RESEARCH ARTICLE

Malaria prevalence in Malakand district, the north western region of Pakistan

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Abstract

Objective: To check the prevalence of malaria in a specific geographical region.

Methods: The prospective study was conducted in Malakand, Pakistan, from January to December 2017, and comprised suspected malaria patients. Blood samples were collected during dry, rainy, and end-of-rainy season, with symptoms of malaria. Thick and thin film of blood were Giemsa-stained, stored in a secured slide box and were reconfirmed by microscopy expert at the Laboratory of District Head Quarter Hospital Batkhela and Tehsil Head Quarter Hospital Dargai in the Khyber Pakhtunkhwa province. Graph Pad 5 was used for data analysis.

Results: Of 1123 suspected patients, 300(26.7%) tested positive for malaria. Of the positive cases, 296(98.6%) were Plasmodium vivax and 4(1.3%) Plasmodium falciparum. No mixed-species infection and no case of Plasmodium ovale and Plasmodium malariae were reported. Malaria was higher in those aged <16 followed by those in the 33-50 group and the least in 51-80 years group ($p>0.05$). Males were more infected than females ($p>0.05$). Individuals screened in the rainy season numbered more than those in the dry and post-rain season ($p< 0.05$).

Conclusions: Malaria was found to be highly prevalent in the rainy season.

Keywords: Malaria suspected patients, Prevalence, Relapses, Plasmodiosis, Malakand-Pakistan.
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Introduction

Malaria is one of the global problems. It not only kills millions of people annually but it renders the most fertile regions of the earth unsafe for human habitation. About 200-300 million cases and half-a-million deaths annually accounted for malaria infection in the world.[1] Almost 50% of people in the world live in areas where malaria is endemic and the illness significantly contributed to the loss of public and financial development in numerous developing countries.[2] Though malarial deaths mostly occur in Africa, southeast Asia has also suffered from malarial deaths in the past. World Health Organisation (WHO) has estimated 1.5 million malaria cases annually and categorised Pakistan in group 3 countries of the Eastern Mediterranean Region, which accounts for 95% of the total regional malaria burden.[3] Malaria distribution in Pakistan is heterogeneous, with high incidence rates in less prosperous districts that have suboptimal healthcare service delivery, such as those near the international borders with Afghanistan and Iran.[3] In contrast, other areas, including Punjab, are considered low-risk for malaria.[4]

Pakistan is one of the endemic regions for both Plasmodium (P.) vivax and P. falciparum.[5] Approximately 150 million people live in malaria-endemic regions.[6] Malaria transmission in Pakistan is seasonal and inclined to epidemic outbreaks in the North West Frontier Province (now called Khyber Pakhtunkhwa [KP]), Balochistan and Sindh.[7] The main malaria transmission season is September-November, following the monsoon season. There is a short-term transmission season during spring (March-April), but most of the spring cases are believed to be delayed expressions of infections acquired after the monsoon or relapsing P. vivax malaria.[1] Overall, P. vivax accounts for 75%, while P. falciparum for 25% of the malaria burden in Pakistan. In Pakistan there are 500,000 new cases and 50,000 deaths caused by malaria each year.[8] P. vivax accounts for 88% of malaria infections compared to P. falciparum which often takes the spotlights given its severity.[6]

Pakistan is a tropical and agricultural country where

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majority of population is poor and lives in the rural areas. The incidence of increase of malaria in Pakistan is due to increasing poverty, environmental deterioration and vector surveillance against chloroquine resistance. Furthermore, prolonged warmer seasons compared to colder temperatures hamper vector control activities.[9] Similarly, extensive agricultural practices, an expansive irrigation network and the monsoon rains act together to sustain favourable habitat for malaria vector in most parts of the country.[10] The current study was planned to determine the prevalence of malaria in a high-risk KP area.

Patients and Methods

The prospective study was conducted in Malaknd, Pakistan, from January to December 2017, and comprised suspected malaria patients. The study was designed at the Laboratory of Parasitology, Department of Zoology, in collaboration with the Department of Pharmacy, University of Malakand. Permission was obtained from the institutional committee.

The climatic factors in the area are optimum for the breeding of malaria vector. The region harbours high vector density and has high incidence of malaria.

Blood samples were collected from suspected malaria patients at District Head Quarter (DHQ) Hospital Batkhela and Tehsil Head Quarter (THQ) Hospital Dargai in Malakand district. The patients were visiting for diagnosis and treatment of malaria-like symptoms. A sample of 3ml blood of each subject in the EDTA sterilized tube was taken. Blood samples were collected during dry, rainy, and end-of-rain season.

Blood was pinched by pricking the fourth finger of the left hand using a sterilised lancet once. The finger was cleansed with spirit-moistened cotton and the first drop of blood was removed with cotton. Both thick and thin blood films were prepared in Giemsa's stain and examined under the microscope in the relevant laboratories of the same hospitals (LaboMed) with a 100X oil immersion lens for the detection of different stages of plasmodium species.

Data was analysed with the aid of Graph Pad 5 by using Chi square test. $P<0.05$ was considered statistically significant.

Results

Of 1123 suspected patients, 300(26.7%) tested positive for malaria. Of the positive cases, 296(98.6%) were P. vivax and 4(1.3%) P. falciparum. No mixed-species infection and no case of P. ovale and P. malariae were found. Malaria was higher in those aged <16 followed by those in the 33-50 group, and the least in 51-80 years

Table-1: Age-wise prevalence of malaria infection in human population of Malakand district, Pakistan.

Ages (years)	No. infected (%)	No. non-infected	No. examined	*P.* vivax	*P.* falciparum	No. infected (%)
3-16	191(28.8)	472	663	188 (98.4)	3(1.57)	191 (28.8)
17-34	68(23.5)	221	289	67 (98.5)	1(1.47)	68 (23.5)
35-50	30(24.3)	93	123	30 (100)	0	30 (24.3)
51-80	11(22.9)	37	48	11 (100)	0	11 (22.9)
Total	300(26.7)	823	1123	296 (98.6)	4(1.3)	300 (26.7)
P.value	0.7205	0.9997				

Table-2: Sex-wise prevalence of malaria infection in human population of Malakand district, Pakistan.

Gender	No. infected (%)	No. non-infected	No. examined	*P.* vivax	*P.* falciparum	No. infected (%)
Male	178 (28.7)	442	620	175 (98.3)	3 (1.65)	178 (28.7)
Female	122 (24.2)`	381	503	121 (99.1)	1 (0.81)	122 (24.2)
Total	300	823	1123	296	4	300
P.value	0.5892			0.8137		

Table-3: Seasonal variation in prevalence of malaria infection in human population of Malakanddistrict, Pakistan.

Seasons	No. positive	No. non-infected	No. examined	*P.* vivax	*P.* falciparum	No. positive
Dec-March (dry season)	52 (25.8)	149	201	49 (94.2)	3 (5.76)	52 (25.8)
April-August (rainy)	182 (33.5)	360	542	181 (99.4)	1 (0.54)	182 (33.5)
September-November (Post rainy)	66 (17.3)	314	380	66 (100)	0	66 (17.3)
Total	300	823	1123	296	4	300
P.value	< 0.0001			0.0493		

group (p>0.05) (Table 1). Males were more infected than females (p>0.05) (Table 2). Individuals screened in the rainy season numbered more than those in the dry and post-rain season (p< 0.05) (Table 3).

Discussion

Malaria is said to be one of the leading causes of morbidity and mortality in tropical and sub-tropical countries and the second most common disease in Pakistan, accounting for about 16.5% of the disease burden. The infection rate of malaria in Pakistan is about 1.6 million per annum. Nearly 0.3 million cases were reported in 2011. More than 80% cases of malaria were contributed by P. vivax and the remaining by P. falciparum.[11] It is difficult to estimate trends of malaria incidence in Pakistan, because of fluctuation of confirmed malaria cases on an yearly basis.[12] The present study shows 26.7% of malaria prevalence in Malakand district. These areas have been affected by flood in the near past. Due to flood in this region, public health infrastructure is greatly affected. Secondly, due to shared border with malaria-endemic regions, the incidence is quite high in Malakand. A study conducted in district Lower Dir, a high malaria incidence of 39.5% was reported[13] while 29% was reported by another study.[14] Areas around the Pak-Afghan border showed 30.9% infection[15] and about 6.8% in Mardan district have also been reported.[16] According to WHO, the border areas of Balochistan, federally administered tribal areas (FATA) and KP have the highest prevalence of malaria as these areas share borders with malaria-endemic Afghanistan and Iran.[6] A study conducted in Buner district reported 6.86% malaria incidence.[17] It has been reported at 7% in Abbottabad.[18] Urban and rural area of Bannu district had 17% malaria endemicity[19] while Mansehra district had 96.2% prevalence.[20] A study conducted on clinical isolates from Karak district reported 83% incidence.[21] Variation in malaria prevalence reflects the different dynamics of malaria transmission among different parts of Pakistan.[22] A study conducted in the border area of Balochistan also reported high 28.8% incidence of malaria infection.[23] A comprehensive malariometric population survey on malarial isolates from all over Pakistan reported P. vivax predominance by 76%.[8]

In the current study, major role in malaria infection was played by P. vivax (98.6%) compared to P. falciparum (1.3%). These findings are in accordance with the data recorded in Mardan district[16] which showed 92.5% P. vivax and 7.44% P. falciparum infections in the general population. A study[21] reported P. vivax and P. falciparum infections of 97% and 3% respectively. Similarly, a report from Mansehra revealed 92.2% P. vivax and 7.79% P. falciparum infections.[21] P. vivax compared to P. falciparum infection in Lower Dir district is reported 30.1% and 9.4% respectively.

In contrast, the prevalence of P. vivax with respect to P. falciparum is absolutely opposite in southwestern parts of Pakistan. For instance, it is 41% and 58.9% respectively in Larkana district.[24] Another study also has been conducted in Larkana which showed 47.1% and 52.8% infection rate[25]; 46.5% and 52.5% in one study in Hyderabad[26] and 47% and 53% in another study in Hyderabad[27]; 24% and 69% in Khuzdar[28]; 40.8% and 58.1% in Dera Ismail Khan[29]; 6.85% and 8.57% in Quetta[30]; 5.55% and 10.7% in another study in Quetta[31]; and 35% and 65% in Karachi.[32] However, P. vivax is a prevalent parasitic infection that might be due to relapses which is not the case with P. falciparum.[33]

No case of P. vivax mixed with P. falciparum was found in the present investigation. P. vivax combined with P. falciparum was reported 3%in a study.[15] Similar prevalence (3.4%) of the combined parasites was reported in Abbottabad.[18] A study from Quetta showed about 2% combined infection[34] and a comprehensive malarial epidemiological survey across Pakistan revealed 7% mixed malaria infection of P. vivax with P. falciparum8. There is no published report available on P. malariae and P. ovale in Pakistan and the current findings are in the line with all the previous studies conducted in Pakistan.

In malaria-endemic parts of the world, including Africa, the infection is prevalent in individuals aged <12 years.[35] The present study showed most of the infection in the 3-16 years age group. The present study showed that males were more infected than females, and this might be due to the fact that their economic responsibilities take them to areas of high risk for serving, while, as per the traditions observed in the area, females are restricted mostly in their homes and not allowed to venture outdoor unless there is a reason.

Conclusions

Malaria was found to be an alarmingly common disease in Malakand, with higher prevalence of P. vivax compared to P. falciparum. Poverty elimination, public health awareness, socio-economic development and adequate

health facilities are key factors in efforts to minimise malaria incidence in Malakand and the larger north-western region of Pakistan.

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