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Prevalence of Malaria in a Tertiary Care Hospital in Navi Mumbai, India

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Abstract

The aim of this study was to determine the prevalence of malarial infections among the patients attending at tertiary care hospital, Navi Mumbai, India, between January and December 2013. 4878 blood samples of suspected malaria cases were examined out of which 809 (16.58%) were positive for malaria. The types of malarial parasites were *Plasmodium vivax* (54.76%), *Plasmodium falciparum* (17.80%), and mixed species (27.44%). The prevalence of malarial infection exhibited seasonal pattern with many cases in the month of July to November with peak in October. Infection prevalence in male patients was 2-fold higher than in female patients. Age group ranged from 11-50 years with 21-30 years had greatest risk. These findings compared with other findings of malaria endemic populations in India that a hospital-based diagnosis and surveillance for malaria reflects seasonal malaria transmission underlying demographic and geographic distribution.

Keywords: Malarial parasites; Microscopic examination; Prevalence; Malaria; Rainy season; Navi Mumbai

Introduction

Malaria is a major cause of morbidity and mortality in the tropics. Disease is of global importance, results in 300-500 million cases yearly and 1.5-2.7 million deaths annually. Approximately 2.48 million malarial cases are reported annually from South Asia, of which 75% cases are from India alone [1,2].

The annual parasite incidence (API) is a malariometric index to express malaria cases per thousand population. As per the National Vector Borne Disease Control Programme (NVBDCP) incidence records, in most parts of India the API was <2, whereas 2-5 API was in scattered regions, while regions with >5 API were seen in the states like Rajasthan, Gujarat, Karnataka, Goa, southern Madhya Pradesh, Chhattisgarh, Jharkhand and Orissa, and in the Northeastern states. The proportion of *P. vivax* and *P. falciparum* varies in different parts of India. Most of the Indo-Gangetic plains, Northern hilly states, Northwestern India and Southern Tamil Nadu state have <10% *P. falciparum* and the rest are *P. vivax* infections; in the forested areas inhabited by ethnic tribes, the situation is reverse and *P. falciparum* proportion is 30-90% and in the remaining areas it is between 10 and 30%. In India, maximum malaria is contributed by the Orissa state. Although Orissa has a population of 36.7 million (3.5%), it contributed 25% of total 1.5 to 2 million reported annual malaria incidence, 39.5% of *P. falciparum* malaria and 30% of deaths due to malaria in India. Similarly, in the other states inhabited by ethnic tribes mainly in the forest ecosystems, meso- to hyper-endemic conditions of malaria exist with the preponderance of P. falciparum to the extent of 90% or even more [3].

Human malaria is caused primarily by 4 different species of Plasmodium namely; *P. falciparum*, *P. vivax*, *P. malariae* and *P. ovale*. Clinical pictures, outcome, prognostic factors, and changing clinical pattern of malaria due to individual species infection have been studied extensively [2]. The high mortality rate from *P. falciparum* is due to its ability to induce severe malaria, and in some cases, multiple organ failure [4].

Malaria transmission depends on two primary factors: 1) location of mosquito breeding sites and 2) clustering of human habitations where people serve as reservoirs of parasites for mosquito infection. Previous successes in malaria control for example in India and Sri Lanka were primarily attributed to the effects of residual insecticide spraying which severely reduced Anopheline population [5].

A typical attack of malaria comprises three distinct stages: Cold stage, hot stage and sweating stage. The clinical features of malaria vary from mild to severe, and complicated, according to the species of parasite present, the patient's state of immunity, the intensity of infection and also the presence of concomitant conditions such as malnutrition and other diseases [6].

Aims and Objectives

- To detect malarial parasitic infection among patients attending tertiary care hospital.
- To correlate positive findings with age and sex.
- To study seasonal variation of malaria.

Materials and Methods

This study was carried out at Department of Microbiology, Central Pathology Laboratory, MGM Medical College and Hospital, Navi Mumbai, India, over a period of one year from January 2013 to December 2013.

Study design: Cross-sectional study.

Study type: Retrospective type of study.

Statistical test: Chi-square test, Z tests and SPSS (version 17) software was used for statistical analysis.

Inclusion criteria: A total of 4878 samples were collected from clinically suspected cases of malaria from Medicine and Paediatric Departments attending tertiary care hospital.

Exclusion criteria: Smear negative for malarial parasites and patients with other positive laboratory test results i.e. for typhoid fever and dengue fever.

Ethical clearance: Ethical clearance was obtained from the Institutional Ethical committee of MGM Institute of Health Sciences (Deemed University), Navi Mumbai before starting the project.

Sampling strategy: The patient's name, age, sex, details of history and clinical examination findings, history of blood transfusion, antimalarial treatment if any were recorded in requisition form. After obtaining informed consent, 3-5 ml blood specimens were collected from antecubital vein of all patients by taking sterile precaution.

Light microscopic examination: Thick and thin smear were prepared. Thick smear was dehaemoglobinized, slide stained with Leishman's stain. After drying, the slides were examined under a light microscope using an oil-immersion lens (100X magnifications) after putting a drop of paraffin oil. Positive result of malaria given if at least one asexual form of parasite was detected in 100 microscopic fields in thick blood film otherwise the report was given as negative. Blood parasite density per microlitre of blood (parasitic index) was determined from the thick films by counting the number of parasites in relation to 200 white blood cells (WBCs). Taking the number of leucocytes per microliter of blood as 8,000 and was expressed as follows:

$$Parasite\ density/\mu l = \frac{Parasite\ count\ X\ 8{,}000}{No.\ of\ WBC\ counted}$$

After thick smear examination, thin blood smears were also examined for speciation of malarial parasites and their infective stages. Morphology of malarial parasites was examined in detail in parasitized red blood cells. Minimum 100 fields were examined (Figure 1 (A-B)).

Results

This study was carried out at Microbiology laboratory and Pathology laboratory to find the prevalence of malarial infection at tertiary care centre. Total numbers of suspected cases 4,878 were studied. Out of which 809 cases were positive for malaria. Prevalence rate were 16.58% (Graph 1).

Sex	*P. falciparum*-malaria	*P. vivax*-malaria	Mixed malaria
Male	92 (63.89%)	283 (63.88%)	141 (63.51%)
Female	52 (36.11%)	160 (36.12%)	81 (36.49%)
Total	144 (100%)	443 (100%)	222 (100%)
Chi-square=0.958, df=2, p value=0.995, not significant			

Table 1: Showing prevalence of malarial parasites in males and females.

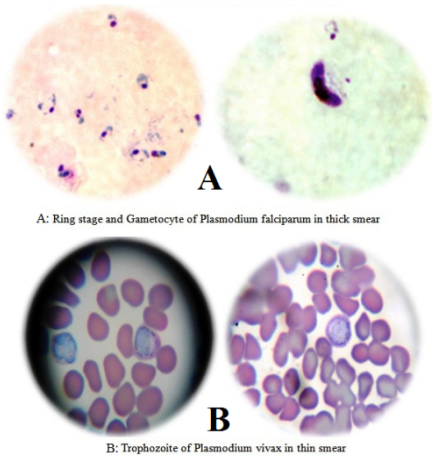


Figure 1 (A-B): Showing morphology of malarial parasites in thick and thin smear.

Maximum number of malaria cases were seen in the months of July to November (12% to 13%) with peak in the month of October (20%) (Graph 2).

Among 809 malarial parasites positive cases, *Plasmodium vivax* was predominant (65.51%), *Plasmodium falciparum* (6.55%) and mixed species (*Plasmodium vivax* and *Plasmodium falciparum*) were 27.93% (Graph 3).

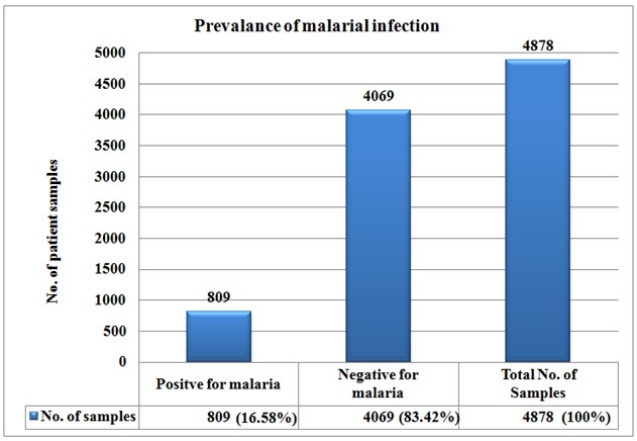
Prevalence of malaria was more in males (64%) as compared to female (36%). In individual species also males were predominant as compared to females. Males and females ratio was 2:1 (Graph 4).This finding was statistically significant (Chi-square=0.958, df=2, p value=0.995, not significant) (Table 1).

Age group (in years)	*P. falciparum*-malaria	*P. vivax*-malaria	Mixed malaria
0-10	6 (4.17%)	41 (9.26%)	3 (1.35%)
11-20	44 (30.56%)	112 (25.28%)	44 (19.82%)
21-30	59 (40.97%)	147 (33.18%)	86 (38.74%)
31-40	12 (8.33%)	62 (14%)	40 (18.02%)
41-50	11 (7.64%)	44 (9.93%)	32 (14.41%)
51-60	7 (4.86%)	31 (7%)	9 (4.05%)
61 and above	5 (3.47%)	6 (1.35%)	8 (3.60%)
Total	144 (100%)	443 (100%)	222 (100%)
Chi-square=39.5, df=12, p <0.001, highly significant.			

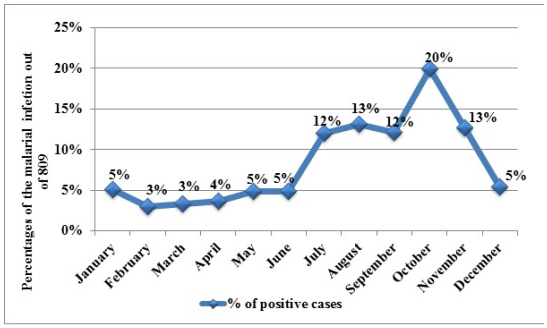
Table 2: Age wise distribution of *Plasmodium* species.

With regard to difference in age group in *Plasmodium vivax*, *Plasmodium falciparum* and mixed species, most of the cases occurred in the age group 11-50 years with peak at 21-30 years (*Plasmodium vivax* 33.18%, *Plasmodium falciparum* 40.97% and mixed species 38.74%). *Plasmodium vivax* was more in the age group 0-10 years

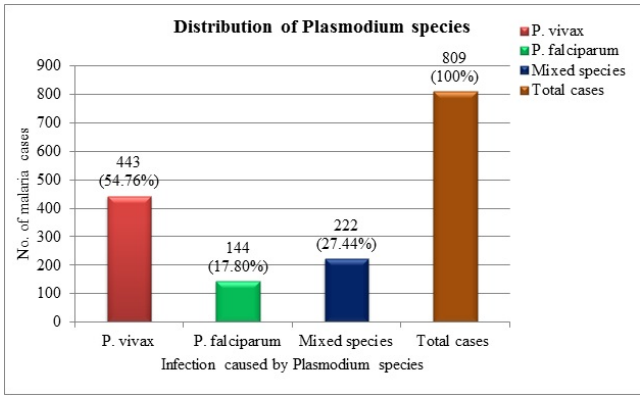
(9.26%) as compared to other species. The finding was highly significant (Chi-square=39.5, df=12, p<0.001) (Table 2).



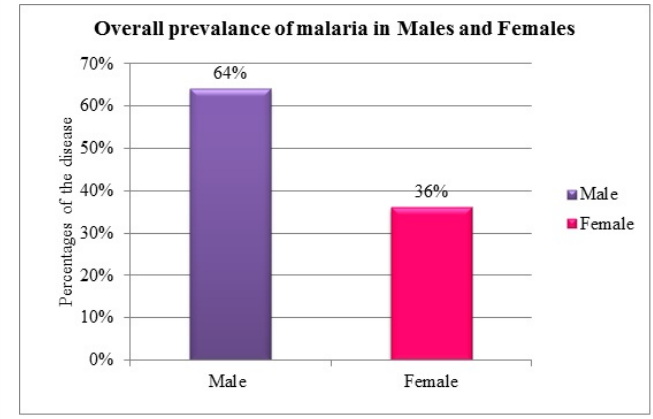
Graph 1: Showing prevalence of malaria in a tertiary care hospital.



Graph 2: Showing month wise distribution of malaria.

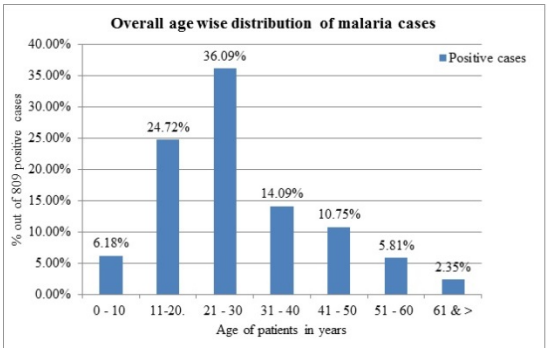


Graph 3: Showing distribution of Plasmodium species.



Graph 4: Showing overall prevalence of malaria in males and females.

Prevalence of malaria was more in the age group 11-50 years (24.72% to 10.75%) with peak in the age group 21-30 years (36.09%) (Graph 5).



Graph 5: Showing overall age wise distribution of malaria cases.

Discussion

Prevalence of malarial parasitic infection in our study was found to be 16.58%. Species distribution was *Plasmodium vivax* (54.76%), *Plasmodium falciparum* (17.80%) and mixed species (27.44%). Male to female ratio was 2:1. Maximum prevalence between July to November with peak in October. Malaria occurred in all age groups with maximum prevalence in 11-20 years and 21-30 years.

There is a wide variation of reports of prevalence of malarial infection in India and other countries. This can be due to differences in geographical and climatic condition which affect mosquito breeding, socio-economic conditions of patients, knowledge about healthcare and public health practices.

Prevalence of malarial infection in our study was 16.58% which is closer to Pandey et al. [7] of Bilaspur (24.74%). However Hadiya et al. [8] from Gujarat and Karlekar et al. [5] from Gadchiroli (Maharashtra) reported much less prevalence of 2.10% and 4.28% respectively. This difference could be due to summer season in which study was carried out.

Regarding seasonal variation, maximum numbers of cases were found in the months of July to November with a peak in October. Similar findings are reported by Sachin et al. [7], Hadiya et al. [8]. The high prevalence of malaria in this period could be due to collection of water in rainy season and mosquito breeding which continues till November.

Regarding prevalence of species, *Plasmodium vivax* was 54.76%, *Plasmodium falciparum* 17.80% and mixed species 27.44%. Our findings are close to Hadiya et al. [8] who reported *P. vivax* 61.41% *P. falciparum* 38.56%, but different from Karlekar et al. [5] who reported *Plasmodium vivax* 33.8% and *Plasmodium falciparum* 66.6%.

Idris et al. [9] from Pakistan reported prevalence of 72.47% for Plasmodium vivax, 24.1% *Plasmodium falciparum* and 3.44% mixed species, which is similar to our findings. Igbeneghu et al. [10] from Nigeria reported much higher prevalence of *Plasmodium falciparum* 93.3%, Abdallah et al. [4] from Sudan reported *Plasmodium falciparum* 81.3% which explains high mortality in these areas, as *Plasmodium falciparum* infection is associated with many complications.

The difference in prevalence of *Plasmodium vivax* and *Plasmodium falciparum* in different areas can be due to presence of endemicity of particular type and higher relapses in *vivax* type.

Male to female ratio in our study was 2:1, which is similar to Karlekar SR et al. [5] from Gadchiroli (Maharashtra) reported 2:1. The difference in M:F ratio could be due to various reasons like body odour, which may attract mosquitoes, movement of males in wider areas, more chances of mosquito bites and some unknown inherent susceptibility.

Maximum number of cases of malaria occurred in the age group 21-30 years (31.52%) followed by age group 11-20 years (25.95%). Our finding correlates with S.R. Karlekar et al. [5] who reported mean age group of 24.8 years and Sahar S et al. [11] reported 16-30 years of age. The reason of higher prevalence in this age group could be due to movement in wider areas possibly endemic, more chances of exposure to mosquito bites and most of carefree behavior.

Conclusion

Our study reveals a significant rate of malarial infection (16.58%) in tertiary care hospital, Navi Mumbai (India). Prevalence of malarial infection showed seasonal variation, more in rainy and winter season which corresponds to period of mosquito breeding and tendency of people to stay indoors. Malarial infections were more in males than females and infection occurred in age group 11 to 30 years. This finding could be due to more chances of exposure of mosquito bites in endemic areas. Lower prevalence of malaria after 30 years of age could be attributed to development of immunity (resistance) due to clinical or subclinical exposures.

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