused by P. falciparum) is known as severe falciparum

malaria. Death from P. vivax, P. ovale or P. malaria infection is very rare. The commonly associated complications of severe falciparum malaria are- coma or cerebral malaria, severe anemia, renal failure, pulmonary edema, or ARDS, hypoglycemia, circulatory collapse or shock, spontaneous bleeding, repeated generalized convulsions, lactic acidosis.

In severe Falciparum malaria renal involvement is very common and can be life threatening at times.
Three types of renal lesions are known in human malaria.
They are-

- Acute renal failure (ARF)
- Glomerulonephritis (GN)
- Nephrotic syndrome (NS)

Specific effects of parasitized erythrocytes with hemorrhagic changes and non-specific inflammatory & associated factors like hypovolemia, intravascular haemolysis, intravascular coagulation, catecholamine effects, endotoxaemia, jaundice, cytokines and free oxygen radicals are two mechanisms responsible for pathogenesis of ARF in P.falciparum malaria**5**. The contribution of malaria to overall hospital admission for ARF varies from 2 to 39% according to the local prevalence of the disease, the relative preponderance of the other causes, patient referral policy and other factors.**6** Jaundice is the most common association with malarial ARF occurring in more than 75% of the cases. Both conjugated and unconjugated bilirubin and bile acid as well have been shown to be involved in the pathogenesis of acute renal failure in falciparum malaria**7,8,9**. Anemia occurs in at least 70% of the patient. ARF is a serious complication of malaria with a reported mortality of 15 to 45%. A report from India described a reduction of MARF mortality from 75 to 26% when a specialized MARF task force was established in the same institution.**10**

II. Materials And Methods

The present study was carried out in the Department of Medicine, Rajendra Institute of Medical Sciences, Ranchi.

Inclusion criteria:

1) Primary pool- patients hospitalized with complain of fever with clinical diagnosis of malaria.
2) Secondary pool- the cases from primary pool with definite diagnosis of cases of P. Falciparum malaria along with features suggestive of acute renal failure.
107 such cases from secondary pool were selected for study.

Exclusion criteria:

1) Pre-existing acute or chronic renal failure evident from history, relevant investigations or presence of oliguria or anuria prior to onset of fever.
2) Recent incidence of hypovolemia, shock or presence of any known cause of acute renal failure other than Falciparum malaria.
3) Age < 15 years

The following investigations have been done in cases under study:

1) Blood for TC & DC of WBCs, Hb% estimation.
2) Peripheral blood smear, both thick and thin for the presence of P.falciparum.
3) Rapid diagnostic kit test for P.falciparum.
4) Random blood sugar
5) Renal function test – Blood urea and serum creatinine.
6) USG Abdomen – Only those cases with relevant findings suggestive of deranged renal function.

III. Statistical Methods

The various variables obtained will be tabulated and inferences will be drawn by using SPSS (Statistical packages for social sciences) version 20. Pair wise comparison between various categories will be done for all parameters. The Range, Mean value, Standard Deviation (S.D.), Standard error of Mean, t value and 'p' values will be calculated as per the applicability by using appropriate formulas. Student t test was used to find the significance of mean values of study parameters between both the groups. Microsoft Excel and Word were used to prepare the tables and graphs.

IV. Result

The total no. of case studied (n=107). Majority of the cases (57) were seen in age group 20-39 years (53.27%). On seeing the sex distribution, total no. of cases among male-62(57.94%) and female-45(42.06%), no. of male was more than females. Majority of the cases comes from rural areas (66.36%) compared to urban areas (33.64%) due to poverty, lack of education and unhygienic conditions. 20% of the patients (21) were tribal and 80% (85) were nontribal. Although proportion of tribal community in study is very less as compared to non-tribal, frequency of ARF is almost equal in communities, tribal (28.57%) and non-tribal (26.74%). Maximum no. of cases are having fever with chills 99%, cases with splenomegaly 44.86%, anaemia 43.93%, hepatomegaly 37.38% and ARF was present in 27.10%. numbers of patients with ARF is maximum in age group of 20-39 years but frequency of ARF is maximum in age group >60 years (45.45%) and minimum in age middle age group (23.08%). The negligent act by our society towards old person is one of the main reasons for such complications, whereas people in middle age group are themselves capable of attending hospitals which prevents further development of complications like malaria.

Standard anti-malarial therapy was given to all cases of ARF (29). 7 cases out of 29 received anti-malarial and (dopamine + furosemide infusion) (24.14%) to increase renal perfusion and in 3 out of 29 cases with severely impaired renal function, haemodialysis was done (10.34%). Treatment with haemodialysis was started in those patients of ARF, who were refractory to conservative treatment with antimalarial and (dopamine + furosemide infusion).There was significant difference in outcome (mortality) of patients who were with ARF than those without ARF, most of ARF cases (29 cases with recovery 89.66%0 and cases without ARF (78 cases with recovery 97.44%) were seen. But in spite of all, out of 107 cases 5 deaths occurred. All the cases that died despite the best possible treatment were having severely impaired renal function, jaundice, anemia, unconsciousness/altered sensorium in varying combination causing multiorgan failure. The additive factors like poor hygiene and improper care of the patients leading to aspiration pneumonia, secondary infections and septicemia made the situation grave.

Tables And Figures

Table 1: Age and sex distribution of cases under study (n=107)

Age Group	Total no. of cases (n=107)	No. of males	No. of females
<20 years	13	5	8
20-39 years	57	38	19
40-59 years	26	12	14
≥60 years	11	7	4
Total	107	62	45

Table 2: Age and sex distribution of acute renal failure among the cases under study

Age group and Gender	No. of cases (n=107)	No. of cases with ARF	% of ARF cases in given age group and gender
<20 years	13	4	30.77%
20-39 years	57	14	24.56%
40-59 years	26	6	23.08%
≥60 years	11	8	45.45%
Male	62	14	22.58%
Female	45	15	33.33%
Total	107	29	27.10%

Table 3: Distribution of ARF among the rural & urban population, Tribals and non-tribals population and in different socio-economic groups

Indwellers Tribal/non-tribal Socio-economic group	No. of cases (n=107)	No. of cases with ARF	% of ARF cases in various groups
Rural	71	21	29.58%
Urban	36	6	16.67%
Tribal	21	6	28.57%
Non-tribal	86	23	26.74%
Poor socio-eco	48	16	33.33%
Average socio-eco	56	11	19.64%
Good socio-eco	3	0	0%

Table 4: Different clinical presentation of cases with ARF under study

Clinical presentation	No. of cases (n=107) (%)	No. of cases with ARF (n=29)	Percentage (%)
Fever with chills	106 (99%)	29	100 %
Vomiting	27 (25.23%)	7	24.14%
Splenomegaly	48 (44.86%)	18	62.07%
Hepatomegaly	40 (37.38%)	11	37.93%
Unconsciousness/altered sensorium	27 (25.23%)	10	34.48%
Jaundice	36(33.64%)	13	44.83%
Anemia	47 (43.93%)	17	58.62%

Table 5: Treatment received by cases with ARF

Treatment	No. of cases (n=29)	Percentage (%)
Standard anti-malarial therapy	29	100%
Anti-malarial+ (Dopamine+Furosemide infusion)	7	24.14%
Hæmodialysis	3	10.34%

Table 6: Outcome of cases with ARF in comparison to total cases under study

	No. of cases	Cured	Death
With ARF	29	26 (89.66%)	3 (10.34%)
Without ARF	78	76 (97.44%)	2 (2.56%)
Total	107	102 (95.33%)	5 (4.67%)

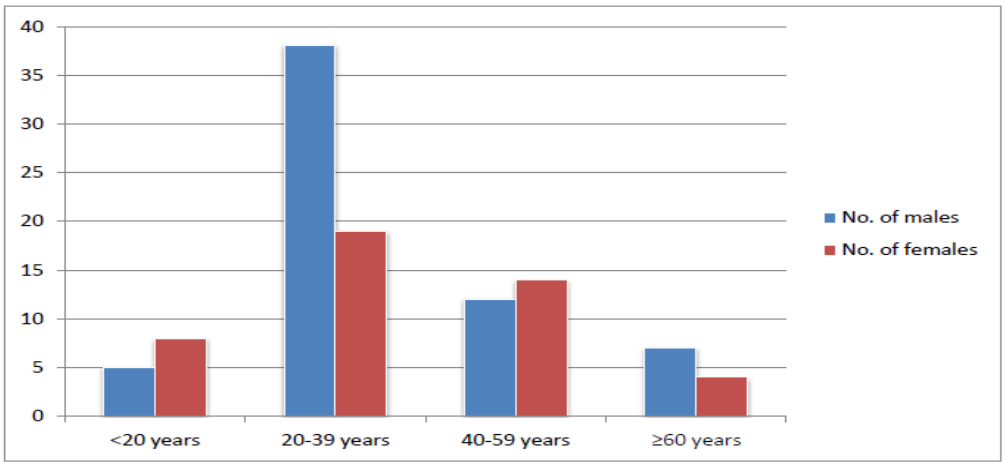

Figure 1: Age and sex distribution of cases under study (n=107)

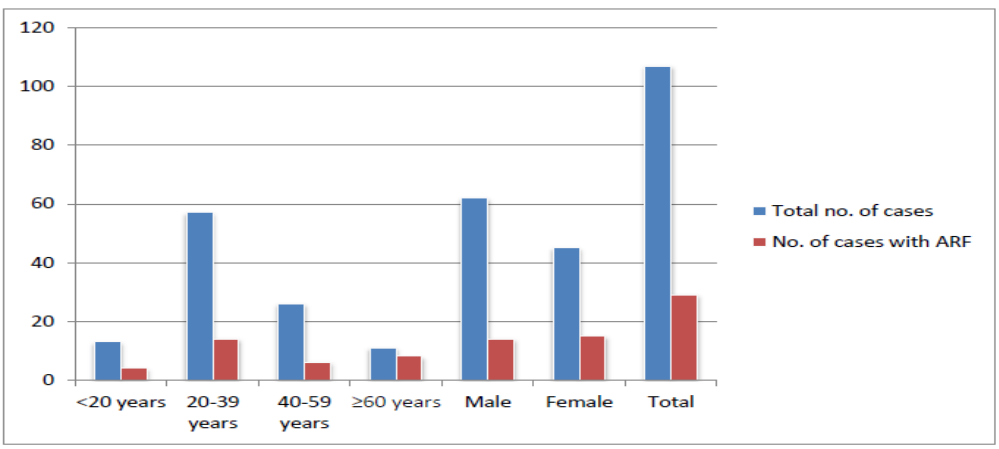

Figure 2: Age and sex distribution of acute renal failure among the cases under study

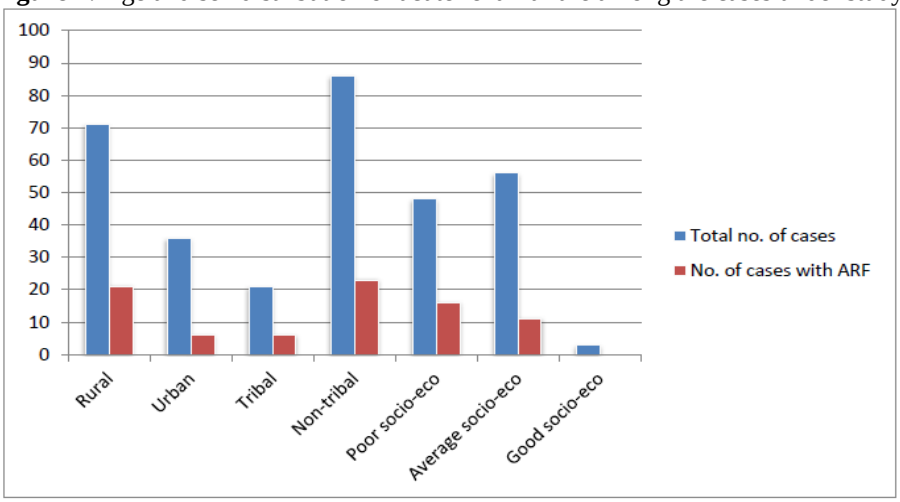

Figure 3: Distribution of ARF among the rural & urban population, Tribals and non-tribals population and in different socio-economic groups

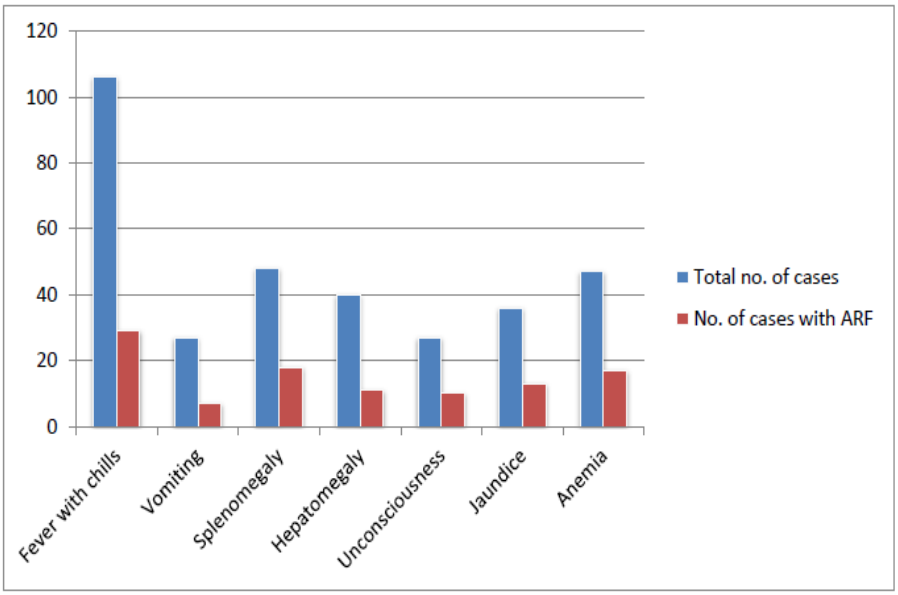

Figure 4: Different clinical presentation of cases with ARF under study

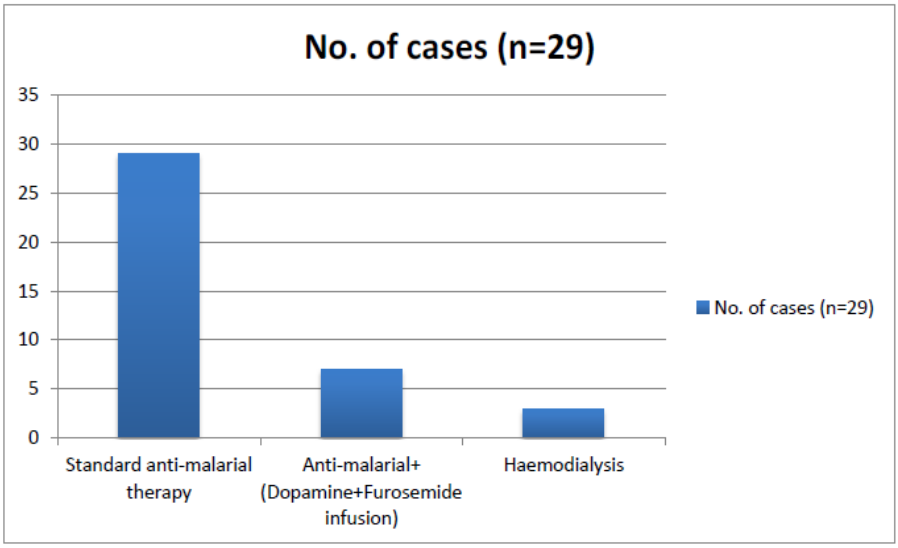

Figure 5: Treatment received by cases with ARF

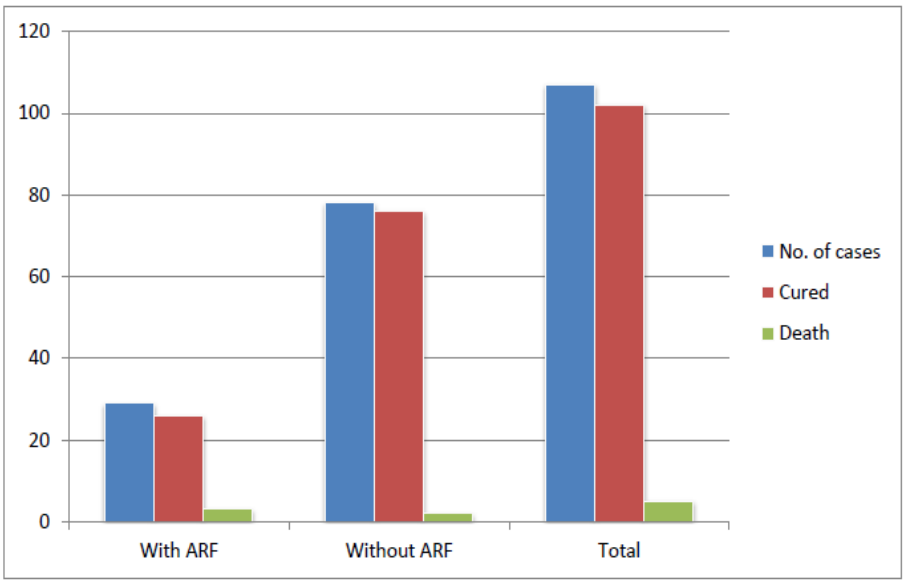

Figure 6: Outcome of cases with ARF in comparison to total cases under study

P. falciparum infection is the most common cause of ARF in patients with severe malaria**11,12**. In a study carried out by Mehta KS, Halankar AR and et al (2001)**13** out of 402 detected smear positive malaria cases, 24 had ARF. Eighteen were of the age group 21-40 years. In another study by Krishnan, Anand, Karnad, Dilip R (2003)**14** maximum numbers of patients of ARF in complicated malaria were of young age group with mean age of patient being 26 years. Our study also shows the same results with majority of the cases (57) were seen in age group 20-39 years (53.27%). Krishnan, Anand, Karnad, Dilip R (2003) also reported renal failure in 91 patients out of 301 malarial cases (30%) out of which 33 required dialysis (36%). Hepatic failure occurred in 77 patients. Regardless of the organ system involved, only 11 of 172 patients with one or no organ failure died (6.8%), whereas mortality rate increased to 48. 8% in 129 patients with multiple organ failure. In our study 29 out of 107 cases of malaria developed ARF (27.10%) which is similar to the above study but requirement of dialysis in our study was less, 3 out of 29 cases (10.1%) which was perhaps due to use of (dopamine + furosemide infusion) in 7 cases out of 29 (24.1%) which reduced the need of dialysis.

The complications noticed in patients of ARF with P.Falciparum malaria were Jaundice, cerebral malaria, severe anemia, hypoglycemia and ARDS. Our study is comparable to Maheshwari A et al**15**, Mathieu Nacher etal**16**, DK kochar et al**17** and Shakya K etal**18**. It appears that several factors contribute to ARF in falciparum malaria which includes parasitized erythrocytes inducing microvascular obstruction and/or causing hemolysis**12**. Apart from parasites glycosylphosphatidyl-inositol which is a receptor on monocytes covalently bound to the surface antigens of falciparum malaria parasites. The monocytes are then stimulated to release the tumor necrosis factor, which in turn enhances synthesis of various cytokine cascades and mediators. These mediators also cause changes in blood volume status, vasodilatation, and increase vascular permeability resulting in hypovolemia which contributes to ischemic renal failure**11**. In a study of clinical profile of acute renal failure in cases of P.falciparum malaria in South Gujarat by Gupta PB, Vadgama P et al (2014)**19** acute renal failures was observed in 10% cases of P.falciparum malaria. 60% patients of ARF had proteinuria and granular cast in urine examination. 60% had oliguric renal failure. 20% cases had hyperkalemia and associated with high mortality. 70% of the patients of ARF required dialysis. There was 30% mortality in cases of ARF with P. falciparum malaria Grade ++++ parasitemia. Hypotension, oliguria and jaundice were associated with poor prognosis. 66% mortality was noticed in patients having thrombocytopenia with ARF. Multi organ system dysfunction (more than or equal to 3 systems) resulted in 100% mortality. The duration of fever in our study was equal to or less than 7 days which is similar to the study of S.K Panda et al**20** in which it was 5-7 days. High grade fever was the commonest clinical presentation as similar to other studies**18,21,22**. Decreased Urine output was present in 60% of patients as similar to 68% in study of Rubina Naqvi et al**21**. Jaundice was found in 44.83% cases of ARF in P.falciparum malaria.

Factor predisposing ARF in P.falciparum malaria are dehydration, severe haemolysis, Jaundice, Impaired consciousness, Fever clearance time >72 hrs, Oliguria, Anaemia, Hepatomegaly, Hypoalbuminemia (<=3 gm/dl) and leukocytosis**23**. Mortality increases as the number of complication increases. In our study when ARF was associated with 3 or more organ dysfunction mortality was 100%. Cerbral malaria, jaundice and ARDS were the commonest associations. Our study is similar to that of MK Mohapatra et al**24**. In developing

countries, limited medical resources at primary health care centers and late referrals compound outcomes. The prevention of malarial infection and early diagnosis are the only measures likely to decrease malarial ARF in developing countries. Earlyreferral to centers equipped to provide renal replacement therapy, if necessary, along with antimalarial therapy and support, could further reduce mortality and enhance recovery of renal function**21**.

References

[1]. Harrison's principle of internal medicine 19th edition page -1368-1384
[2]. WHOworldmalariareport2010 (http://www.who.int/malaria/world_malaria_report_2010/en/)
[3]. Park's text book of preventive & social medicine 23rd edition 2015page no- 255-269
[4]. KH Koh, CL Tan and PH Chew, Acute renal failure in severe Falciparum malaria patients in an intensive care unit in Malaysia, The Journal of the Royal College of Physicians of Edinburgh, vol 36, pp 107-11, 2006.
[5]. Das BS, Patnaik JK, Mohanty S, Mishra SK, Mohanty D, Satpathy SK et al, Plasma antioxidants and lipid peroxidation products in Falciparum malaria, Am J Trop Med Hyg 1993;49:720-5
[6]. Sural S, Sharma RK, Gupta A, Sharma AP, Gulati S, Acute renal failure associated with liver disease in India: etiology and outcome, Ren Fail 2000;22:623-34
[7]. Odel GB, Natzschka JC, Storey GNB, Bilirubin nephropathy in the Gunn strain rat, Am J Physiol 1967; 221: 931-935
[8]. Baum M, Sterling GA, Dawson JL, Further study into obstructive jaundice and ischaemic renal damage, Br Med J 1969; 2: 229-232
[9]. Aoyagi T, Lowenstem LM, The effect of bile acid and renal ischaemia on renal function, J Lab Clin Med 1969; 71: 686-690
[10]. S Mohanty, SK Mishra, SS Pati, J Pattnaik and BS Das, Complications and mortality patterns due to Plasmodium Falciparum malaria in
[11]. hospitalized adults and children, Rourkela, Orissa, India, Transactions of the royal Society of Tropical Medicine and Hygiene, vol.97,
[12]. no.1,pp 69-70, 2003
[13]. S. Eiam-Ong and V. Sitprija, Falciparum malaria and the kidney:a model of inflammation, American Journal of Kidney
[14]. Diseases,vol.32,no.3,pp.361–375,1998.
[15]. P. Wilairatana, E. K. Westerlund, B. Aursudkijetal., Treatment of malarial acute renal failure by hemodialysis, The American Journal of Tropical Medicine andHygiene,vol.60,no.2,pp.233–237, 1999
[16]. K. S. Mehta, A. R. Halankar, P. D. Makwana, P. P. Torane, P. S. Satija, and V. B. Shah, Severe acute renal failure in malaria, Journal of Postgraduate Medicine,vol.47,no.1,pp.24–26,2001.
[17]. Krishnan A, Karnad DR. Severe Falciparum malaria: an important cause of multiple organ failure in Indian intensive care unit patients. Crit Care Med 2003;31:2278-84
[18]. Maheswari A,Singh AK,Dept of Nephrology,IMS,BHU,Varanasi
[19]. Association of Hematology and Jaundice with Acute Renal Failure,Thailand,Mathieu D. K. Kochar, S. K. Kochar, R. P. Agrawal et al., The changing spectrum of severe falciparum malaria: a clinical study from Bikaner (northwest India), Journal of Vector Borne Diseases, vol.43,no.3,pp.104–108,2006.
[20]. Shakya K,Kattel BH et al,Dept of Medicine,Nepal,CIN 2003
[21]. P.B Gupta, Parul Vadgama, K N Bhatt, Mehul V Bhavsar, Hardikkumar Desai, Clinical Profile of Acute Renal Failure in Cases of P. Falciparum Malaria in South Gujarat, Int J Res Med. 2014; 3(4);108-114
[22]. Risk factors for acute renal failure in severe falciparum malaria, S K Panda,M C Das,P K Rathod, Dept of Nephrology and Medicine, MKCG Medical college, Barhampur Outcome in severe acute renal failure associated with malaria, Rubina Naqvi, Ejaz Ahmad, Fazal Akhtar, Anwar Naqvi and Adib Rizvi Sindh Institute of Urology and Transplantation, Dow Medical College and Civil Hospital, Karachi, Pakistan.
[23]. Falciparum malaria, various presentation: Khalid Mahmood, Krishanlal Jairamani, Pakistan Journal of Medical Sciences
[24]. R. Bellomo, C. Ronco, J. A. Kellum, R. L. Mehta, P. Palevsky, and Acute Dialysis Quality Initiative Workgroup, Acute renal failure—
[25]. definition, outcome measures, animal models, fluid therapy and information technology needs: the Second International Consensus Conference of the Acute Dialysis Quality Initiative (ADQI) Group, Critical Care, vol. 8, no. 4, pp. R204– R212, 2004.
[26]. MK Mohapatra The National History of Complicated Falciparum Malaria A prospective study