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Frequency of mixed plasmodium infections of malaria reported at PMCH Nawabshah a tertiary care hospital

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[1,4]Drafting the work or revising it critically for important intellectual content
[3,5]Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work.
[2]Final approval of the version to be published

Funding Source: Nil
Conflict of Interest: Nil

Received for Publication: February 23,2019
Accept for Publication: May 9, 2019

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Cite this article as*: Jamali AA, Shaikh S, Tanwani BM, Jamali GM, Jamali AA. Malaria: frequency of mixed plasmodium infections of malaria reported at PMCH Nawabshah a tertiary care hospital. Ann Pak Inst Med Sci. 2019; 15(1): 32-36.*

ABSTRACT

Objective: To find out the frequency of Mixed Plasmodium Infections of Malaria at tertiary care Hospital.

Methodology: This cross sectional study was conducted on indoor and outdoor patients of medical department of Peoples Medical University Hospital Nawabshah, during January 2017 to December 2017. Complete medical history and clinical examination were done. Blood sample of each patient for malaria parasite and plasmodium type were collected and sent to the Hospital diagnostic laboratory to detect the incidence of mixed malaria infections by using thick and thin Geimsa stains and rapid diagnostic test (ICT). All the data was recorded in the proforma.

Frequency and percentage were calculated for categorical variables. Mean and standard deviation were calculated for numerical variables. Stratification with respect to the age and gender was done. Chi-square test was applied and p-value <0.05 was considered as significant.

Results: A total of 2260 cases of suspected malaria were recruited, out of them 450 cases were positive for malaria, their mean age was 38.33+13.17years, 53.8% were males and 46.2% were females. Combined malaria infection was observed in 11.78 % of the subjects by malaria ICT antigen test. There was no significant association of mixed plasmodium species according to age and gender; p-values were quite insignificant.

Conclusion: Combined malaria infection was observed 11.78% by malaria ICT antigen test. Early diagnosis and management is crucial to save the lives in subjects suffering from mixed malaria infections.

Key Words: Mixed infections, *Plasmodium vivax*, *Plasmodium falciparum*, Pakistan.

Introduction

Malaria is prevalent throughout the world. It is the most important parasitic illness affecting humans in the tropical and subtropical areas of more than one hundred countries. Every year about 500 million cases of malaria are reported and about 1 to 3 million victims of malaria die.[1] Malarial infection is a protozoal infection and 4 different types of plasmodium are responsible to produce disease. The *P. falciparum* is responsible for tropical malaria. Tertian malaria occurs due to *P. vivax* and *P. ovale* and *P. malariae* is the cause of quartan malaria. In view of the investigations related to core and mitochondria nucleic acid arrangements, it is observed that p. falciparum had genetically different types and is diligently correlated with P. galli-naceum. Africa is

apparently the place of its origin.[1] Approximately 60% population of Pakistan belongs to malaria- endemic areas.[2,3] Malaria is epidemic in Pakistan since 1970 and recently its occurrence had increased may be due to the floods that affected more than 20 million subjects from sixty districts.[3] About half million cases of malaria are reported each year and about 50,000 malaria related deaths occur each year in Pakistan.[4] Regions along the borders of Iran and Afghanistan contribute 37% of total reported malaria cases in Pakistan.[5] Severity of mixed malaria infection is variable; ranging from less severe to severe and high grade fever.[6,7] Mixed infections may be misdiagnosed and the therapy may be ineffective in eradicating the hidden species. If in the misdiagnosis the hidden organism is P. Falciparum there is 25% risk of treatment failure due to the chloroquine resistant strains of plasmodium falciparum in the region.[8] Studies available at international levels but no adequate data found at local level. Therefore this study has been conducted to determine the frequency of Mixed Plasmodium Infections of Malaria at tertiary care Hospital. This study will provide the literature knowledge regarding prevalence of mixed infection among local population.

Methodology

This cross sectional study was conducted on indoor and outdoor patients of medical department Peoples Medical University Hospital Nawabshah, during January 2017 to December 2017. Patients more than 15 years of the age, having clinical history of malaria and detected malaria parasite antigen (MP/ ICT Antigen) and both gender were included. Subjects unwilling to participate in study, diagnosed cases of blood disorders, HBsAg, sickle cell disease were excluded from study. Complete medical history and clinical examination were carried out. Samples of blood for malaria parasite and plasmodium type were collected and sent to the Hospital diagnostic laboratory to detect the incidence of mixed malaria infections by using thick and thin Geimsa stains and rapid diagnostic test (ICT). All the data was recorded in the proforma. Data was analyzed by SPSS version 16. Frequency and percentage were calculated for categorical variables. Mean and standard deviation were calculated for numerical variables. Stratification with respect to the age and gender was done. Chi-square test was applied and p-value <0.05 was considered as significant.

Hospital ethical committee PMCH Nawabshah permitted to conduct study. Data was collected after the permission of head of department of the Medicine. Written agreement was obtained from all participants and all of them were ensured about to keep their data confidential.

Results

There were total 450 adult subjects studied in present research. Mean age of participants was 38.33±13.17years. Males were most common 53.8%. Most of the patients were with age group of 15-30 years.

Plasmodium falciparum was found among 50.7% cases followed by 36.4% plasmodium vivax, 01.1% plasmodium malaria and 11.8% had mix infection of plasmodium falciparum and vivax, results showed in Table I.

Table I: Demographic characteristics of patients (n=450)

Variable	**Sub-variable**	**Frequency (%)**
Age Groups	15-30 years	274(60.9%)
	31-45 years	139(30.9%)
	46-60 years	37(8.2%)
	Mean+SD	38.33+13.17years
Gender	Male	242(53.8%)
	Female	208(46.2%)
Marital status	Married	419(93.1%)
	Single	31(6.9%)
Occupation	Office Worker	95(21.1%)
	Manual Worker	143(31.8%)
	House Wife	212(47.1%)
Residence	Rural	329(73.1%)
	Urban	121(26.9%)
Socioeconomic status	Poor Class	412(91.6%)
	Middle Class	25(5.6%)
	Upper Class	13(2.9%)
Education	Primary	189(42.0%)
	Middle - Matriculation	91(20.2%)
	Intermediate	53(11.8%)
	Graduate	42(9.3%)
	Uneducated	75(16.7%)
Type of Plasmodium	Plasmodium Falciparum	228(50.7%)
	Plasmodium Vivax	164(36.4%)
	Plasmodium Malariae	5(1.1%)
	Plasmodium Falciparum & Vivax	53(11.8%)
	Total	**450(11.8%)**

There was no significant association of any types of plasmodium with any age group p-values were quit insignificant. Table II.

No significant association was found Plasmodium Falciparum, Plasmodium Vivax, Plasmodium Malariae and mixed infection according to gender, p-values 0.805, 0.274, 0.655 and respectively, results showed in Table III.

Table II: Types of plasmodium according to age (n=450)

Type of Plasmodium	Age groups			Total	p-value
	15-30 years	31-45 years	46-60 years		
Plasmodium Falciparum	145	67	16	228	0.795
Plasmodium Vivax	94	56	14	164	0.313
Plasmodium Malariae	03	03	00	06	0.709
Plasmodium Falciparum & Vivax	32	16	05	53	0.976

Table III: Types of plasmodium according to gender (n=450)

Type of Plasmodium	Gender		Total	p-value
	Male	Female		
Plasmodium Falciparum	119	109	228	0.805
Plasmodium Vivax	89	75	164	0.274
Plasmodium Malariae	03	02	05	0.655
Plasmodium Falciparum & Vivax	31	22	53	0.126

Discussion

Many areas of world that are endemic for malaria had reported that not only plasmodium falciparum and vivax are common all over but mix infections are now commonly reported due to advancement in diagnostic facilities and other appropriate methods. Mixed species infection can not only complicate diagnosis, but also alter the severity and morbidity of the disease.[10]

In present study different types of plasmodium were identified and plasmodium falciparum was dominant 50.67%, followed by plasmodium vivax 36.44%, plasmodium malaria 01.11% and mix infections of p. falciparum and vivax were 11.8% respectively. A retrospective cross sectional study Agha Khan Hospital Karachi reported that 83.0% cases of malaria had P. vivax, while 13.0% had P. falciparum and 4% had mixed infection[11], this mixed infection less than our study and this may because our study population was belonging to lower class on large scale and Agha Khan Hospital is main representative of urban population, while in current study there is dominant number of patients from rural setup. Tajebe A et al[12] also found similar findings regarding mixed infection as mixed infection was 12.50%, while inconsistently 66.67% had falciparum and 5.95% had P. vivax infection. On her hand Singh US et al[13] also found compare results regarding mixed infection of p. falciparum and vivax as 11%. As usually due to low education profile and not to be seriously ill, main issue is that the patients were not reported and treated properly. There is some variation of male female ratio in presentation of malaria but not significant at higher levels due lack of prevalence studies. Misdiagnosis, decreased facilities for diagnosis, practice of presumptive treatments and unavailability of ACT are the main issues of Pakistan in controlling and managing malaria[14,15].The above facts were also observed in present study also.

Malaria was more common in rural areas and plasmodium falciparum was more common and prevalent than plasmodium vivax as observed in studies by Sheikh SH et al[16] and Jamali AA et al.[17] Similarly we found majority of subjects (73.1%) reported from rural areas and 26.9% were from urban areas.

In a study stated that there is paucity of comprehensive prospective studies that comprise perfect diagnosis of malaria and detect comorbidities.[18] Depending on clinical characteristics and investigations as microscopy and n PCR with severe disease 77.1% (262) had infection with plasmodium falciparum, 7.9% (27) with p. vivax and 14.7% (50) subjects had mixed malaria infection with falciparum and vivax and only one had mixed p. falciparum and malaria infection (0.3%) and higher frequency of mixed infection of p. falciparum and vivax.[18] It is reported that infections with mixed plasmodium species especially with falciparum/vivax had equivalent and higher morbidity rate in comparison to mono infections by plasmodium falciparum.[6,19] Microscopy is usually unreliable to diagnose the mixed infections and also in mono infections with low concentrations. There is a particular condition with residents of diverse racial origins in French Guiana, and also variable malaria vulnerabilities in relation with alterations in confined epidemiology. Clinicians those involved in routine care do not have access to real-time PCR and thus have a non-negligible risk of treating mixed malaria infection. The recognition of mixed infection by *P. falciparum/P. vivax* is of great clinical significance for the reasons that interface among the diverse species concurrently infecting the same subject can consequence in important alterations in the sequence of the infection and illness, and also result modifications in treatment approaches. The detection of low density mixed infections of p. vivax and p. falciparum by the availability of rapid tests for diagnosis had resulted in early diagnosis and management of mixed infections and thus decreased malaria infections and a step towards the elimination of the malaria infection.[20] Infection with multiple plasmodium species had documented substantial difference among clinical features and outcomes in severe infection by plasmodium vivax, falciparum and falciparum/vivax mixed infections. Severe vivax malaria and severe falciparum malaria infection are usually similar however respiratory distress is notably increased in severe vivax infection probably related to enhanced

cyto-adherence of parasite in the respiratory microvasculature. The outcome is worst in severe mixed infection by plasmodium falciparum/vivax possibly sharing the adversarial clinical features of particular mono infection at presentation.

In this study no significant association was found od malarial parasites with age and gender. While Hussain TA et al[21] reported that malarial parasites were significantly associated with males and 15-64 years of age. Khan AQ et al[22] also found irrelevant findings regarding age and gender. Further studies are suggested from these findings on the plasmodium vivax infections, when it infects alone and particularly in mixed infection with other species of plasmodium.[18]

Conclusion

Combined malaria infection was observed 11.78% by malaria ICT antigen test. Health care personnel must have extra attentive concern for mixed infections in local area where *P. vivax* and *falciparum* are endemic, in order to bring best concerns in subjects with malaria infection. There is need for to use of experienced rapid diagnostic tests for detecting mixed as well as low density infections by mono species. Pakistan is taking a lot of efforts with collaboration of different agencies to eradicate and control malaria in region.

Acknowledgements: The writers of current study were very thankful to health management staff of PMC Hospital Nawabshah for their assistance and cooperation in research. We are also thankful to management staff of Jhooly Lal diagnostic laboratory Nawabshah, for their contribution in data gathering.

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