RISK FACTORS ASSOCIATED WITH THE RECENT OUTBREAK OF DENGUE FEVER IN PESHAWAR

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ABSTRACT

Background: Dengue fever is a rapidly emerging arthropod born viral disease threatening to become an international public health problem. It is receiving attention all over the world for its epidemic expansion and high mortality rate. Globally, approximately 50-100 million cases of dengue fever occur and 500,000 people suffer from dengue hemorrhagic fever and dengue shock syndrome with 20,000 deaths annually. Pakistan is at high risk of being hit by large epidemics because of many factors and conditions that promote the spread of infectious diseases and consequently every year a large number of epidemics occur in different parts of the country. It appears to be emerging in Peshawar in recent years.

Objectives: Objective of this study was to look into the risk factors associated with the development of the recent outbreak of dengue fever in Peshawar.

Materials and Methods: This cross sectional descriptive study was carried out at three teaching hospitals of Peshawar during January to October 2015. Data was collected from 84 patients who came to different units of the hospitals with suspected Dengue fever. Questionnaire was used to collect data from the conveniently selected subjects.

Results: Out of the total of 84 patients, 49 were adult males, 30 were females and 5 children. Age of the patients ranged from 13 to 53 years with a mean of 33 $\pm$ 12 years. Dengue Serology was positive in 56 (67.69 %). Source of water supply was found associated with dengue seropositivity ($p=0.002$) but no significant statistical association of seropositivity was found with demographic variables.

Conclusion: Source of water is a determinant of contracting dengue fever owing to it a breeding media for Ades Agyptes mosquitoes. All other phenomena associated with use of water and sanitation needs to be part of long term control of dengue that will also contribute to controlling other diseases with the same determinants.

Key words: Dengue fever, dengue hemorrhagic fever, dengue shock syndrome, water sources, epidemic, outbreak, Peshawar.

INTRODUCTION

Dengue is the most important vector-born disease in many different parts of the world and is expanding into other areas of the globe without hindrance. The morbidity and mortality due to dengue complications are increasing globally at an alarming rate[1]. About 50–100 million cases of dengue fever and 500,000 cases of Dengue Hemorrhagic Fever (DHF), resulting in around 24,000 deaths, are reported annually. Over half of the world's population resides in areas potentially at risk for dengue transmission, making dengue one of the most important human viral disease transmitted by arthropod vectors in terms of morbidity and mortality[2]. The World health Organization (WHO) declares dengue and dengue hemorrhagic fever to be endemic in South Asia. Out of the current estimates of WHO, which are 50-100 million dengue infections worldwide every year, in 2007 alone, there were more than 890,000 reported cases of dengue in the Americas, of which 26,000 cases were Dengue Hemorrhagic Fever (DHF)[3]. The disease is now endemic in more than 100 countries in Africa, Americas, the Eastern Mediterranean, South-east Asia and the Western Pacific. South-east Asia and the Western Pacific are the most seriously affected.

Pakistan is at high risk of being hit by large epidemics because of many over crowded cities, unsafe drinking water, inadequate sanitation, large number of refugees and low vaccination coverage. These conditions promote the spread of infectious diseases and consequently every year a large number of epidemics/ outbreaks occur in different parts of the country, which result in increased morbidity and mortality. The only reported dengue fever outbreak in Pakistan occurred in June 1994, and a large number of cases have been reported in the region since then.

The aetiological agent of dengue fever is the dengue virus having four distinct but antigenically re-

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lated serotypes. Infection with one serotype does not provide immunity against the other serotypes, rather puts the individual at a greater risk to develop dengue hemorrhagic fever and dengue shock syndrome if the infection is contracted subsequently. Severe manifestations of the disease are also influenced by the age of the patient and his genetic predisposition.

In addition to the increasing severity of the disease, it is also becoming more explosive in nature. Many factors have been identified for this pattern of the disease. Some of them include a lack of political will to prevent and control the disease, paucity of funds to implement preventive strategies, unavailability of piped water supply, increase in international travel, and the lack of effective solid waste management favoring the unchecked growth of the larval habitats[4]. In order to design and employ effective preventive and control strategies against the disease, it is necessary to identify the risk factors of the disease prevailing in the country to have targeted approach. This study was conducted to determine the risk factors associated with dengue fever in patients coming to out-patient departments (OPD) of the three tertiary level hospitals of Peshawar during the recent dengue epidemic.

METHODOLOGY

This cross-sectional descriptive study was carried out during January to October 2015 in the three teaching hospitals of the provincial capital, Peshawar. Data was collected from Lady Reading Hospital, Khyber Teaching Hospital and Hayatabad Medical Complex, Peshawar. Data was collected through a structured questionnaire from the patients who came to medical and pediatric OPDs of these hospitals with suspected or serologically confirmed dengue cases. Approval of the hospitals administration was obtained before approaching the patients. Patients were selected through convenient sampling. Data was collected from the patients after obtaining informed consent. Where the age was less than 15 years, informed consent was obtained from respective parents/guardians. Confidentiality of information was assured and ensured and any possible ethical concerns were discussed prior to starting the survey by the team members. Critically ill patients were excluded from the study on ethical grounds. Those who were unwilling, did not give consent, left before confirmation of diagnosis were also excluded from the study. A pre-tested questionnaire was used to collect the data about demographic variables, habit of sleeping in open air, water pans for animals around the house, pond around the house, empty containers in the house, source of water supply, screening of windows, patient's usage of anti-mosquito measures like coils/ nets/repellents and patients contact with dengue patient. Dengue virus rapid diagnostic tests were set as confirmatory criteria & immunoglobulins i.e. IgM & IgG levels, dengue NS 1 antigen & platelet counts were recorded. Data was analyzed using SPSS-16.0. Descriptive statistics were used to describe the distribution of the demographic data. Results were analyzed and reproduced as frequencies, standard deviations, and p-values. The variables were compared by chi-square test. P-value of < 0.05 was considered as the cut off for significance level.

RESULTS

Total patients included in the study were 84. Out of the total of 84, 49 were males, 30 females and 5 were children. Age of the patients ranged from 13 to 53 years with a mean of 33.30 ± 12.12 years. The following Table No. 1 shows that out of 84 subjects, both IgM and IgG antibodies were positive in 14 (16.7 %) patients. Antibodies of IgM type were positive in 50 (59.5 %) patients, while IgG antibodies were positive in 16 (19 %). Dengue NS1 antigen was positive in 4 (4.8 %) cases. Platelets count was low (< 50,000/ml) in 51 (60.7 %) patients as shown in table No 2. Results of Dengue Serology are also shown in Figure No. 1.

As shown in Table No. 3, the study did not find significant association between dengue fever and demographic variables like age, sex, marital status and educational level.

Empty containers in house was identified as a higher risk ($p \leq 0.001$) for dengue fever. Out of 84 subjects, 61 responded in affirmative to the question of having empty containers in house (Table No 4).

There was a significant association ($p < 0.05$) between patients contact with another patient of dengue at home or at hospital and the result of dengue serology. 55 patients out of 84 were having some or the other contact with a patient of dengue fever (Table 5).

When the association of dengue fever and sleeping habit like sleeping in open air was analyzed, it was found that out of 84 patients, 73 were having the habit of sleeping out door (Table No. 6). The p-value calculated was less than 0.01 which signifies a very strong association between these two variables. So sleeping out door is considered a high risk in the causation of dengue fever. The following bar chart also shows the association of sleeping out door in the open air and dengue fever.

Another factor associated with a higher risk of dengue fever identified as source of water supply i.e. piped water vs. water storage in open containers (Table-7). Out of 84 patients included in the study 58 were having open containers as source of water at home. Open containers of fresh water provides a good environment for breeding of the aedes aegypti, the mosquito transmitting dengue virus, and so an overwhelming association ($p=0.002$) was found between these two variables meaning that presence of fresh water open containers in the nearby places is considered a high risk factor in the causation of dengue fever. The following graph represents the association of source of water

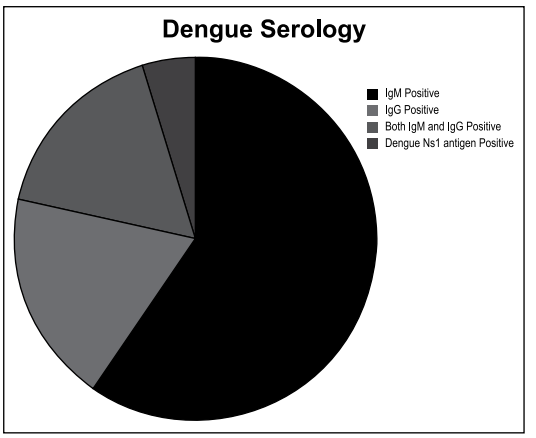
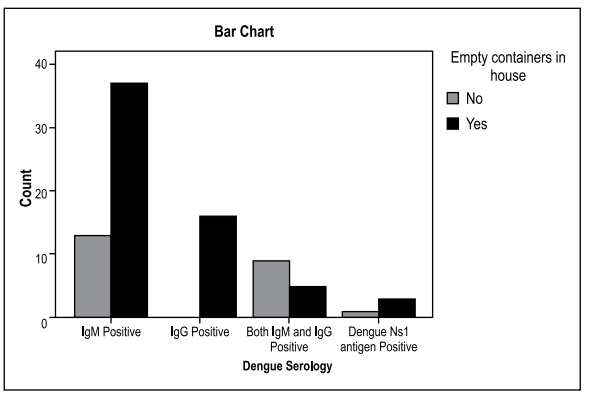
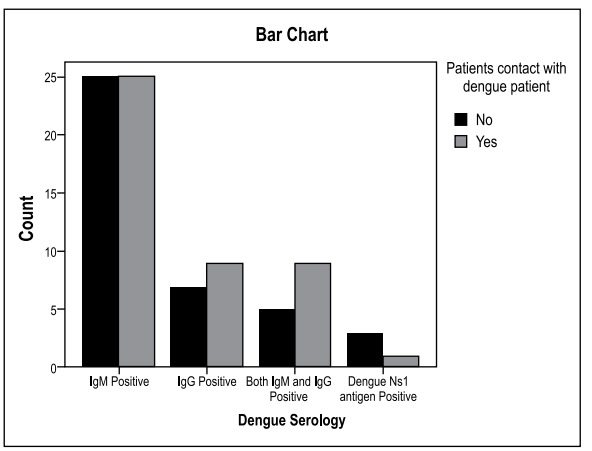


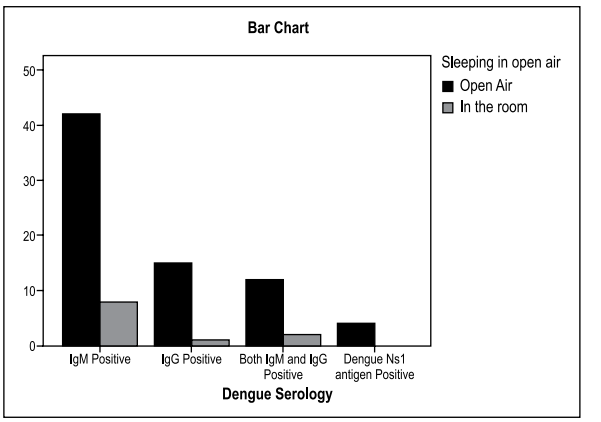
Figure No: 1. Dengue Serology results

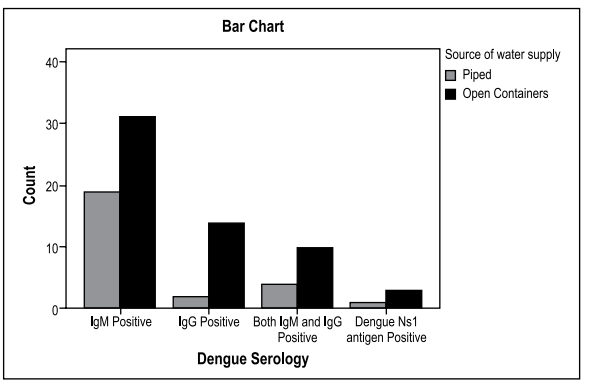


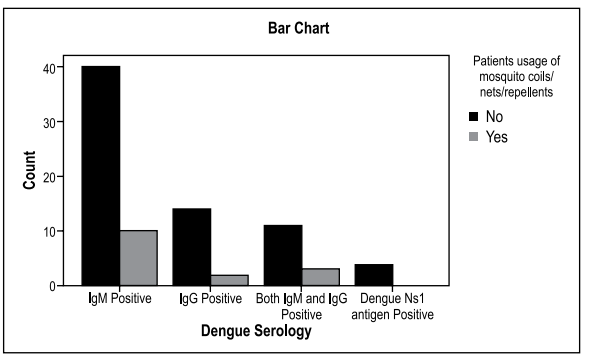


supply and dengue serology.

The anti-mosquito measures like the use of mosquito coils, nets and repellants creams etc. was also identified as a major determinant in the causation of dengue fever. Out of 84 patients, 69 (82.14 %) did not take any anti-mosquito measures. The p-value calculated was less than 0.03 which means that there is strong association between dengue fever and non-use of anti-mosquito nets, coils and repellant creams and lotions. The graph below also shows the association between patients usage of mosquito coils, nets, repellents and dengue serology.







DISCUSSION

Dengue virus infection is increasingly recognized as one of the world's emerging infectious diseases. About 50-100 million cases of Dengue Fever (DF) and 500,000 cases of Dengue Hemorrhagic Fever (DHF), resulting in around 24,000 deaths, are reported annually. A pandemic of dengue began in Southeast Asia after World War II and has spread around the globe since then. In the 1980s, DHF began a second expansion into Asia when Sri Lanka, India, and the Maldives Islands had their first major DHF epidemics. Pakistan first reported an epidemic of dengue fever in 1994. Dengue virus is now endemic in Pakistan, circulating throughout the year with a peak incidence in the post monsoon

Table No: 1. Dengue Serology Results

Dengue Serology Results	Frequency	Percent	Cumulative Percent
IgM Positive	50	59.5	59.5
IgG positive	16	19.0	78.6
Both IgM and IgG Positive	14	16.7	95.2
Dengue NS1 antigen Positive	4	4.8	100.0
Total	84	100.0	

Table No. 2: Platelets Count of the patients

Platelets Count	Frequency	Percent	Cumulative Percent
Low	51	60.7	60.7
Normal	33	39.3	100.0
Total	84	100.0	

Table No. 3. Dengue Serology positivity by demographics

Demographics	Positive Dengue serology	Total	p- value
Age group			
15 Years or less	4	5	< 0.727
15-30 Years	33	33	
31-40 Years	21	21	
41 Years and above	25	25	
Patients Gender			
Male	49	49	< 0.81
Female	35	35	
Marital status			
Married	29	29	
Unmarried	55	55	
Educational Qualification			
Illiterate	9	9	< 0.052
Primary	16	16	
Secondary	29	29	
Bachelor	20	20	
Master	10	10	

Table No.4: Cross tabulation of empty containers in house and dengue fever

Dengue Serology	Empty containers in house		Total	p-value
	No	Yes		
IgM Positive	13	37	50	< 0.001
IgG positive	0	16	16	
Both IgM and IgG Positive	9	5	14	
Dengue NS1 antigen Positive	1	3	4	
Total	23	61	84	

Table No. 5: Cross tabulation of dengue serology and patients contact with dengue patient

Dengue Serology	Patients contact with dengue patient		Total	p-value
	No	Yes		
IgM Positive	18	32	50	< 0.05
IgG positive	4	12	16	
Both IgM and IgG Positive	4	10	14	
Dengue NS1 antigen Positive	3	1	4	
Total	29	55	84	

Table No 6: Cross tabulation of dengue serology and sleeping in open air

Dengue Serology	Sleeping in open air		Total	p-value
	Open Air	In the room		
IgM Positive	42	8	50	< 0.01
IgG positive	15	1	16	
Both IgM and IgG Positive	12	2	14	
Dengue NS1 antigen Positive	4	0	4	
Total	73	11	84	

Table No 7: Cross tabulation of dengue serology and source of water supply

Dengue Serology	Source of water supply		Total	p-value
	Piped	Open Containers		
IgM Positive	19	31	50	< 0.002
IgG positive	2	14	16	
Both IgM and IgG Positive	4	10	14	
Dengue NS1 antigen Positive	1	3	4	
Total	26	58	84	

Table No.8:Association of patient's usage of mosquito coils/nets/repellents and dengue serology

Dengue Serology	Patients usage of mosquito coils/ nets/repellents		Total	p-value
	No	Yes		
IgM Positive	40	10	50	< 0.03
IgG positive	14	2	16	
Both IgM and IgG Positive	11	3	14	
Dengue NS1 antigen Positive	4	0	4	
Total	69	15	84	

period. Recent flood in Pakistan made the situation worse. Researchers have identified that co-circulation of DEN-2 and DEN-3 was responsible for the 2006 out-break in Karachi. Primary and secondary cases were seen in both groups. Cases with DHF showed marginal association with DEN-2. Introduction of a new serotype (DEN-3) and or a genotypic shift of endemic serotype (DEN-2) are the probable factors for the recent out-break of DHF in this region. Dengue infection is caused by any of 4 different serotypes of the virus (DEN-1, DEN-2, DEN-3, and DEN-4). After an incubation period of 2-8 days after an infective mosquito bite, the disease usually begins with sudden onset of fever and headache[2]. As mentioned above that dengue fever is endemic in Pakistan with seasonal rise in cases. However, recently, the transmission of dengue fever has intensified in the country with increased incidence and geographic expansion. Apart from the KPK province, cases have also been reported from the provinces of Punjab, Sindh, and Balochistan[5].

In our study no significant association was detect-

ed between dengue fever and demographic variables like age, sex, educational qualification, occupation and marital status. This is comparable with the results of Fatima Mukhtar et al[4] and Khalida Shaikh et. al[6]. While in a study conducted in district Swat, male population was found to be greatly affected (68.6%) than female (31.3%) and the infection rate was less in children[7]. And yet another study shows that males were 69% infected by dengue virus and the female were 31% in the same district i.e. Swat[8]. Ole Wichmann et al conducted a study of the same nature in Thailand and found that children are more (65 %) affected than adults (35 %)[9]. In a similar study A.A.N. Kholedi, O. Balubaid, W. Milaat, I.A. Kabbash and A. Ibrahim on the other hand detected in their study in Jeddah, Saudi Arabia that older age groups were also significantly more likely to be infected than those aged less than 10 years[10].

We also found in our study a significant association between dengue fever and fresh water open containers in and around the house, open containers water supply and ponds around the house. These results are similar to the results of Toan DT, Hoat LN, Hu W, Wright P, Martens P, who investigated the risk factors in a case control study in Hanoi, Vietnam, and found that that living in rented housing, living near uncovered sewers, and living in a house discharging sewage directly into to ponds were all significantly associated with dengue fever (DF) and dengue hemorrhagic fever (DHF). They also identified that people living in an unhygienic house, or in a house discharging sewage directly to the ponds were 3·4 times and 4·3 times, respectively, more likely to be associated with DF/DHF[11]. In another study, conducted by Heukelbach J, de Oliveira FA, Kerr-Pontes LR and Feldmeier H in Fortaleza, north-east Brazil[12], the significant risk factors identified were receptacles in the garden or courtyard, plants with temporary water pools on the property, gutter to collect rainwater, uncovered water storage container, uncovered overhead water tank, and no waste collection. Socio-economic variables were not associated with dengue fever. These findings are also almost the same as our study.

Housing is important and basic need for human being. Selection of area for housing, use of material and its proximity to other houses all contributes to increase risk. Surroundings of housing should be clean so the disease producing virus and bacteria cannot enter the house. Mostly people sleep in open environment due to hot climate and load shedding. This is again making them vulnerable for dengue fever. Other main reasons for these diseases is high occupancy in small space, reasons can be cultural or financial restraints. In the current study when the association of dengue fever and sleeping habit like sleeping in open air was analyzed, a very strong association between these two variables was determined and so sleeping out door is considered a high risk in the causation of dengue fever. Studies have also shown that increased temperature, increased rainfall, and increased humidity were each associated with increased risk of dengue[13].

In our study the anti-mosquito measures like the use of mosquito coils, nets and repellants creams were identified as a major factor in the prevention of dengue fever. While in a study in Thailand it is reported that higher number of unprotected containers increased the likelihood of the house being infested with one or more adult *Aedes aegypti* and surprisingly, houses of respondents that used mosquito coils or had screening on doors and windows were significantly more likely to be infested (odds ratio =2.0) with adult Ae. Aegypti[14]. In a study by Itrat A et al it was found that use of anti- mosquito spray was the most prevalent (48.1%) preventive measure. About one-half (51.1%) of those interviewed were cognizant of the fact that the dengue mosquito breeds in clean standing water. Most of the people knew that the mosquito usually bites either at sunset (57.5%) or at sunrise (44%). Mosquito sprays and mosquito mats were considered the most common choices for prevention, stated by 54.9% and 50.1% of the sample, respectively. Preventive practices regarding dengue were consistent with the knowledge about these practices, with majority of the respondents relying on mosquito sprays (48%) and mosquito mats and vaporizers[2].

CONCLUSION

Dengue infection has emerged as a major health concern in Southeast Asia especially Pakistan. The problem is emerging and is on the rise in Peshawar. Till a specific vaccine or an antiviral agent become available, we have to rely on early identification of risk factors associated with developing complications of dengue fever; just like the warning features specified by WHO as well as the ones identified in this study. The risk factors identified in our study are habit of sleeping in open air, water pans for animals around the house, pond around the house, empty containers in the house, source of water supply, screening of windows, patient's usage of anti-mosquito measures like coils/ nets/repellents and patients contact with dengue patient. This integrated analysis of the eco-social determinants of dengue fever transmission risk contributes to improved understanding of the dynamics of dengue transmission in Peshawar. Our study shows various well-known risk factors of dengue fever which are components of human behavior, can be addressed through modifications of municipal services. The social and demographical contexts and lifestyles of people, particularly in Peshawar, will significantly influence transmission and all information on this population will support dengue prevention and control programs. So a proactive approach is needed to prevent this communicable disease and its complications. Family practice also has opportunity for research-based evidence on Dengue fever and more interventional research is required in community to eradicate this problem. On-going public awareness campaign need to be strengthened and vigorous cam-

paign need to be initiated at all levels. Family doctors in primary health care setting have an opportunity not only give the best possible supportive care to their patients but also educate them regarding the spread of Dengue fever and vector control.

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