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ECO-EPIDEMIOLOGICAL ANALYSIS OF DENGUE INFECTION IN RAJKOT, GUJARAT

Vachhani Nishith A. Head-Dept. of Quality Assurance, Life Blood Centre, Rajkot

Khorajiya Shaimhusen Dept. of Microbiology, Shree M. & N. Virani Science College, Rajkot

Vaghasia Rutva Dept. of Microbiology, Shree M. & N. Virani Science College, Rajkot

ABSTRACT

Background: Dengue virus belongs to family Flaviviridae, having four serotypes that spread by the bite of infected *Aedes* mosquitoes. It causes a wide spectrum of illness from mild asymptomatic illness to severe fatal dengue haemorrhagic fever/dengue shock syndrome (DHF/DSS). Approximately 2.5 billion people live in dengue risk regions with about 100 million new cases each year worldwide. The incidence of dengue has increased 30-fold over the last 50 years.

Methodology: This survey study is designed to find out relationship of dengue fever with climatic factor such as rainfall, temperature and humidity during the period of five months (i.e. August 2016 to December 2016).

Results: Total 1226 samples were analyzed for serological test of dengue. 154 (12.56%) found to be positive for dengue test including 108 male and 46 female cases. Maximum number of dengue cases reported was in 21-30 years age group. Maximum positive cases were detected in November.

Conclusion: Dengue is one of the major public health problems in India. A large number of cases are reported in the monsoon and post-monsoon period. Preventive measures should be taken both at personal and government level to reduce morbidity and mortality from dengue.

KEYWORDS : Dengue, Dengue Haemorrhagic Fever, Dengue Shock Syndrome

INTRODUCTION

Dengue infection (DI) is amongst the most important emerging viral diseases transmitted by mosquitoes to humans, in terms of both illness and death. The worldwide large-scale reappearance of dengue for the past few decades has turned this disease into a serious public health problem, especially in the tropical and subtropical countries.[8] It is estimated that 52% of the global population are at the risk of contracting Dengue fever (DF) or dengue hemorrhagic fever (DHF) lives in the South East Asian region.[5] In most of the countries, dengue epidemics are reported to occur, during the warm, humid and rainy seasons, which favor abundant mosquito growth and shorten the extrinsic incubation period as well.[3] Dengue is an acute viral infection with potential fatal complications. Dengue fever was first referred as "water poison" associated with flying insects in a Chinese medical encyclopedia in 992 from the Jin Dynasty (265420 AD). The word "dengue" is derived from the Swahili phrase Kadinga pepo, meaning "cramp like seizure". The first clinically recognized dengue epidemics occurred almost simultaneously in Asia, Africa, and North America in the 1780s. The first clinical case report dates from 1789 of 1780 epidemic in Philadelphia is by Benjamin Rush, who coined the term "break bone fever" because of the symptoms of myalgia and arthralgia.[6-7] Although DF has been endemic in India from the nineteenth century, dengue haemorrhagic fever (DHF) was first reported in 1987.[9] The first major widespread epidemic of DHF and dengue shock syndrome (DSS) was reported in 1996 with four serotypes reported to be in co-circulation. The disease manifestations range from an influenza-like disease known as dengue fever (DF) to a severe, sometimes fatal disease characterized by haemorrhage and shock, known as dengue hemorrhagic fever/dengue shock syndrome (DHF/DSS), which is on the increase.[2] Dengue fever and dengue haemorrhagic fever/dengue shock syndrome are caused by the four viral serotypes referred to as DV1, DV2, DV3 and DV4 transmitted from viraemic to susceptible humans mainly by bites of *Aedes aegypti* and *Aedes albopictus* mosquito species. Recovery from infection by one serotype provides lifelong immunity against that serotype but confers only partial and transient protection against subsequent infection by the other three.[4]

Dengue virus is a positive stranded encapsulated RNA virus and is composed of three structural protein genes that encode the nucleocapsid or core protein (C), a membrane associated protein (M), an envelope protein (E) and seven nonstructural (NS) protein genes: NS1, NS2a, NS2b, NS3, NS4a, NS4b, and NS5.[10] Among the NS proteins, NS1 is a highly conserved glycoprotein, which is essential for virus replication. During the acute phase of DENV infection, NS1 protein is found associated with intracellular organelles and can be transported via cellular secretion pathway to the infected cell surface. NS1 protein was also released from infected mammalian cells and may then be found circulating in the sera of patients.[14] The WHO 2009 classification divides dengue fever into two groups: uncomplicated and severe, though the 1997 WHO classification is still widely used. The 1997 classification divided dengue into undifferentiated fever, dengue fever (DF), and dengue haemorrhagic fever (DHF). Four main characteristic manifestations of dengue illness are (i) continuous high fever lasting 27 days; (ii) haemorrhagic tendency as shown by a positive tourniquet test, petechiae or epistaxis; (iii) thrombocytopenia (platelet count <100×10/l); and (iv) evidence of plasma leakage manifested by haemoconcentration (an increase in haematocrit 20% above average for age, sex and population), pleural effusion and ascites, etc.[15] NS1 (nonstructural protein 1) is a highly conserved glycoprotein that is essential for the viability of dengue virus and is produced both in membrane associated and secretory forms by the virus. The detection of secretory NS1 protein represents a new approach to the diagnosis of acute DV infection.[11] Treatment is supportive with fluid replacement for plasma leakage, detected through regular monitoring for rising hematocrit levels, being the key feature. Although early diagnosis is useful in triaging patients, it could have a central role in dengue case management at a future time when antiviral drugs for dengue-the subject of intense research interest-become available for clinical use.[12] A rapid and accurate dengue diagnosis is of paramount importance for effective control of dengue outbreaks.[13]

MATERIALS & METHODS:

Retrospective study was conducted for a period of five months in Rajkot, Gujarat, India. A total of 1226 patients of both the sex and age were enrolled in this study. A consent form along with an information sheet giving details of the study (nature of the study, what will be expected from the participants, and expected risks and benefits) were provided. The details were also explained verbally to the potential participants. A predesigned and pretested questionnaire was used to collect the following socio-demographic and clinical manifestation of serologically diagnosed cases: Age, Sex, Clinical manifestations: fever, vomiting, headache, abdominal pain, hepatomegaly, myalgia, bleeding manifestations, generalized weakness, cough, splenomegaly, rashes, diarrhea etc. Monthly data of total rainfall, temperature and relative humidity for the study period was obtained from Meteorological Department of Rajkot and retrospectively analyzed. SD BIOLINE Dengue Duo (NS1 Ag and IgG/IgM) was used for the detection of dengue-specific antigen and antibodies. One step, immunochromatographic assay designed to detect both dengue virus NS1 antigen and antibodies IgG/IgM against dengue virus in human

whole blood, serum or plasma. 3 drops (about 100 µl of serum/plasma/whole blood) was added in to a sample well followed by addition of 4 drops (about 90~120µl) of assay diluents into the round assay diluent well. Results of the test were read after 15-20 minutes. Detection of at least one component (NS1, IgM, or IgG) was considered to be positive for sero diagnosis.

RESUTS:

Dengue infection is observed to be a seasonal disease in Rajkot. A case was included if there was high fever with clinical symptoms suggestive of dengue infection as per WHO criteria. Out of total 1226 (815 male, 411 female) suspected cases of dengue, 154 (12.56%) including 108 male and 46 female were found positive for serological test. 143 patients were positive for Dengue NS1 Ag and 11 were positive for Dengue IgG and/or IgM. [Table-1] Highest number of dengue cases was reported in 10-20 years age group 47 (30.52%). Dengue cases in age group 21-30 years and 31-40 years were 46 (29.87%) and 16 (10.39%), respectively. However, dengue cases in <10 years, and >40 years age group were reported to be 20 (12.99%) and 25 (16.23%), respectively. [Table-2] According to intensity of rainfall, weather data was divided in two periods, namely; monsoon period: from August – September, 2016 and post monsoon period: from October – December, 2016. During the monsoon period, only 8 cases (5.19%) were confirmed serologically positive in the month of August, and 34 cases (22.08%) in the September. Dengue-specific antigen-antibody positive cases were mainly reported during the post monsoon period, 32 (20.78%) in October and with maximum number of cases 75 (48.70%) cases reported during the month of November and 5 (3.25%) cases in the December. [Table-3]

TABLE – 1 Sex-wise distribution of Dengue cases

	Aug.16	Sept.16	Oct.16	Nov.16	Dec. 16
Male	6	25	20	54	3
Female	2	9	12	21	2
Total	8	34	32	75	5

TABLE – 2 Age group wise distribution of Dengue cases

Month	< 10 Y	10-20 Y	21-30 Y	31-40 Y	> 40 Y
Aug.16	0	4	3	0	1
Sept.16	5	14	6	6	3
Oct.16	7	7	9	5	4
Nov.16	7	21	27	5	15
Dec.16	1	1	1	0	2
Total	20	47	46	16	25

TABLE – 3 Temperature–Humidity–Rainfall & Dengue cases

	Aug. 16	Sept. 16	Oct. 16	Nov. 16	Dec. 16
Temp. (oC)	28	29	29	26	22
Humidity (%)	82	78	56	49	50
Rainfall (mm)	75	60	47	31	4
Positive Cases	8	34	32	75	5

DISCUSSION:

In our study, the largest proportion of serologically positive cases was recorded in the post monsoon period, which is in agreement with study of Chakravarti A. *et. al.* and Rathore M. et. al. Most of vector borne diseases exhibit a distinctive seasonal pattern and climatic factors such as rainfall, temperature and other weather variables affect in many ways both the vector and the pathogen they transmitted.[1] we found maximum number of patients in age group of 21-30 years. A similar study by Pardeshi *et. al*., in KEM hospital, Mumbai revealed maximum number of dengue cases were in the age group of 21-30.[16]

CONCLUSION:

In developing countries like India, building of laboratory capacity for diagnosis and combat mode ready preparedness for the management of dengue cases in emergency situation may reduce dengue related mortality. This can be achieved in a wider scale through an integrated approach through the community, professionals and the public health departments. Straightforward community education to reduce breeding sites for mosquitoes performed better than chemical spraying. The combination of the NS1 antigen and antibody tests could increase the diagnostic efficiency for early diagnosis of dengue infection. The morbidity and the mortality of DHF can be reduced by early diagnosis, hospitalization and symptomatic care. This prospective study highlighted rain, temperature and relative humidity as the major and important climatic factors, which could alone or collectively be responsible for an outbreak. More studies in this regard could further reveal the correlation between the climatic changes and dengue outbreaks, which would help in making the strategies and plans to forecast any outbreak in future well in advance.

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