Prevalence of Dengue Viral Infection in Febrile Patients of Kanpur Nagar, Uttar Pradesh, India in Tertiary Medical Care

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Abstract

Background: Dengue fever (DF) is one of the most important emerging diseases of the tropical and subtropical regions, affecting urban and peri-urban areas. **Aim:** The aim of the study is to know the overview of the symptomology, gender, epidemiology, age, and seasonal variability in a tertiary care setup. **Materials and Methods:** An analysis of 117 suspected dengue patients of all age groups of either sex at a Medical College located at Kanpur Nagar, Uttar Pradesh, India from 2019 to 2020 revealed 31 cases seropositive for dengue. **Results:** The lower age group (0–20 years) was the most affected than the others with the incidence proportion of 26.49%. Males were affected more than females with the predominant symptom of fever followed by headache and back pain. The positive cases were found to be higher during November and December months of the study period. **Conclusion:** The study concluded that every individual in the community to get awareness of the dengue and to take necessary action for prevention and control of DF.

Keywords: Dengue, Mosquito, Seropositive, Vector, Virus

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Introduction

Dengue fever (DF) is one of the most important emerging diseases of the tropical and subtropical regions, affecting urban and peri-urban areas. Dengue viruses are widely distributed throughout the tropical and subtropical areas of the world specially India. In India, the risk of dengue is dramatically increased in recent years due to rapid urbanization, lifestyle changes, and deficient water management. Improper water storage practice, in urban, periurban, and rural areas lead to proliferation of mosquito breeding sites. DF is a mosquito borne tropical infectious disease caused by the dengue virus. It is the fastest growing mosquito borne viral infection transmitted by *Aedes aegypti* (Tiger Mosquito) and *Aedes albopictus* mosquitoes also known as break bone fever. Dengue Virus (DEN) infection in human results from four virus serotypes encompasses DEN-1, DEN-2, DEN-3 and DEN-4, which belongs to *Flavivirus* genus of family *Flaviviridae*. *Flavivirus* is a small (50 nm) virus that contains single-stranded RNA as genome. Based on the symptoms, World Health Organization (WHO) classifies the dengue virus infection into DF, dengue hemorrhagic fever (DHF), and dengue shock syndrome (DSS).[1]

Dengue disease was first identified during World War II, but Dengue-like disease had been previously described in the ancient eastern hemisphere. The well-described dengue symptoms were reported in the Philadelphia outbreak of 1780 (Halstead, 2008). Dengue disease has been documented in all continents except Antarctica. It is mostly found in tropical and subtropical areas, but rarely reported in Africa (Halstead, 1980). It is possible that black Africans are genetically resistant and rarely express severe disease, even though a high prevalence of antibodies has been found (Halstead, 2001). Dengue virus was isolated in a laboratory in 1943–1944 (Gubler, 2002). Inoculation of virus known to be harmful to humans does not produce infection in several animals, including chickens, guinea pigs, rabbits, hamsters, and rats, but does infect primates (Halstead, 2008). Infection of primates may be asymptomatic but with viremia occurring at levels sufficient to infect mosquitoes. The WHO considers dengue as a major

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global public health challenge in the tropic and subtropic nations. Dengue infection affects more than 100 countries. The first reported case of dengue like illness in India was in Madras in 1780, the first virologically proved epidemic of DF in India occurred in Calcutta and Eastern Coast of India in 1963–1964. India has mostly tropical weather; the climate of India is strongly influenced by the south west monsoon. Enhanced rainfall has been associated with increased aedes breeding in some area of India.[2]

With approximately 2 billion people living in tropical and subtropical regions of the world, and an additional roughly 120 million people each year travelling to these regions, a large share of the world's population is at risk of contracting dengue. It has been suggested that between 50 and 100 million cases of DF

occur annually with an incidence rate of 2.5–5.0% of the 2 billion people worldwide at risk. These cases result in hundreds of thousands of hospitalizations, and about 20,000 deaths each year.[2]

Dengue virus infection causes a spectrum of clinical manifestation ranging from unapparent to fatal hemorrhagic disease. Classic dengue or break bone fever is characterized by the sudden onset of fever, intense headache myalgia, arthralgia, and rashes. DF/DHF, one of the dangerous diseases, can be detected by tourniquet test. The symptoms of this disease include high fever, severe frontal headache, pain behind eyes, muscles and joint pain, loss of appetite, measles-like rashes over chest and upper limbs, nausea, and vomiting. Clinical presentations of the febrile phase include a milder non-localizing fever syndrome, or influenza-like illness. Immediately after the febrile phase, the disease may progress to the more severe but less common forms of disease, which include DHF (DHF; a febrile illness followed by abnormally low platelet counts, withdrawal of plasma into the pleural and abdominal cavities, and hemorrhagic symptoms), and DSS (DSS; DHF with evidence of systemic hypo perfusion). Although death occurs rarely in the febrile phase, it is most commonly the result of hypo perfusion after the development of DHF.[3]

A dengue vaccine, Dengvaxia®, has been registered in several countries. The protective efficacy of Dengvaxia® against virological confirmed dengue in the respective individual trials has been estimated to range b/w 50.2% and 76.6% for different ages and serotypes. Dengvaxia® has not yet been approved by the Ministry of Health and Family Welfare, Govt. of India. Dengue causes severe disease in babies and children more so in healthy babies. Women are at high risk than man.[4]

Dengue can be prevented through elimination of mosquito breeding places because the mosquito will breed in any container where water is allowed to settle. These containers are often found in and around homes, schools, workplace, and other place where people gather. Get rid of stagnant water from places where mosquitoes breed, such as in old containers, flowers pots, and used tyres. Serological diagnosis by detection of IgM and IgG antibodies to dengue in the serum is essential for monitoring the treatment. Commercial kits are available, which can help in differentiating between primary and secondary dengue infections. A rapid dengue detection test kit is used for the preliminary diagnosis. Enzyme-Linked Immunosorbent Assay (ELISA) tests are very useful in dengue serology. They detect IgM and IgG in the serum and thus are able to distinguish primary and secondary infection (Who.int/world-health-day, Vector-Borne-Diseases).[5]

Since the occurrence of dengue infections and complications such as DHF and DSS is increasing, this study was conducted to study the incidence of dengue infections, to evaluate the seropositivity dengue virus in a tertiary care setup, thereby to create awareness of the preventive measures to be taken by the general public and the health-care system, and to improve our infrastructure for diagnosing and treating dengue infections.

Materials and Methods

The present study was conducted at the Department of Microbiology, G.S.V.M. Medical College and Hospital, Kanpur Nagar, Uttar Pradesh, India, from September 2019 to March 2020. Detailed history of the patients reported was recorded in survey form. Before data collection, a verbal consent has been taken from the patients. The samples were collected from clinically suspected dengue patients diagnosed on the basis of any or all of the signs

and symptoms of dengue, such as high fever, rash, headache, arthralgia, muscles, and joint pain. A total of 117 serum and blood samples were collected aseptically and properly transported to the VDRL laboratory, Department of Microbiology, G.S.V.M. Medical College and Hospital, Kanpur Nagar, Uttar Pradesh, India, for the confirmatory diagnosis of dengue using commercial available dengue IgM Capture ELISA (MAC-ELISA) Kit (Panbio®). The test was performed as per the protocol described by the manufacturer. The data entry and the analysis of result were performed with the SPSS computer software package (IBM SPSS, version 22; SPSS Inc., Chicago, IL, USA). (Reference: IBM Corp. (2016) IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp). All relevant variables were calculated using descriptive statistics.

Results and Discussion

At first, dengue virus was isolated successfully from mice which were inoculated with serum of infected patients in 1943 at Japan, while in India, from serum samples of the United States of American soldiers in 1944 at Kolkata.[6] The first epidemic of clinical dengue-like illness was reported in Chennai (earlier Madras) way back in 1780 and large outbreak occurred in Kolkata (earlier Calcutta) in 1963–1964 and huge mortality was recorded during the outbreak.[7] Further, India become endemic to dengue virus and witnessed many outbreaks in the past few decades.

The present study was a hospital-based observational study conducted for a period of 1 year. The total number of reported cases was 117 and the samples were collected from all them to test for dengue virus infection. Out of the total samples, 31 patients were found to be seropositive for dengue either by NS1 or IgM MAC-ELISA with an incidence proportion (risk) of 26.5% [Table 1]. According to the National Vector Borne Disease Control Programme, Uttar Pradesh ranked seven in 2019 among the Indian states in dengue cases and deaths. It also stated that the number of cases rose from 2892 in 2015 to 10557 cases in 2019. However, due to the improvised health-care facilities, being the higher incidence rate of the infection compared with the earlier years, the mortality rate was very fewer (0.246%) in 2019 (Dengue/DHF situation in India, NVBDCP).

In general, in India, all age groups are susceptible for dengue infection.[8] Younger age group under 15 years is more prone for dengue infection.[9] The current study [Table 2] also revealed that the lower age groups (0–20 years) was affected in higher percentage (31.42%) than the middle (21–40 years) age groups (30.35%) and higher age (>40 years) group (11.53%). Many studies conducted during various epidemic also reported that the 5–12 years old age group was highly infected such as in Delhi (1996), Madhya Pradesh (2001 and 2003), Tamil Nadu (1998 and 2003), West Bengal (1990 and 2005), and Uttar Pradesh in 2003–2006.[7] Role of immunity could play a possible role in higher incidence in the lower age group patients than others.[10]

The proportion of male (30.90%) was infected higher than the female (22.95%) with the ratio of (M:F) being 1.35:1 [Table 3], which shows the male has higher chances of susceptibility than the females. Our study is in accordance with Chakravarti *et al.*, Singh *et al.*, and Sinha *et al.*.[9,11-13] Our observations are also in contrast

Table 1: Incidence proportion (risk) of dengue fever in Kanpur Nagar

Total number of cases	Dengue positive cases	Risk*
117	31	26.5%

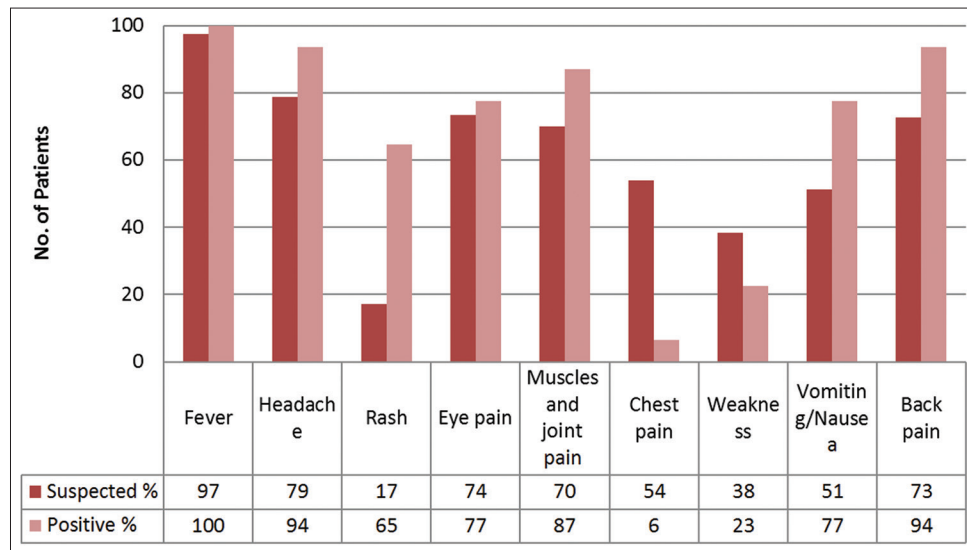*Incidence proportion (risk)=31/117×100=26.49%

Figure 1: Clinical presentation of patients reported for Dengue at Hospital, Kanpur Nagar

Table 2: Distribution of age groups-wise seropositive cases in Kanpur Nagar

Age group	Total cases	Positive cases	Percentage
0–20 years	35	11	31.42
21–40 years	56	17	30.35
>40 years	26	03	11.53

Table 3: Sex distribution of dengue seropositive cases in Kanpur Nagar

Sex	Total cases	Positive cases	Percentage
Male	55	17	30.90
Female	61	14	22.95
Total	117	31	26.50
Ratio	M:F	30.90/22.95	1.35:1

Figure 2: Seasonal distribution of dengue cases at Kanpur Nagar

	Nov,19	Dec, 19	Jan,20	Feb,20	Mar, 20
Reported Cases	3	55	15	37	7
Positive Cases	2	22	4	3	0

with the findings of Dar *et al*. and Mehendale *et al*.[14,15] The possible reason could be for this gender difference is the sex ratio, as India is male predominant country.

Clinical presentation of patients reported suspected for dengue at Kanpur Nagar Hospital is presented in Table 4. The predominant symptoms (both suspected and positive cases) with which the patients presented in the current study [Figure 1] were fever (97% and 100%), followed by Headache/Cephalgia (79% and 94%), back pain/Backache (0% and 94%), eye pain/Ophthalmalgia (74% and 77%), muscle and joint pain/Myalgia and arthralgia (70% and 87%), chest pain (54% and 6%), and vomiting/Emesis (51% and 77%). A very few patients had a complaint of rashes (17% and 65%). The study conducted by Sripriya and Lee *et al*., found that fever followed by myalgia/arthralgia, hemorrhagic manifestations, headache, and rash was the most common symptoms, which is in accordance with the present study.[8,16]

Tropical countries like India, irrespective of season, virus transmission occurs through vector mosquitoes, but the infection rate escalates at the beginning of the rainy season due to the stretched life span (high humidity) and decreased extrinsic incubation period (elevated temperature). Many studies reported that the majority of the dengue cases observed then and consequent to monsoon months in India[17] which is also supported by our present study that the confirmed (positive) cases were found
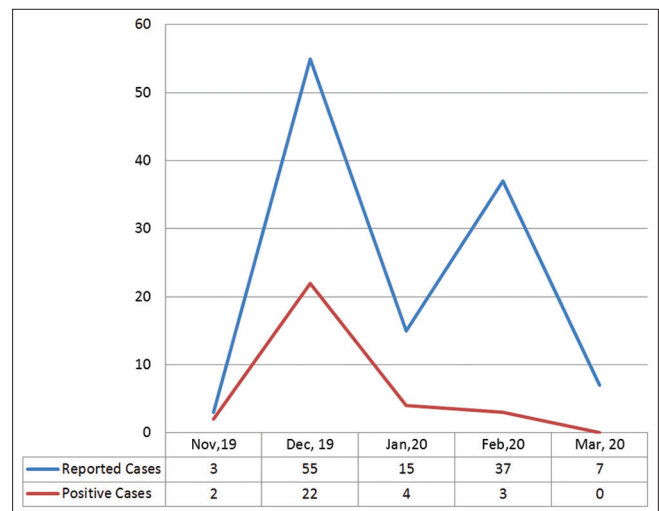
to be higher following rainfall in November and December months over others [Figure 2]. Further, during rain, mosquito multiply rapidly actively due to substandard wastewater management systems,[18,19] and human-made water logged enables a conducive environment in urban areas December month had a higher report of dengue suspected cases (55), followed by February month. Our study is in contrast others findings particularly outbreaks taken place during the summer months in Rajasthan, Maharashtra, Tamil Nadu, and throughout the whole year in Lucknow.[20-24]

In our study, both rapid dengue method [Figure 3] and IgM MAC ELISA [Figure 4] were performed. Out of nine tested samples, seven found to be positive by rapid dengue test, whereas 24 found to be positive out of 108 tested samples using IgM ELISA [Table 4]. Rapid test was positive for nine samples, IgM ELISA in 108 samples. Dengue Duo Cassette Kit (Rapid Test) is a rapid immunochromatography test, which is used detect IgM and high-titer IgG antibodies to DENV, whereas Dengue IgG Capture ELISA detects the increased concentration of IgG antibodies to DENV (serotypes 1–4), even with the secondary infection.[18,19]

Table 4: Types of test used for diagnosis of dengue cases at Kanpur Nagar

Methods	Tested	Positive	%
Rapid test	9	7	77.77
IgM ELISA	108	24	22.22
Both rapid and IgM ELISA	117	31	100
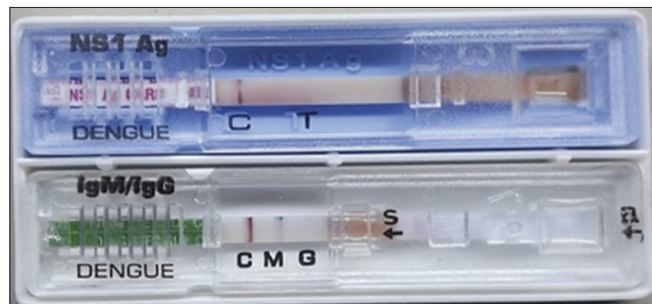
Figure 3: Dengue rapid (duo cassette) test kit showing IgM positive

Figure 4: Well of ELISA strip showing the blue color on dengue positive samples

Conclusion

From our study, we conclude that male and young age group is highly susceptible for dengue infection rather than female and middle and old age group. As the dengue infection in India has evolved rapidly and regular outbreaks have been observed. Dengue is a vector borne viral disease. Hence, it is a responsible of every individual in the community to get awareness of the dengue and to take necessary action for prevention and control of DF.

Acknowledgments

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