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ORIGINAL ARTICLE

Epidemiology and Presentation of Malaria among Population of Karachi, Pakistan

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ABSTRACT

Background: Malaria is widespread in Pakistan. It is a major threat to public health. Malaria presents in various forms, and its clinical presentation varies in different age groups and comorbid conditions. It is important to understand the recent epidemiology and presentation of malaria in our part of the world so that we can treat it effectively and further decrease mortality from this treatable and preventable disease.
Aim: To determine the epidemiology and presentation of malaria in Karachi.
Methods: This study was conducted at the Malaria Control Program clinic at Ruth K.M. Pfao Civil Hospital, Karachi, from January 2020 to December 2020. Patients of either gender and of any age with suspected symptoms of malaria were included in the study. Samples were collected to identify parasites. Patients were asked about clinical features and noted in proforma. Statistical analysis was performed using SPSS-20.
Results: A total of 197 patients were included in this study, out of which 114 were males and 83 were females. 172 belonged to the province of Sindh, while the remaining belonged to Baluchistan province. Plasmodium falciparum was found in 22 [11.2%] patient samples, while vivax was present in a majority of 175 [88.8%] patients. The highest numbers of patients were reported in the winter months, from January to March. Fever was the most common complaint, at almost 95.4%. Chills, weakness, and body aches were also present in 25.9%, 21.3%, and 18.3%.
Practical Implication: The study emphasizes the significance of focusing intervention programs on geographical variations in malaria prevalence, taking into account the demographic features of patients. Given that Plasmodium vivax is the most common species, it highlights the necessity of species-specific treatment approaches.
Conclusion: Malaria is most commonly found during the winter months. The most common clinical features are fever, chills, weakness, and body aches.
Key words: Endemic area, partial immunity, Plasmodium falciparum, parasitic disease, Southeast Asia, female anopheles

INTRODUCTION

Malaria is the most common parasitic disease among humans in most of the tropical and sub-tropical regions of Africa, parts of South and Central America, the Middle East, and Southeast Asia. This is caused by various species of parasitic plasmodium[1].

Malaria is caused by a single-celled parasite of the genus plasmodium. The most common mode of transmission is through mosquito bites (female Anopheles mosquito). Other modes of transmission that are uncommon include transmission from infected mother to unborn child (congenital malaria), organ transplantation, sharing of contaminated needles, nosocomial transmission, and in non-endemic areas, mosquitoes infected after biting infected immigrants or travelers[2].

Four species of the genus plasmodium cause classic malaria. Plasmodium falciparum is mostly responsible for severe malaria, whereas Plasmodium vivax, Plasmodium ovale, and Plasmodium malariae are much less common causes of severe malaria. Severe malaria is defined as the presence of signs of severe illness, organ dysfunction, or a high parasite load, that is, peripheral parasitaemia greater than 5% or greater than 200,000 parasites/ul[3]. Plasmodium knowlesi, a parasite of macaque monkeys, is now recognized to cause malaria in humans, which can be potentially fatal. It is found throughout Southeast Asia but is more common in Malaysia[4].

People who are at risk of severe disease are young children and infants, older adults, pregnant women, and travelers[5]. Travelers from non-endemic areas are generally not immune and are at risk of developing severe malaria at any age. Due to repeated exposure to parasites, residents of endemic areas develop partial immunity, which prevents severe disease in older children and young adults[1,6].

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Infected mosquitoes during feeding inject sporozoites in humans, which circulate to the liver and infect hepatocytes, where they mature into liver-stage schizonts, which burst to release thousands of merozoites in the blood. In Plasmodium vivax and Plasmodium ovale infections, the maturation of schizonts may be delayed for 1-2 years. Merozoites infect erythrocytes and within erythrocytes merozoites either matures into gametocytes- the sexual stage, infectious to anopheles mosquito or into asexual erythrocytic-stage schizonts containing merozoites, rupture of schizonts releases merozoites which infect other red cells and that is responsible for human disease where symptoms start[7].

It is important to understand the recent epidemiology and presentation of malaria in our part of the world so that we can treat it effectively and further decrease mortality from this treatable and preventable disease.

METHODOLOGY

Study Design: The study employed an observational design to investigate suspected cases of malaria presenting at the Malaria Control Program clinic at Ruth K.M Pfao Civil Hospital, Karachi. This design allowed for the collection of data over a one-year period from January 2020 to December 2020, enabling the examination of trends and patterns in malaria cases during this time frame.
Study setting: The research was conducted at the Malaria Control Program clinic, which is situated within Ruth K.M Pfao Civil Hospital, Karachi. This clinic serves as a primary facility for diagnosing and managing suspected cases of malaria in the region.
Participant selection: The study population included men and women aged between 2 to 70 years who presented with suspected cases of malaria. Participants were selected based on their attendance at the clinic during the study period. Exclusion criteria were applied to ensure the homogeneity of the study population,

with patients diagnosed with COVID-19 disease, typhoid fever, acute hepatitis, chronic kidney disease, and malignancy being excluded.

Data Collection: Data were collected using a pre-designed form that captured relevant study variables. These variables included age, residence (urban or rural), clinical features (such as fever, chills, fatigue, headache), and parasite found on diagnostic testing. Prior to data collection, informed written consent was obtained from all participants or their legal guardians, depending on their age. Additionally, the study protocol received approval from the institution's ethics committee to ensure compliance with ethical standards.

Data Entry and Analysis: Data entry was performed using SPSS version 20. This software facilitated the organization and management of the collected data, ensuring accuracy and efficiency in the analysis process. Descriptive statistics were utilized to summarize demographic and clinical characteristics of the study population. Additionally, the chi-square test was applied to analyze qualitative data and assess associations between variables. A significance level of 0.05 was considered for statistical tests, indicating a threshold for determining the presence of statistically significant relationships between variables.

Ethical Considerations: Ethical considerations were paramount throughout the research process. Informed written consent was obtained from all participants or their legal guardians prior to data collection, ensuring voluntary participation in the study. Furthermore, approval from the institution's ethics committee was obtained to ensure that the study adhered to ethical guidelines and safeguarded the rights and well-being of the participants. Confidentiality of participant information was maintained throughout the study, with data anonymized and stored securely to protect privacy.

RESULTS

Baseline characteristics: A total of 197 patients were included in this study. Mean age of study population was 25.62 years. Proportion of male patients was higher, 114(57.9%) and 83(42.1%) respectively. Table 1 shows baseline characteristics of the study patients.

Table 1: Baseline characteristics of patients (n=197)

Characteristics	Total
Gender	
Male	114[57.9%]
Female	83[42.1%]
Age (years)	
Mean ± SD	25.62 ± 16.98 years
Up to 18 years	68 [345%]
18 to 40 years	61[30.9%]
41 to 60 years	54[27.4%]
More than 60 years	14[7.1%]
Residence	
Sindh province	172[87.3%]
Baluchistan province	25[12.7%]
Parasite found	
Plasmodium Falciparum	22[11.2%]
Plasmodium Vivax	175[88.8%]

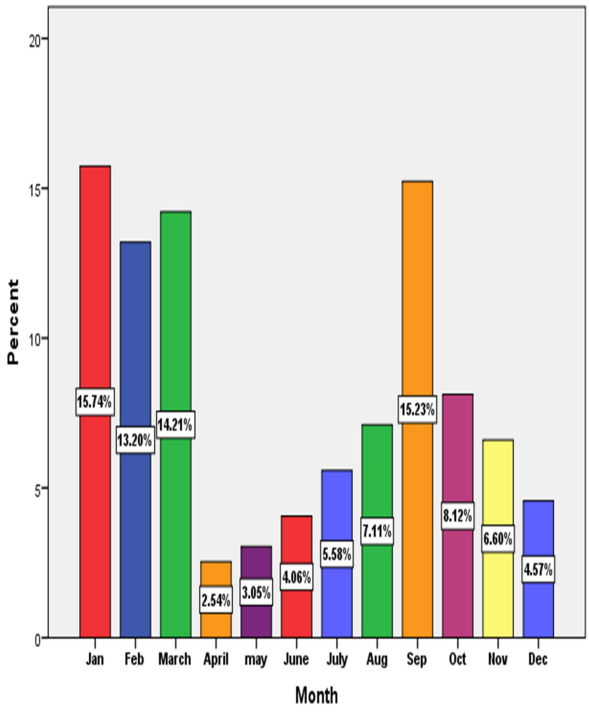
Table 2: symptoms of patients (n=197)

symptoms	Total
Fever	188 [95.4%]
Chills	51 [25.9%]
Body Ache	36 [18.3%]
Headache	25 [12.7%]
Loss of appetite	15 [7.6%]
Weakness	42 [21.3%]
Cough	25 [12.7%]
Rash	13 [6.6%]
Bleeding	06 [3%]

Frequency of malaria through years: Graph 1 shows frequency of malaria during various months of year. Point to be noted that even during months when COVID 19 cases were emerging a good number of patients had malaria too.

Frequency of various Clinical features: Table 2 suggests various clinical features. Bleeding tendency though uncommon was also noted in some patients. Most common symptoms could have easily mixed with symptoms of COVID 19.

Graph 1: Frequency of malaria during various months of year



DISCUSSION

Malaria is a major public health problem and an important cause of morbidity and mortality. According to the WHO, the majority of cases reported were from Africa, followed by those from Southeast Asia and the Eastern Mediterranean regions, and the remainder from the American and Western Pacific regions[8]. Malaria elimination is a global health objective. The first countries that were certified malaria-free by the WHO were Granada and Saint Lucia in 1962; recent certifications were awarded to Algeria and Argentina in 2019 and China is on its way to being declared a malaria-free zone soon. In Southeast Asia, the Maldives and Sri Lanka became malaria-free in 2015 and 2016, respectively[9].

In our study, malaria was most common in males (57%) as compared to females (42%), which is comparable to a recent study conducted in Indonesia where males were 58% and females 42%[10]. It is so close, which may be due to the fact that Indonesia is a tropical country and Karachi is a tropical city in Pakistan. In our study, malarial cases were reported more commonly in the months of January, February, March, September and October, which is comparable to studies where malarial infections were more commonly reported in the spring and rainy seasons[11,12].

87% of malaria patients were from Karachi and 12% from Balochistan. This result is in accordance with WHO's statement that malaria is endemic in tropical areas. [8] In our study, Plasmodium Vivax is 88% and Plasmodium falciparum is 11%, which is comparable to a study conducted in India, Karnataka, where Vivax was 60%, Falciparum was 35%, and mixed malarial infection was 11%[12].

In our study, fever was present in 95% of patients. Fever is the most common symptom of malaria in one study it was reported 100% while in another study fever was present in 98% of patients[12,7,13]. Classic paroxysms of malaria include chills, high-grade fever, and then sweats. Patients remain well between the febrile episodes. Initially, fever is usually irregular, and without therapy, it may become regular with 48-hour (Plasmodium Vivax and Ovale) or 72-hour (Plasmodium Malariae) cycles, especially with non-falciparum disease[14].

Body aches were present in 18% of patients in our study; chills were reported in 25.9%; headaches in 12% and weakness in 21%. It is comparable to a study in which only parasitaemia was present; fever was not reported at the time of presentation, and in that study, the most frequent symptoms were headache (18%), chills and body aches (12.4%) and weakness (11.2%), respectively[15]. The main pathogenic mechanism in body aches is microvascular sequestration with parasitized RBCs, resulting in decreased oxygen delivery and tissue hypoxia[16]. In our study, cough was present in 12% of patients, which is comparable to a study in which cough was present in 11% of patients[12]. In another study, self-limiting cough occurred in both Plasmodium falciparum (36% and Ovale (53%, as it can impair gas transfer and have pulmonary phagocytic activity[17].

Rash is present in 6% of our patients. Rash is an uncommon presentation of malaria, but in endemic regions, malaria can present with unusual features due to the development of partial immunity and inappropriate use of antimalarial drugs. In a case report of a 9-year-old girl who presented with fever and rash for 2 days, there were multiple erythematous and papular skin lesions in both upper and lower limbs. Her peripheral film revealed trophozoites of plasmodium vivax, and the rash completely disappeared on the 3rd day of the initiation of the antimalarial drug[18].

In our study, bleeding and epistaxis were present in 3% of patients. In one study of complicated plasmodium falciparum malaria patients, overt bleeding was present in 45% of cases, and within this 25%, patients presented with epistaxis. Causes of bleeding in these patients were coagulopathy, thrombocytopenia, and disseminated intravascular coagulation (DIC)[19].

CONCLUSION

The Malaria Control Program clinic in Karachi provided data on 197 suspected malaria cases. Patients tended to be more male, with a mean age of 25.62 years. The majority of patients were younger and from the region of Sindh. Vivax Plasmodium was the most common species. The research discovered that malaria cases fluctuated all year round, even in the midst of COVID-19 instances. Comprehending these trends is crucial for public health approaches aimed at reducing the effects of malaria and guaranteeing prompt identification and treatment.

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