

Acute Dengue Infection in the Western Terai Region of Nepal

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ABSTRACT

Introduction: Dengue fever is an emerging mosquito borne disease in Nepal claiming substantial morbidity and mortality. The objective of the study was to find out frequency of acute dengue infection in patients from the hospitals of the western Nepal.

Methods: The study was conducted between August 2007 and July 2008 in patients visiting hospitals of the western terai of Nepal with chief complains of fever. The sero-diagnosis of acute dengue infection was determined by enzyme linked immunosorbent assay among 239 patients visiting Lumbini Zonal Hospital, Butwal; Bheri Zonal Hospital, Nepalgunj; Bardiya District Hospital, Bardiya and Mahakali Zonal Hospital, Mahendranagar.

Results: The anti-dengue IgM positivity was 29.3 %. There was slight male preponderance with a male to female ratio of 1.2:1. Out of the total positive cases, the highest positive cases (75.7 %) were from the age group 15 - 50 years followed by < 15 years old (15.7 %). Out of four hospitals, the highest positive cases (54.3 %) were in Lumbini Zonal Hospital, Butwal. The age and gender were independent predictors to dengue virus infection. The highest numbers of dengue positive cases were in October (52.6 %). The association between dengue disease and the month was statistically significant.

Conclusions: The dengue positivity was estimated in acute patients from hospitals of western Nepal by enzyme immunoassay. Therefore, the serological marker can be used to diagnose acute patients of dengue during outbreaks.

Keywords: dengue, ELISA, post monsoon, sero-diagnosis

INTRODUCTION

Dengue is an acute febrile illness caused by a virus that is transmitted from humans to humans via species of infected *Aedes aegypti* mosquito. Four dengue virus (DENV) serotypes, i.e. DEN1-4, belonging to the genus flavivirus, are responsible for the disease. It manifests as dengue fever (DF), dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS).¹ Specific

symptoms vary according to the severity of dengue.² Previous studies have shown that all the serotypes of DENV are found in Nepal.^{3,4,5} Nepal reported indigenous transmission of dengue cases³, although DF had already been observed in foreign visitors earlier.^{3,6} Because of the open border, Nepal is vulnerable to more serious consequences of DENV infection as infected people can

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easily come across and the virus might be transmitted by the vector, which is already evident in several locations of the terai region. The aim of the study was to determine the frequency of acute dengue infection using the serological method. The present study would be helpful by providing information on the epidemiology of the disease in the western terai region of Nepal.

METHODS

This was a cross-sectional study conducted between August 2007 and July 2008 in which samples were collected during the post-monsoon period (August - November 2007). The serum samples were collected from Mahakali Zonal Hospital, Mahendranagar; Bardiya District Hospital, Bardiya; Bheri Zonal Hospital, Nepalgunj and Lumbini Zonal Hospital, Butwal. Patients with high fever and clinical symptoms suspected of DENV infection (according to WHO guideline)⁷ visiting the hospitals were included in the study, while patients infected with malaria and enteric fever were excluded. Similarly, subjects with previous Japanese Encephalitis immunizations were also excluded from the study. Patients' personal details about the symptoms and age, sex, etc, were obtained through a questionnaire method by direct interview after taking the consent.

Dengue antibodies were measured with enzyme linked immunosorbent assay, i.e. IgM capture ELISA (PanBio, Australia), and results interpreted according to the manufacturer's instructions. The cut-off value was obtained by multiplication of the average absorbance of calibrators and calibration factor (provided in the kit, i.e. 1).

The collected data was analyzed to find out the age, sex, hospital and month wise distribution of the cases. Chi square test was used as a statistical tool. The statistics was done using Win Pepi software version 7.9, 2008.

RESULTS

Among 239 suspected dengue cases investigated during the study period, 132 (55.2 %) were males and 107 (44.8 %) were females. The patients under

investigation were of the age range 1 - 78 years. The highest numbers of cases (175, 73.2 %) were from the age range of 15 - 50 years followed by 35 cases (14.6 %) above 50 years and 29 cases (12.1 %) below 15 years. The highest numbers of cases (n = 118) were from Lumbini Zonal Hospital, Butwal followed by Mahakali Zonal Hospital, Mahendranagar (n = 54), Bardiya District Hospital, Bardiya (n = 39) and Bheri Zonal Hospital, Nepalgunj (n = 28) (Table 1).

The dengue positivity was 29.3 % (70/239). Out of the total 70 positive cases, the highest numbers of positive cases were in the age group 15 - 50 years and the highest numbers of positive cases were in Lumbini Zonal Hospital, Butwal. The ratio of dengue positive cases in male to female was 1.1:1 (37:33). The association of the disease with age (P = 0.2) and sex (P = 0.6) was statistically insignificant (Table 2). Among four months, the highest number of positive cases 37 (52.9 %) were in October. Likewise, 17 (24.3 %) in November, 10 (14.3 %) in September and 6 (8.6 %) in August (Fig 1). The association between the month and the occurrence of disease was statistically significant (P = 0.01).

Table 1. Distribution of the subjects by sex, age and hospitals

Samples collected	239
Male:female ratio	1.2:1(132:107)
Age range (years)	
< 15	29
15 - 50	175
> 50	35
Hospitals	
LZH	118
MZH	54
BDH	39
BZH	28

LZH: Lumbini Zonal Hospital, MZH: Mahakali Zonal Hospital, BDH: Bardiya District Hospital, BZH: Bheri Zonal Hospital.

Table 2. Distribution of total positive cases

	LZH		BZH		BDH		MZH		
	Male	Female	Male	Female	Male	Female	Male	Female	
< 15	1	3	0	0	4	3	0	0	11
15 - 50	16	13	2	1	9	9	1	2	53
> 50	3	2	1	0	0	0	0	0	6
Total	20	18	3	1	13	12	1	2	70

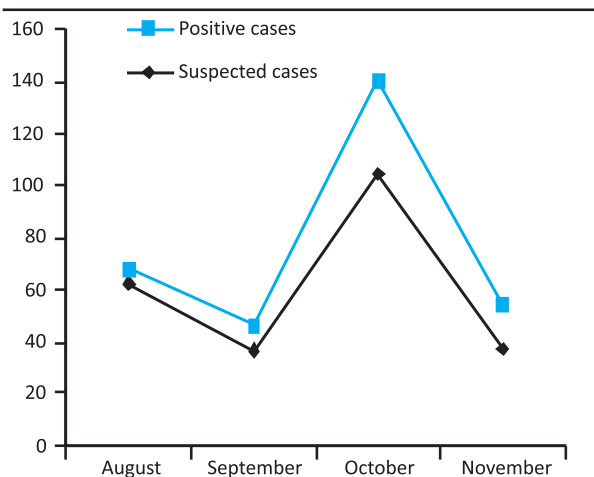


Figure 1. Month wise distribution of dengue cases.

DISCUSSION

A major proportion of the study subjects had been exposed to DENV as reflected by the increasing seropositivity of DENV infection. Information on the sero-epidemiology of DENV specific IgM among Nepalese patients would provide a clue to the extent of DENV infection in Nepal. In this study, 29.3 % were found to have been suffering from acute dengue infection. However, DHF and DSS cases were completely absent. The result coincides with a previous study carried out in Nepal.⁸

The change in demography and society due to urbanization, migration, transportation, deforestation, ecology, etc, creates an environment that helps in the emergence of dengue.⁹ Moreover, dengue has already been evident in neighbouring countries – China and India. The *Aedes* vector can easily come across the territory because of modern transportation, although the vector is already found in Nepal. The open border in the terai region also increases the transmission of the disease as infected people can come across with the vector and transmit the disease. These might be the reasons for the higher positivity of dengue in the study.

The study was based on the commonly used ELISA test (99 % sensitivity and 84.4 % specificity), which also detects cross-reacting antibodies to other flavivirus, such as Japanese encephalitis virus (JEV).^{10, 11} The false positive results might be minimal because IgM capture ELISA is highly specific as only 10.7 % DENV infection cross-reacted with JEV antigen.¹² Subjects with previous JE immunizations were excluded from the study; therefore, false positive results because of cross reactivity were minimal.

The age wise distribution showed that the highest positive dengue cases were in the age group of 15 - 50

years which constitutes 75.7 % of the total positive cases followed by the age group <15 years comprising 15.7 % and 8.6 % in the > 50 years age group. The result is in harmony with the data obtained in the outbreak of dengue in Nepal in the year 2006 in which the highest dengue positive cases were recorded in the age group greater than 15 years.³

The reason for the lower number of isolates in the younger age group could be due to the improper clinical selection of cases. Dengue fever in a younger age group manifests as rather an undifferentiated illness, such as an upper respiratory like infection accompanied by headache and mild gastrointestinal complaints. The disease in adults is severe enough that patients feel sick and demand medical attention.

Out of 70 positive cases, the highest numbers of positive cases (37, 52.9 %) were in October followed by November (17, 24.3 %). The result is consistent with the data obtained during an outbreak of dengue in Nepal in which 75 % of DF cases were reported in October and a few positive cases in September and November.³

The cases coincide mainly with the post monsoon period of subnormal rainfall because the relative prevalence and distribution of *Ae. aegypti* larval indices are highest during the post monsoon period. Heavy rainfall subsequently leads to a decrease in temperature during the later part of the monsoon period. The temperature remains almost constant and subsequent rainfall further leads to a decrease in the temperature. The result is an increase in relative humidity and the abundant stocks of fresh water reservoirs generated due to rain develop optimum conditions for mass breeding and propagation of the vector and transmission of the virus.¹³

The highest numbers of positive cases were in Lumbini Zonal Hospital, Butwal. The comparatively higher positive cases might be due to the abundance of the vector, the *Aedes* species mosquitoes, and the circulation of multiple dengue viral strains. Butwal is one of the busiest stations from where people go to other parts of the country as well as to India and vice versa. So, DEN infected people might come across with the vector and transmit the disease.

The cross reactivity to JEV was not performed. Additionally, paired serum samples were not taken during laboratory tests. These remained the limitations of the study.

CONCLUSIONS

The positivity of dengue was estimated in acute patients from hospitals of western Nepal by IgM capture ELISA and the most affected group was the 15 - 50 years.

Thus, ELISA can be used to diagnose acute patients of dengue and people of all age groups should be educated about the mode of disease transmission and prevention. Artificial collections of water should be discouraged in order to prevent breeding of *Aedes mosquitoes* and enhanced vector control programmes should be commenced.

ACKNOWLEDGEMENTS

The authors thank Everest International Clinic and Research Centre (EICRC), different participating hospitals, Kiran Pandey and Dr. Durga Dutta Joshi for their cooperation.

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