Original Article

Epidemiology and seropositivity of dengue fever cases in a tertiary care hospital of NCR in 2013

Shilpi Gupta[1], Sachin Bansal[2]

From [1]Department of Microbiology, Lok Nayak Hospital, Maulana Azad Medical College, New Delhi, India, [2]Department of Pathology, Narinder Mohan Hospital, Ghaziabad, Uttar Pradesh, India

Correspondence to: Dr. Shilpi Gupta, Lok Nayak Hospital, Maulana Azad Medical College, New Delhi, India. Phone: +91-9654398679. E-mail: shilpigupta15nov@yahoo.com

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ABSTRACT

Background: Dengue has been known to be endemic in India for over two centuries. Dengue fever is more commonly seen in adults and older children. Clinical presentation varies from mild to severe fatal forms; therefore, laboratory diagnosis is very essential. **Objective:** The surveillance study was conducted to analyze dengue seropositivity and epidemiological profile among patients with dengue fever like illness who presented to the outpatient department or was admitted to a tertiary care private hospital in Ghaziabad, Uttar Pradesh from January 2013 to December 2013. **Materials and Methods:** Serum samples from 1186 clinically suspected dengue fever cases (671 males and 515 females) were received in serology laboratory over the period of 1 year. The samples were screened for non-structural protein 1 (NS1) antigen and IgM and IgG dengue specific antibodies by rapid immunochromatographic test. **Results:** Out of total 1186 blood samples tested, 574 were found to be positive for dengue infection. Of 574 blood samples, NS1 Ag was positive in 498 (86.7%) cases while IgM with or without NS1 Ag was positive in 15 (2.6%) cases. **Conclusion:** A detailed and continuous epidemiological surveillance is required for monitoring the incursions and spread of dengue viruses. This will help in undertaking and implementing effective control and management strategies.

Key words: *Dengue specific IgG, Dengue specific IgM, Dengue, Epidemiology, Immunochromatographic test, Non-structural protein 1 Ag*

Dengue is the most common and widespread arthropod-borne viral infection of humans in the world today [1]. Globally, it is estimated that 2.5 billion people are at risk of dengue among which 975 million of these live in urban areas of the tropical and subtropical countries of South-East Asia, the Pacific and the Americas [2]. Each year approximately 100 million cases occur, with 500,000 hospitalizations. Global death out of which is recorded in more than 20,000 persons [3].

Dengue viruses belong to the family flaviviridae and transmitted to vertebrate host mainly by *Aedes aegypti* and *Aedes albopictus* mosquitoes. The dengue virus has antigenically four distinct serotypes called as DEN1, DEN2, DEN3, and DEN4. Each serotype of the virus produces a specific lifelong immunity but it provides only a short term cross immunity [4,5]. Classical dengue fever is characterized by high-grade fever, headache, myalgia, retro-orbital pain, vomiting, maculopapular rash, leukopenia, and thrombocytopenia. Dengue hemorrhagic fever and dengue hemorrhagic shock syndrome are severe potentially fatal complication, often associated with an infection by second serotype [6].

The first epidemic of a clinical dengue like illness in India was recorded in Chennai, in 1780 [7]. In the last decades, dengue has assumed pan India proportion. Among 18 endemic states and union territories, outbreaks and deaths have been reported from Northern states of Delhi, Uttar Pradesh, Punjab, and Haryana; Southern states of Andhra Pradesh, Tamil Nadu, and Karnataka; Western states of Gujarat and Rajasthan and Eastern states of West Bengal. In fact, the case fatality rate has been >1% over the last 10 years [8]. According to the estimates of National Vector Borne Disease Control Programme (NVBDCP), 75,808 cases were reported in the year 2013, in India [9]. The increased burden of dengue cases in India in recent times is due to unplanned, urbanization and migration of population from rural to urban areas with a lack of proper sanitation facilities [10].

This surveillance study was conducted to assess the magnitude of dengue virus and its epidemiological profile in national capital region in year 2013 to develop an early warning signal for timely detection of an impending outbreak.

MATERIALS AND METHODS

This study was undertaken on the serum specimen of patients with clinical suspicion of dengue fever like illnesses, who presented in the outpatient department or were admitted to a 350 bedded hospital tertiary care private hospital in Ghaziabad, Uttar Pradesh from January 2013 to December 2013. During the study period, a total

of 1186 consecutive nonrepetitive serum samples from clinically suspected dengue cases were received in the Microbiology Laboratory of the Hospital. Patient details such as age, sex, number of days of fever, and other relevant clinical features like vomiting, rash, retro-orbital pain, and thrombocytopenia were noted on a preformed pro forma. Serum samples were tested for dengue non-structural protein 1 (NS1) antigen if the patient presented with fever <5 days and dengue specific IgM and IgG antibodies if fever lasted for 5 or more than 5 days or as demanded by the clinicians. The samples were processed in the laboratory using commercially available rapid diagnostic tests (RDTs). These RDTs are based on immunochromatographic (ICT) detection of NS1 antigen and anti-dengue IgM and IgG antibodies. The well of the test kit contains recombinant dengue virus envelope proteins-colloidal gold conjugates and anti-dengue NS1 Ag-colloid gold conjugate. On addition of patient's sample along with buffer, antigen-antibody complex is formed which migrates along the length of the test strip by capillary action where it is captured by the anti-dengue NS1 antigen and antihuman IgM and antihuman IgG in the case of NS1 antigen and anti-dengue IgM and IgG, respectively. The results were graded as reactive (visible band) or non-reactive (no band). Results were considered valid after checking control band included in the assay for antigen and antibodies. The primary dengue infection was defined by visible IgM band without a visible IgG band, whereas a secondary infection was defined by a positive IgG band with or without a positive IgM band [11].

RESULTS

Out of the total 1186 blood samples tested for dengue viral infection, 574 (48.39%) blood samples tested positive for one or more parameters. Among positive 574 cases, sex wise distribution of dengue cases showed male predominance with male to female ratio 1.4:1. Figure 1 shows the distribution of the percentage of dengue cases in various age groups. The highest number of cases belongs to age group 16-30 years followed by 31-45 years of age group. Figure 2 shows the monthly distribution of dengue fever cases in year 2013. The maximum numbers of cases were observed in the month of October.

The presence of NS1 antigen in 498 cases and the presence of dengue specific IgM antibodies with or without NS1 antigen in 14 cases indicated the primary infection (89.19%). The presence of dengue specific IgG antibodies with or without any other parameter in 62 patients further categorized cases into secondary infection (10.8%) (Figure 3).

DISCUSSION

Dengue has emerged as a major public health problem in India. Dengue infection has been known to be endemic in many parts of India for over two centuries. Detection and hence prevalence of all 4 dengue serotypes in India has now rendered India hyper endemic [12]. The identification of dengue cases is possible by distinct clinical features, but the usual presentation is with varied

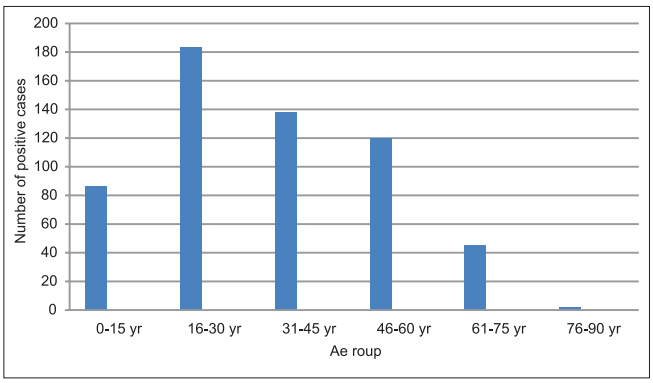

Figure 1: Age-wise distribution of dengue fever cases

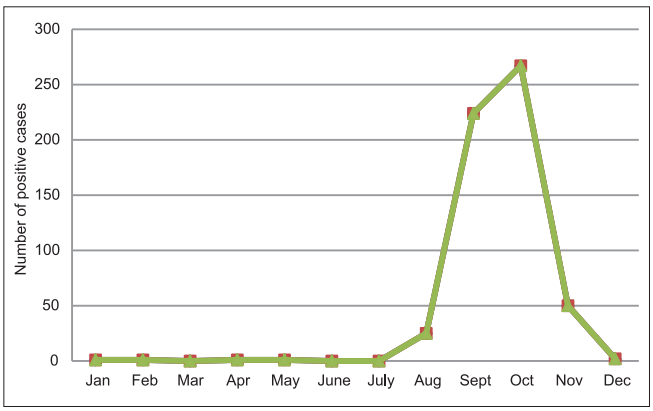

Figure 2: Month-wise distribution of dengue fever cases in 2013

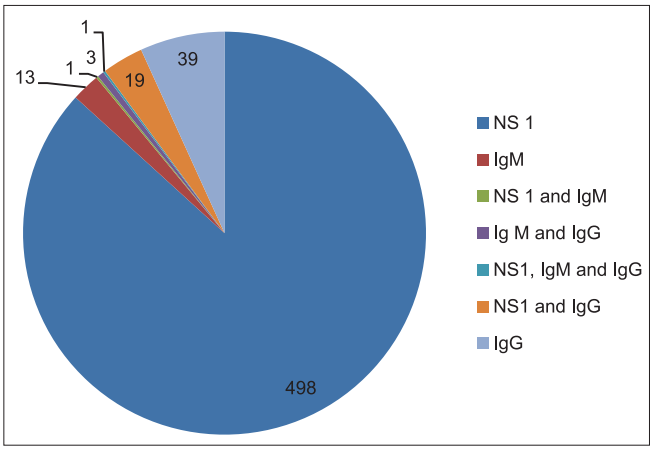

Figure 3: Distribution of dengue fever cases on basis of antigen and antibodies distribution

manifestations. The laboratory diagnosis of dengue infection is crucial, as the infection manifests with broad spectrum of clinical presentations and late diagnosis can lead to significant morbidity and mortality [4]. No study from this part of state, i.e., Uttar Pradesh is recorded to report the seropositive cases from patients with clinically suspected cases of dengue fever.

During 1 year of the study period, we found 48.39% of dengue positive cases among clinically suspected patients. This was near to the prevalence reported by Gupta et al. in Delhi who reported 44.56% of confirmed dengue infection serologically [13]. However, another study conducted in Delhi reported 19.66% prevalence of dengue infection [14]. Various other studies have

reported the prevalence in between the range of 19.7% and 31.3% [15-17].

The male to female ratio in this study was found to be 1.4:1 showing male predominance as reported by various other authors [13,18]. This may be the representation of those who visited the hospital to seek care rather the truly infected population. However, an epidemiological study conducted in West Bengal stated no statistically significant difference in distribution of dengue/diastolic heart failure across gender [19]. The highest numbers of cases in our study were recorded in age group 16-30 years which were also reported by Bhaswati et al. Smita et al. [1,4]. Similar findings were reported in few hospital based studies [13,20]. Our findings were in contrast to those of some Indian studies which had reported the vulnerability of younger children including infants to dengue infection [15,21]. However, in a study conducted in Kolkata reported maximum cases in the age group 0-10 years with female preponderance [22]. The month wise analysis of dengue infection in our study revealed the increase of dengue cases gradually from July onward with a peak in the month of October. This seasonal pattern of increase in dengue cases in monsoon and post monsoon period was in accordance with earlier reported studies [1,4]. The presence of stagnant water after rainfall favors the mosquito breeding which leads in an increased occurrence of dengue cases. Hence, it is recommended to undertake the preventive measures at the very onset of the monsoons and continued until post monsoon months.

During the peak season or an epidemic rapid diagnosis of dengue fever is the key to proper management of the patient. Laboratory diagnosis is mandatory before labeling any clinically suspected case of dengue fever as dengue virus infection. Earlier studies have demonstrated a high circulating level of NS1 antigen in dengue infection by enzyme immunoassay [23,24]. Antibodies to the virus appear after the viremia starts declining. IgM anti-dengue antibodies appear followed by IgG anti-dengue antibodies [4]. In this study, we used rapid ICT kit which detects dengue specific antigen and antibodies. This helps to differentiate between primary and secondary infection [17]. The rate of primary infection in our study was found to be 89.19% which was higher than secondary infection (10.8%). A similar finding was observed by Saini et al. [17]. In contrast, Ratho et al. reported secondary infection significantly higher than primary infection [25]. In this study, 39 (6.8%) were found to be old dengue secondary cases with only IgG antibodies and 23 (4%) were found to be true secondary dengue cases with IgG detected along with other parameters. Saini et al. explained in the study that the true endemicity is reached when the infection in adult declines and children are affected more by the infection [17]. The diagnostic efficiency for early diagnosis of dengue infection increases if tested with a combination of NS1 antigen and antibodies [26]. In our study, we also observed the advantage of dengue package as reported by Arya et al. [27]. Dengue package is comprehensive detection of dengue virus NS1 antigen, anti-dengue IgM antibody, anti-dengue IgG antibody, and platelet enumeration [27]. The package helped in early detection and management of dengue cases. Hence reducing morbidity and mortality associated with dengue infection.

The study showed a significant prevalence of dengue infection among suspected dengue patients in national capital region. Our study showed the primary infection significantly higher than the secondary infection. Molecular methods such as polymerase chain reaction, need well-trained laboratory personnel, and specialized laboratory, which are usually not available in hospital settings but rapid screening methods like ICT test was found to be valuable in our study.

CONCLUSION

Our study had shown an alarming result especially during peak season. The clinicians and laboratory personnel need to plan ahead of time and considering diagnostic tools as an important aspect should arrange for reliable rapid diagnostic devices for timely diagnosis. Although rapid diagnostic methods provide result in less than an hour and were found to be helpful for early screening of dengue cases in our study but are not type specific. Further studies are required for evaluation of their diagnostic accuracy and comparison of their sensitivity and specificity with ELISA methods.

REFERENCES

1. Bandyopadhyay B, Bhattacharyya I, Adhikary S, Konar J, Dawar N, Sarkar J, et al. A comprehensive study on the 2012 dengue fever outbreak in Kolkata, India. ISRN Virol. 2013;2013:5.
2. Guzman MG, Halstead SB, Artsob H, Buchy P, Farrar J, Gubler DJ, et al. Dengue: A continuing global threat. Nat Rev Microbiol. 2010;8 12 Suppl: S7-16.
3. Streit JA, Yang M, Cavanaugh JE, Polgreen PM. Upward trend in dengue incidence among hospitalized patients, United States. Emerg Infect Dis. 2011;17(5):914-6.
4. Sood S. A hospital based serosurveillance study of dengue infection in Jaipur (Rajasthan), India. J Clin Diagn Res. 2013;7(9):1917-20.
5. Abrol A, Dewan A, Agarwal N, Galhotra A, Goel N, Swami H. A clinic-epidemiological profile of dengue fever cases in a peri-urban area of Chandīgarh. Internet J Epidemiol. 2007;5(7):1-5.
6. Lal M, Aggarwal A, Oberoi A. Dengue fever - An emerging viral fever in Ludhiana, North India. Indian J Public Health. 2007;51(3):198-9.
7. Kennedy RS. Some notes on an epidemic of dengue from fever among Indian troops, Calcutta. Indian Med Gaz. 1912;17(11):42.
8. World Health Organization. Regional Office for South-East Asia, New Delhi: Trend of Dengue Cases and CFR in SEAR Countries; c2009. Available from: http://www.searo.who.int/en/section332/Section2277.htm. [Last accessed on 2016 Dec 10].
9. National Vector Borne Disease Control Programme. Dengue/Dengue Hemorrhagic Fever; 2013. Available from: http://www.nhp.ov.in/nvbdcp. [Last accessed on 2016 Dec 10].
10. Bennett SN, Holmes EC, Chirivella M, Rodriguez DM, Beltran M, Vorndam V, et al. Selection-driven evolution of emergent dengue virus. Mol Biol Evol. 2003;20(10):1650-8.
11. Available from: http://www.panbiodenue.com/product/dengue -duo-cassette. [Last accessed on 2012 July 21].
12. Park K. Park's Textbook of Preventive and Social Medicine. 22nd ed. Jabalpur: Banarasidas Bhanot; 2013. p. 224-32.
13. Gupta E, Dar L, Kapoor G, Broor S. The changing epidemiology of dengue in Delhi, India. Virol J. 2006;3:92.
14. Sharma Y, Kaur M, Singh S, Pant L, Kudesia M, Jain S. Seroprevalence and trend of dengue cases admitted to a government hospital, Delhi - 5-year study (2006-2010): A look into the age shift. Int J Prev Med. 2012;3(8):537-43.
15. Garg A, Garg J, Rao YK, Upadhyay C, Sakhuja S. Prevalence of dengue among clinically suspected febrile episodes at a teaching hospital in North India. J Infect Dis Immun. 2011;3(5):85-9.

16. Ukey P, Bondade S, Paunipagar P, Powar R, Akulwar S. Study of seroprevalence of dengue fever in central India. Indian J Community Med. 2010;35(4):517-9.
17. Saini S, Kinikar AG, Deorukhkar S, Bhalerao D, Roushani SB. Epidemiology and seropositivity of dengue fever cases in a rural tertiary care hospital of Western Maharashtra, India. IJBAR. 2013;4(7):473-7.
18. Chakravarti A, Matlani M, Kashyap B, Kumar A. Awareness of changing trends in epidemiology of dengue fever is essential for epidemiological surveillance. Indian J Med Microbiol. 2012;30(2):222-6.
19. Hati AK. Studies on dengue and dengue haemorrhagic fever (DHF) in West Bengal state, India. J Commun Dis. 2006;38(2):124-9.
20. Kumar A, Rao CR, Pandit V, Shetty S, Bammigatti C, Samarasinghe CM. Clinical manifestations and trend of dengue cases admitted in a tertiary care hospital, Udupi district, Karnataka. Indian J Community Med. 2010;35(3):386-90.
21. Kabilan L, Balasubramanian S, Keshava SM, Thenmozhi V, Sekar G, Tewari SC, et al. Dengue disease spectrum among infants in the 2001 dengue epidemic in Chennai, Tamil Nadu, India. J Clin Microbiol. 2003;41(8):3919-21.
22. Sarkar A, Taraphdar D, Chatterjee S. Molecular typing of dengue virus circulating in Kolkata, India in 2010. J Trop Med. 2012;2012:960329.
23. Young PR, Hilditch PA, Bletchly C, Halloran W. An antigen capture enzyme-linked immunosorbent assay reveals high levels of the dengue virus protein NS1 in the sera of infected patients. J Clin Microbiol. 2000;38(3):1053-7.
24. Dussart P, Labeau B, Lagathu G, Louis P, Nunes MR, Rodrigues SG, et al. Evaluation of an enzyme immunoassay for detection of dengue virus NS1 antigen in human serum. Clin Vaccine Immunol. 2006;13(11):1185-9.
25. Ratho RK, Mishra B, Kaur J, Kakkar N, Sharma K. An outbreak of dengue fever in periurban slums of Chandigarh, India, with special reference to entomological and climatic factors. Indian J Med Sci. 2005;59(12):518-26.
26. Blacksell SD, Mammen MP Jr, Thongpaseuth S, Gibbons RV, Jarman RG, Jenjaroen K, et al. Evaluation of the Panbio dengue virus nonstructural 1 antigen detection and immunoglobulin M antibody enzyme-linked immunosorbent assays for the diagnosis of acute dengue infections in Laos. Diagn Microbiol Infect Dis. 2008;60(1):43-9.
27. Arya SC, Agarwal N, Parikh SC, Agarwal S. Simultaneous detection of dengue NS1 antigen, IgM plus IgG and platelet enumeration during an outbreak. Sultan Qaboos Univ Med J. 2011;11(4):470-6.

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