



To Study the Association of Retinopathy with Plasmodium Species in Children's with Cerebral Malaria

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Abstract

Objectives: To study the association of retinopathy with plasmodium species in children's with cerebral malaria

Design: Prospective, observational, cohort study. Cohort study comprising of all malaria positive patients.

Setting: Study was carried out in Department of Paediatrics, S.S.M.C and associated G.M. Hospital Rewa, Madhya Pradesh during the period of 1st August 2015 to 31st July 2016.

Participants: 100 consecutive patients with cerebral malaria evaluated by ophthalmologist for changes of retinopathy were included in the study. All 100 cases were malaria positive.

Results: In cerebral malaria out of 100 cases, 12 cases were *Plasmodium vivax* positive, 74 cases are *Plasmodium falciparum* positive, and 14 cases are both *Plasmodium vivax* and *Plasmodium falciparum* positive. Out of total 41 cases of retinopathy maximum cases were *Plasmodium falciparum* positive (78%), *Plasmodium vivax* is positive in 2.5% of cases. While 19.5% cases were both pv and pf positive.

Conclusions: Malarial retinopathy is significantly associated with *P.falciparum* species of malarial parasite in children with cerebral malaria indicating *P.falciparum* as the most important cause of cerebral malaria or serious disease.

Keywords: Cerebral Malaria, Retinopathy, *Plasmodium vivax*, *Plasmodium falciparum*.

Introduction

Malaria is a mosquito-borne infectious disease caused by a eukaryotic protist of the genus *plasmodium*¹ that is widespread in tropical and subtropical regions².

There are four types of malarial³ parasite namely; *P.falciparum*, *P. vivax*, *P.ovale* and *P.malariae*. Recently, fifth type *P. knowlesi* (a primate malarian species) was also shown to cause malaria

in human. Among these *P.falciparum*, *P. vivax* are the most importantly species responsible for causing malaria.

Cerebral malaria appears to be one of the most common non-traumatic encephalopathy in the world^[4]. Cerebral malaria can be fatal in the absence of prompt recognition of the disease and its complication, and in the absence of active appropriate management of patients, especially in

the high risk groups like pregnant women and young children. Cerebral malaria is thought to be caused only by *P.falciparum* but now *P. vivax* has also being seen to cause cerebral malaria.

The pathogenesis of coma in cerebral malaria remains poorly understood. Obstruction of the brain microvasculature because of sequestration of parasitized red blood cells is one of the mechanism that could contribute to coma^[5-9]. The retina provides a unique opportunity to observe the central nervous system vasculature and therefore to study cerebral vasculature directly i.e. eye being regarded as an extension of the brain. The detection of malarial retinopathy can be a good diagnostic tool for cerebral malaria. Malarial retinopathy acts as a marker of serious disease. This area of Madhya Pradesh is classified under hyper endemiczone for malaria^[10,11].

Objective

To study the association of retinopathy with plasmodium species in children's with cerebral malaria

Methodology

The study was carried out in the Department of Pediatrics, SS Medical College and associated GM Hospital, Rewa, Madhya Pradesh during the period of 1st August 2015 to 31st July 2016, after clearance from the Institutional Ethics Committee. The study design is observational cohort study.

The study group comprised of 100 consecutive children with cerebral malaria between age 1 month to 18 years presenting with acute febrile encephalopathy and either peripheral smear or Rapid diagnostic test positive for malaria with Glasgow Coma Scale ≤ 10 with or without seizures. All cases were malaria positive. Children were managed as per standard guidelines for treatment of cerebral and non-cerebral malaria. All cases were evaluated by ophthalmologist for any changes of retinopathy.

A detailed clinical evaluation including history and examination was carried out for all study participants at the time of admission. A base line

evaluation in the form of blood sugar estimation (glucose strip), complete blood counts, and blood culture were done at the time of admission in all children. By using aseptic precautions, finger prick sample of blood was collected to prepare thick and thin smears of blood on glass slides, and evaluated for presence of any malarial parasite under oil immersion, as per standard procedures.

Rapid diagnostic test kits were also used for the diagnosis of malaria. (SD BIOLINE Malaria Ag Pf./Pan kit manufactured by Standard Diagnostics (Alere) limited, Korea.)

Fundus examination was performed by ophthalmologist in all patients, after pupils were fully dilated using mydriatic eye drops. Presence of papilledema, retinal haemorrhages and vessel changes, peripheral whitening, and blurring of disc margins were noted and recorded separately, in addition to any other ophthalmologic abnormality.

Subsequently, all investigations required for clinical management were done.

In unconscious patients, vitals, Glasgow Coma Score and blood sugar were recorded until they became conscious or till demise. Initially, it was done every 6 hours for first 24 hours then every 12 hours until they became conscious.

Statistical analysis: The data of the study were entered and analysed using the software Microsoft Excel 2013 for windows. Appropriate univariate and bivariate analysis were carried out using the Student t test for the continuous variable / proportion test (z test / t test) and two-tailed Fisher exact test or chi-square (χ^2) test for categorical variables. The critical levels of significance of the results were considered at 5% i.e. $P < 0.05$ was considered significant.

Results

In our study in cerebral malaria (malaria positive with encephalopathy) 59% were males and 41% were female patients. (Table no. I)

In cerebral malaria out of 100 cases, 12 cases were *Plasmodium vivax* positive, 74 cases are *Plasmodium falciparum* positive, and 14 cases are

both *Plasmodium vivax* and *Plasmodium falciparum* positive. Out of total 41 cases of retinopathy maximum cases were *Plasmodium falciparum* positive (78%), *Plasmodium vivax* is positive in 2.5% of cases. While 19.5% cases were both pv and pf positive.(Table II)

Table I

Sex	Cerebral malaria(CM) (n=100)
Male (M)	59(59%)
Female(F)	41(41%)
Total	100(100%)
Age	
<6 month	5(5%)
6 month – 5 years	27(27%)
6 years – 12 years	47(47%)
13 years – 18 years	21(21%)

Table II Incidence of retinopathy in relation to *Plasmodium* species in Cerebral malaria

Retinopathy (CM group)	Total	Pv	Pf	Both
Present	41	1(2.5%)	32(78%)	8(19.5%)
Absent	59	11(19%)	42(71%)	6(10%)
Total	100	12	74	14
P value	0.0309			

Discussion

In our study we found that in the Cerebral malaria (malaria positive with encephalopathy) 59% patients had normal fundus and 41% patients had retinopathy. In cerebral malaria, 74% were infected with isolated *Plasmodium falciparum* and 12% cases with isolated *plasmodium vivax*, while 14% were infected with both the species. Thus *Plasmodium falciparum* was the most common cause of cerebral malaria.

Jain, et al. had also reported 96%cases of cerebral malaria caused by *Plasmodium falciparum* in their study^[12]. In our study we also found cases of cerebral malaria which were caused by *plasmodium vivax* which was in accordance with the observation of Ahmed^[13] and Gopinathan^[14].

Retinopathy was seen more frequently with *Plasmodium falciparum* (78%) compared to *P vivax* (2.5%). The difference in the incidence of retinopathy in *P.falciparum* cases and *P vivax* cases in both groups was statistically significant ($p<0.0309$). Thus showing retinopathy was significantly correlated with *P.falciparum* malaria.

Conclusions

Plasmodium falciparum was the most common cause of cerebral malaria in the study but we also found cases of cerebral malaria which were caused by *plasmodium vivax* and some of the

cases which were infected with both species together.

Malarial retinopathy is significantly associated with *P.falciparum* species of malarial parasite in children with cerebral malaria indicating *P.falciparum* as the most important cause of cerebral malaria or serious disease.

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