

Dengue Outbreak in Khyber Pakhtoonkhwa, Pakistan. 2013

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Abstract:

This study was conducted to evaluate the Epidemiology, Clinical Characteristics and virological characteristics of Dengue fever and Dengue hemorrhagic fever. In this survey 8911 patients - 72.66% male and 27.33% female - were investigated by visiting hospitals and infected areas of Khyber Pukhtunkhwa. During our study we visited different areas of Khyber pakhtunkhwa (Swat, Mardan, Malakand, Lower Dir, Shangla, Mansehra, Buner and Haripur), the dengue infection rate being high in Swat - 8343 (93.62%). The infection rate was less in children. The death rate was 57 (0.63%) and in the 20-40 years of age population, the infection rate was much higher. The characteristic symptoms were vomiting (70.17%), splenomegaly (28.56%) and abdominal pain (49.12%). The rate of primary infection was (85.24%) and secondary infection was (14.76%). The major factor involve in this epidemiology was the migration of infected individual form other infected areas. Due to no vaccines available in the market the disease can reemerge in the future.

Key words: Dengue fever, Dengue Hemorrhagic fever, Epidemiology, Clinical Findings.

1. Introduction

Dengue fever has become the major cause of mortality and morbidity in tropical and subtropical areas in several past decades globally (Sarkar et al. 2011).

Dengue virus belongs to the genus Flavivirus, family Flaviviridae, having four distant serotypes (DENV-1 to DENV-4). According to an estimate, the risk of dengue virus transmission is in 2.5 billion people of tropical and subtropical areas distributed in 100 countries (Guedes et al. 2010). Dengue fever is an arthropod-borne disease transmitted by *Aedes aegypti* and *albopictus* by blood-feeding or by transoviral transmission (De Figueiredo et al. 2010).

South Asia is declared as endemic area for dengue and dengue hemorrhagic fever by World Health Organization (WHO). About 50 million dengue infections are estimated every year by WHO currently. In America 890000 cases of dengue were reported, of which 26000 were dengue hemorrhagic fever (DHF) only in 2007 (Jahan 2011).

In Pakistan the dengue virus is now endemic; in the post monsoon periods, the virus circulates throughout the year with a peak incidence. The situation is made worse by the recent floods in Pakistan (Jahan 2011).

Dengue type 1 and 2 were detected in sera of children in Karachi through serological studies (Khan et al. 2007; Akram et al. 1998). In 2005, outbreak of DHF in Karachi DEN-3 infection was reported by Jamil et al. (2007). In 2006, outbreak of Karachi the circulation of DEN-2 and DEN-3 were reported by Khan et al. (2008). Cases with dengue infection were reported in the 2008 outbreak of Lahore. 17 samples were checked through real-time PCR, in which infection of DEN-4 was detected in 10 patients, DEN-2 in 5 patients and DEN-3 in 2 patients (Humayoun et al. 2010).

In Pakistan dengue virus infection was reported to have

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made several outbreaks. In 1982 the first dengue infection in Pakistan was documented from Punjab in which out of 174 patients, 12 were found positive for dengue virus. The collection of samples was done in 1986 and 1978 respectively. In 1994 the first outbreak of DHF was reported by Chan and colleagues, who tested 10 patients for dengue virus in which they observed DEN-1 and DEN-2 in 3 patients (Fatima et al. 2011).

In the current study we aimed to demonstrate the epidemiology, clinical and laboratory findings associated with Dengue Fever (DF) and Dengue Hemorrhagic Fever (DHF) in the recent outbreak of Khyber Pukhtunkhwa.

2. Methods and Materials

This survey was conducted in different districts of Khyber Pakhtunkhwa in order to study the critical infection rate of dengue in the recent outbreak of 2013. The study was carried out from August to November 2013. The data was collected from the hospitals that admitted patients as well as at the homes in which patients presented dengue infection symptoms and fulfilling the diagnostic criteria of dengue fever and dengue hemorrhagic having positive IgG , IgM and NS1 anti-dengue antibodies. For the determination of primary and secondary infection, rapid tests were done through strips. Tourniquet test was also done to know about the condition of fever. All the infected patients were examined thoroughly for Petechiae, Abdominal pain, Splenomegaly (enlarged liver), Epistaxis, Gum bleeding, Haematemesis, and vomiting. The data about signs, symptoms and laboratory analysis were collected. According to the WHO severity grades the patients were categorized into DF and DHF (Khan et al. 2008). The patients presenting symptoms as petechiae, purpura, and bleeding from the mucosa, gastrointestinal tract, hematemesis or melena and positive tourniquet test were categorized in DHF. Five ml blood was collected from each patient along with a proforma containing

the whole information of respective patients. The blood samples were immediately brought to the Zoology department of Abdul Wali Khan University Mardan (AWKUM), Buner Campus, Khyber Pukhtunkhwa.

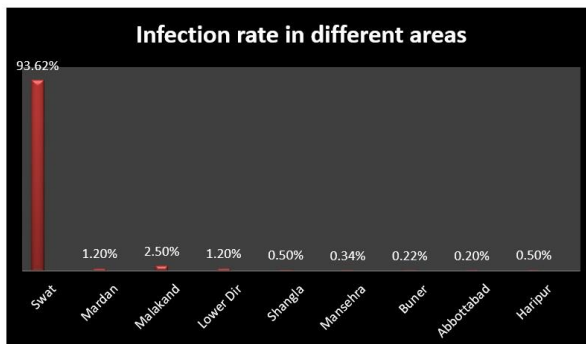
3. Results

3.1. Epidemiological and demographic findings

Khyber Pakhtunkhwa (KPK) formerly called as NWFP is located in the north-west of the country. It is a beautiful province of Pakistan due to its location and natural beauty. The total population of this area is spread on 74,521 km². At the west and south it is connected with the Federally Administered Tribal Areas (FATA), at the north-east to the Gilgit–Baltistan, at the east to Azad Kashmir, at south-east to the Punjab and the Islamabad Capital Territory, at southwards to Baluchistan province and at north-west to Afghanistan. The capital of KPK is Peshawar, which is the largest city.

3.2. Burden of infection rate in different areas

The rate of dengue infection was high in Swat, that was 8343 (93.62%), 112 (1.2%) in Mardan, 223 (2.50%) in Malakand, 111 (1.2%) in Lower Dir, 48 (0.5%) in Shangla, 31 (0.34%) in Mansehra, 20 (0.22%) in Buner, 18 (0.20%) in Abbottabad and 5 (0.05%) in Haripur. The infection rate is shown in the graph 3.2.



Graph 3.2: Infection rate in different areas of Khyber pakhtunkhwa

3.3. Sex and age wise distribution of dengue infection

We investigated 8911 cases of Dengue fever patients out of which 6475 (72.66%) were male and 2436 (27.33%) were females. Most of the patients belonged to the district Swat and the infection rate was low in other districts as compared to first one. Most of the affected patients were of 21-40 years. Figure 3.3 shows the age and sex wise distribution ratio of Dengue infected patients.

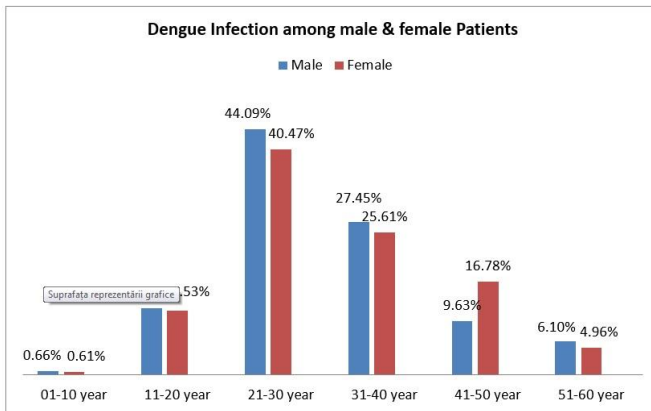


Figure 3.3: Table show Dengue Infection among male & female Patients (n=8911).

3.4. Laboratory Tests and clinical features.

The most common symptoms among the infected patients observed were fever (100%), vomiting (70.17%), and abdominal pain (49.12%), while splenomegaly was 28.56%, Petechiae 14.43% and gum bleeding 5.69%. In figure 3.4 the common symptoms recorded of dengue fever (DF) and dengue hemorrhagic fever (DHF) are shown.

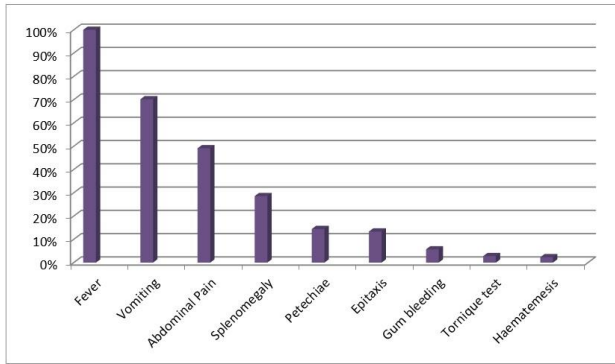
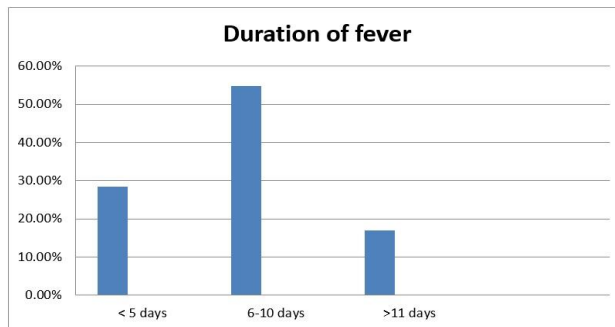


Figure 3.4: Patients presenting signs & symptoms of dengue fever and dengue hemorrhagic fever (n=8911)

The duration of fever in the patients affected with dengue was of differentiated pattern. The duration of fever in most of the patient was from 6-10 days. The Graph 3.5 shows the duration of fever in dengue patients.



Graph 3.5: Graph showing duration of fever in patients (n=8911)

In the study the condition of fever of the patients was variable, the fever of 3595 (22.46%) was continuous, 10127 (63.29%) was intermittent and 2278 (14.23%) was remittent. Table 3.6 shows the condition of fever in patients identified with dengue fever.

Continuous N (%)	Intermittent N (%)	Remittent N (%)
2001 (22.45%)	5639 (63.28%)	1268 (14.22%)

Table 3.6: Condition of fever of Dengue patients (n=8911)

In the anti-dengue antibodies the ratio of NS1 was 4941 and IgG, IgM was 1534 in males and 1738, 698 respectively in females. The table 3.7 shows the ratio of anti-dengue antibodies.

Anti-dengue Antibodies	Male	Female
NS1	4941 (76.30%)	1738 (71.34%)
IgG, IgM	1534 (23.69%)	698 (28.65%)

Table 3.7: Table showing Anti Dengue Antibodies in patients (n=8911)

Platelets counts were recorded from the clinical records of the patients. In Table 3.8 the frequency of platelets count is shown.

Platelets count / cmm	Frequency	Percentage %
> 50,000	1427	16.01%
50,000-100,000	2726	30.59%
100,000-150,000	4758	53.39%

Table 3.8: Table showing platelets count/cmm among dengue patients (n=8911)

The rate of infection increased in rainy months and the rate became much high in September and October. This might be due to the well-established breeding of *Aedes* larvae in raining months. Monthly infection rate is shown in graph 3.9

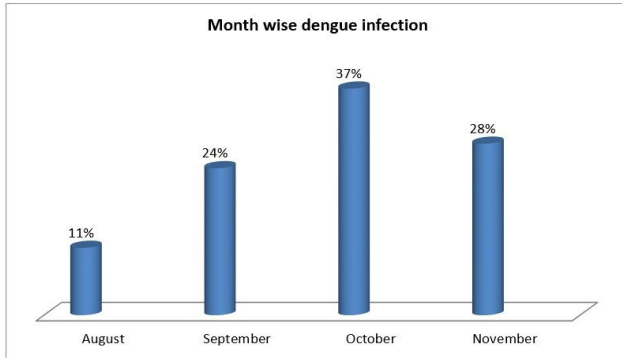


Table 3.9: Graph showing the month wise dengue infection (n=8911)

4. Discussion

We surveyed the information of dengue patients in the recent outbreak of Khyber Pakhtunkhwa in 2013, which was a big outbreak of dengue in the history of the Khyber Pukhtunkhwa and which has affected a great population of about 8911 with 57 deaths.

Unprecedented population growth and unplanned urbanization are the two main factors that have led to the emergence of dengue virus infection in tropical developing countries (Gubler 1998). Such conditions are found in the Khyber Pakhtunkhwa because it is a beautiful province of Pakistan due to its location and natural beauty. It is located in the lap of mountainous ranges; the larger part of Khyber Pakhtunkhwa is covered with mountains and hills. The network of river swat is distributed in all areas of the Khyber Pakhtunkhwa and these areas receive water from river Swat for irrigation and other purposes, which provides sufficient breeding grounds for mosquitoes.

In 1985, a research was conducted to study the prevalence of dengue virus infection in Pakistan. It showed that about 50-60% of the Pakistanis, especially those living in Karachi were Haemagglutination inhibition (HI) antibody positive for West Nile, Japanese encephalitis and DENV-2

Flaviviruses. These cases rapidly increased from July to October in patients ranging from 6 to 20 years of age (Cobelens et al. 2002). Analysis of monthly dengue cases showed peak incidence from August to October 2006. This pattern is consistent with reports from other endemic countries (Gupta et al. 2006; Lai et al. 2004; Islam et al. 2006) and correlates well with the hot summer and monsoon season which provide ideal breeding conditions for *Aedes aegypti*. Similarly in our study the infection gradually increased from August to November, in August infection rate was 11%, in September it was 24%, in October it reach 37% to and in November it was 28%. This might be due to the well-established breeding of *Ades* larvae. High frequency of dengue fever (DF) was reported in younger population from the study of the outbreak of dengue viral fever in Karachi, Pakistan from June 1994 to September 1995 (Qureshi et al. 1997). In Southeast Asia DHF was the main cause of hospitalization of young children and it was considered that the DHF is the disease of children under 15 year old (Gubler 1998). The highest incidence during 2003 outbreak in India in Delhi revealed that the infection rate was among young adults (Singh et al. 2005), whereas in the previous studies the infection rate has been indicated high in children (Kittigul et al. 2007). According to Sajid et al. (2012) 35 cases of Dengue fever were recorded out of which 20 patients were male and 15 were females. According to Khan et al. (2007) out of a total of 15040 patients (63.2% male and 36.8% female), 3952 (26.3%) tested positive for dengue IgM antibody. Regarding the previous studies that show the high infection rate in the males as compared to females, similar results are found in our study. In our study out of total 911 patients 627 (68.82%) were male and 284 (31.17%). In our study the infection rate in children was low and was 12.71% in males and 12.15% in females, while the infection rate was high in the age of 21-40 - 71.55% in male and 66.09% in the female population.

According to Sajid et al. (2012) most of the patients had platelet count between 50,000-100,000/cmm and 4 patients had counts below 50,000/cmm. According to Khan et al. (2007) thrombocytopenia with an overall mean platelet count of 85.5 cells/mm³ was noted in 81.4% of patients. The lowest platelet count was 5 cells/mm³.

The abdominal pain and vomiting were found prominent presenting symptoms (Anuradha et al. 1998). According to Khan et al. (2007) the symptoms of the patients were vomiting in 110 (64%), abdominal pain in 50 (29.1%) and diarrhea in 46 (26.7%). Body aches were reported by 41 (23.8%). The majority of these patients had right hypochondrial tenderness on examination. A diffuse erythematous or maculopapular rash, over the face, upper torso and/or lower limbs was noted in 65 (37.8%) of the patients. The exact mechanism underlying gastrointestinal symptoms in dengue virus infections is not fully known. Gastrointestinal manifestations of DF are mainly in the form of bleeding or liver function abnormalities (Rama Krishna et al. 2006). Liver injury from dengue virus is mediated by its direct infection of hepatocytes and Kupffer cells (Ling et al. 2007). Liver involvement is usually associated with severe complications such as gastrointestinal bleeding, secondary to the associated coagulation defects (Wichmann et al. 2004). The quite similar characteristic symptoms were found in our study that was vomiting (70.17%) and abdominal pain (49.12%).

According to Khan et al. (2007) 83.6% of adult patients presented to the hospital with signs and symptoms compatible with DHF. A similar age distribution was also noted during the 1994—1995 outbreak in Karachi. This observation is consistent with reports from other endemic countries. A 3-year study from India showed a maximum number of cases between the ages of 21 and 30 years (Gupta et al. 2006). In the 2001 outbreak in Kaohsiung city in Taiwan, the mean age of the patients with DHF was 55 years (Lai et al. 2004). Similarly in Singapore,

young adults were predominantly affected by DHF in the 2005 outbreak (Low et al. 2006). In our study most of the affected patients were of 21-40 years.

Analysis shows that the high incidence of dengue cases was from August to October 2006. A similar pattern of infection is reported from other dengue endemic countries (Gupta et al. 2006; Islam et al. 2006; Lai et al. 2004). In our study the infection rate of dengue was at peak from August to November 2013. According to the previous studies of dengue fever (DF), the usual duration of fever is reported as being up to 10 days (Shah and Katira 2005). In our study the duration of fever of the patients was from 6-10 days and most of the patients recover in this period.

Regarding the previous literature upon Dengue outbreaks in Pakistan, were observed during a single dengue outbreak in Khyber Pukhtunkhwa, which shows that dengue cases show cyclical deviation with high epidemic years and non-epidemic years. This seasonality is determined by high transmission of this disease, which is influenced by characteristics of the host, the vector and also the agent.

5. Conclusion

In Pakistan the dengue virus has caused many endemics since 1994 till 2011. The present study shows the epidemics of first dengue outbreak in Khyber Pakhtunkhwa in 2013, which had badly affected the population, that is about 8911. Till now no vaccines are available for the disease because the major problem in developing vaccines is the four distant serotypes of the virus (Idrees and Ashfaq 2012). For this, public awareness campaigns are needed to make aware the people to use mosquito repellent nets, mosquito quills, mosquito repellents etc in order to minimize the chance of infection. Family support is needed for the infected patients; fluids are to be given orally if they do not tolerate the fluids orally intravenous fluids are to

be given. Aspirin should be avoided and paracetamol are to be used as pain killer. IgG, IgM & NS1 anti dengue antibodies were detected through strips.

Author Contribution

Mr. Naveed Akhtar (M.Sc research student) carried out this research work under the supervision of Mr. Jehangir Khan (lecturer Zoology department AWKUM Buner Campus Khyber Pakhtoonkhwa Pakistan). Mr. Asar Khan also took part in this research.

Acknowledgment

I am very thankful to Chief Executive and MS of all the concerned hospitals who help me during my field work.

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