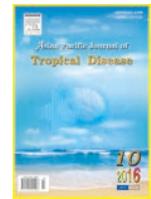




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Seroprevalence and epidemiological status of dengue viral infection in remote areas of Pakistan

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ABSTRACT

Objective: To investigate the epidemiological status of dengue viral infection and associated risk factors in Khyber Pakhtunkhwa, Pakistan.

Methods: A total of 302 clinically suspected cases of dengue were enrolled in this study. All the serum samples were subjected to ELISA for the detection of anti-dengue immunoglobulin G antibody.

Results: Dengue prevalence was significantly detected in male patients ($n = 149$, 87.13%) as compared to female patients ($n = 22$, 12.87%) ($P = 0.0004$). Patients in the age group of 20–39 years ($n = 114$, 66.67%) were more prone to dengue, but less prevalent in the age group more than 60 years. Gender, age category and area were significant factors in the dengue prevalence ($P = 0.0348$).

Conclusions: The overall prevalence of anti-dengue immunoglobulin G was 56.60% ($n = 171$) in referred dengue-suspected patients. Stagnant water reservoirs were found responsible for the spread of the disease favoring mosquito breeding sites.

1. Introduction

Dengue viral infection is an emerging tropical mosquito-borne viral infection caused by dengue virus. This viral infection is transmitted mainly by *Aedes aegypti*[1,2]. The disease in human beings is characterized by intermittent biphasic high-grade fever, headache, myalgia, prostration, lymphadenopathy, leucopenia, distinctive rashes on skin, blood leakage from vessel, gingival bleeding and gastro intestinal hemorrhage observed during dengue hemorrhagic fever[3]. Further complications in the most severe stage is called dengue shock syndrome as accompanied by a hypovolemic shock syndrome resulting in a weak or narrow pulse pressure or hypotension with cold clammy skin and altered mental status[4].

Worldwide prevalence is about 50–100 million cases of dengue fever in more than 100 tropical and subtropical countries threatening approximately 250000–500000 people each year[5]. The disease is epidemiologically unstable with a large number of unpredictable and hazardous sources of transmission with multiple factors accredited to the emergence and noticeable spread of multiple serotypes, like ecologic disturbances, human-made environmental and climactic changes along with acute predisposition of host immune status[3,6]. Other factors include human immunodeficiency virus infection,

inadequate vector or reservoir control, lack of vaccines, international travels and conflicts, urbanization, deforestation, movement of non-immune persons to endemic regions, massive migration from rural to urban areas, decline in social and economic circumstances and population growth[7]. The present study is designed to document the prevalence of dengue infection and associated risk factors in the southern region of Khyber Pakhtunkhwa, Pakistan. Findings of the study will be helpful for proper control and prevention strategies against dengue.

2. Materials and methods

A total of 302 referred patients with high-grade fever, severe headache, joint pain, nausea, vomiting and thrombocytopenia were enrolled in the study. The analysis of risk factors was carried out to assess the overall prevalence status of the disease. Spot questionnaire was filled for the suspected dengue patients. ELISA was performed as a manufacture protocol to detect anti-dengue immunoglobulin G (IgG) antibody. The study duration was from August 2012 to October 2012, a peak season of regional outbreak of the disease in Khyber Pakhtunkhwa, Pakistan. The study protocol was performed according to the Helsinki declaration and approved by Department Ethical Committee. Informed written consent was obtained from patients. Data was analyzed by SPSS software.

3. Results

The demographic study was conducted in various regions of Khyber Pakhtunkhwa, Pakistan. A total of 302 cases were mostly from urban areas, of which 171 (56.62%) cases were positive for anti-dengue IgG antibody and 131 (43.38%) were declared negative

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by ELISA (Table 1). The *Chi-square* analysis between gender wise distributions showed that dengue infection was more prevalent in male group 149 (87.13%) and anti-dengue IgG antibody positive cases as compared to female group that accounted for only 22 (12.87%) cases.

Table 1

Analysis of the risk factor determinants.

Parameters	ELISA (%)		P	
	Positive (n = 171)	Negative (n = 131)		
Gender wise distribution	Male group	149 (87.13)	93 (70.99)	0.0004
	Female group	22 (12.87)	38 (29.01)	
Age wise distribution	1-19	24 (14.03)	34 (25.95)	0.0348
	20-39	114 (66.67)	70 (53.44)	
	40-59	30 (17.54)	18 (13.74)	
	> 60	3 (1.75)	9 (6.87)	
Breeding sites	Domestic animals	23 (13.45)	11 (8.39)	0.4430
	Storage water tanks	32 (18.71)	21(16.03)	
	Stagnant water reservoirs	86 (50.29)	80 (61.07)	
	Flower pots	30 (17.54)	19 (14.50)	
Region wise distribution	Hazara	34 (19.88)	91(69.47)	0.0000
	Kohat	16 (9.36)	1 (0.76)	
	Malakand	17 (9.94)	9 (6.87)	
	Mardan	11 (6.43)	3 (2.29)	
	Dera Ismail Khan	5 (2.92)	0 (0.00)	
	Peshawar	82 (47.95)	26 (19.85)	
	Bannu	6 (3.51)	1 (0.76)	

4. Discussion

The previous study shows that dengue prevalence is more in male as compared to female[8]. Mostly the noticed symptoms was fever followed by myalgia, headache and gum bleeding. And to a lesser extent, rash was reported in clinically suspected patients. However, the warning signs found in this study were similar but far less to symptoms noticed in addition to vomiting and diarrhea followed by breathlessness, chills/rigor, abdominal pain, stiff neck, mental confusion and unconsciousness[9]. Patients in age group of 20-39 years were the most affected proportion with 114 (66.67%) anti-dengue virus IgG antibody positive cases. A study conducted in Pakistan and in Saudi Arabia[8,10] showed almost similar results stating that individuals between the age of 16 and 60 years were more affected by dengue infection. However, surprisingly, people in age group of above 60 years was less susceptible with only few cases reported. This may be due to the decline in social activities and less travelling histories to endemic regions and thus they are at less risk of acquiring infection.

Risk factors analysis favoring mosquito breeding sites such as stagnant water reservoirs garbage and abandoned tires with stagnant water were found more dominant (n = 86, 50.29%) to dengue virus transmission following by storage water tanks like buckets, bottles, cans and water coolers, flower pots like plant saucers and vases inside homes and domestic animals including bird pets found as 32 (18.71%), 30(17.54%) and 23(13.45%) anti-dengue virus IgG positive cases, respectively. Investigations lying on the basis of fundamental strategy of household hygiene status in dengue outbreak revealed that poor drainage, coconut shells, boats and puddles are the potential mosquito breeding sites[11].

Patients' history revealed that most of the infected patients had visited endemic areas, while others also carried antibodies against dengue virus that had no traveling history to the endemic areas. Prevalence status of dengue viral infection among various regions of Khyber Pakhtunkhwa, Pakistan showed that high ratio of prevalence was observed in Peshawar division with 82 (47.95%), ELISA positive cases followed by 34 (19.88%) in Hazara division. In Malakand

and Kohat divisions, 17 (9.94%) and 16 (9.35%), patients were observed positive, respectively. Mardan, Bannu and Dera Ismail Khan represented the outbreaks of 11 (6.43%), 6 (3.51%) and 5 (2.92%) cases from each division, respectively. The line observations were reported in Pakistan[12]. The present study documented that dengue infection showed significant association to gender and age factor. Previous studies indicated that the environmental conditions of residential areas, climate changes, impact of higher environmental temperature, frequent rainfall in post-monsoon season and humidity are frequently associated risk factors leading to dengue infection outbreak[13,14].

The overall prevalence of anti-dengue virus IgG was 56.60% (n = 171) by ELISA among suspected dengue cases. The results indicate that male patients in age group of 20-39 were found more susceptible as compared to female group, while high prevalence ratio was observed in the region of Peshawar. The study also indicates that stagnant water reservoirs are the main risk factors for dengue viral infection in these areas. Anyway, the findings of the current study will be helpful for disease survival, outbreak, prevalence and dengue control.

Conflict of interest statement

We declare that we have no conflict of interest.

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