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Original Research Article

Epidemiological analysis of dengue's one-year laboratory data in a tertiary care center in Western India

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ABSTRACT

Background: Aedes aegypti and Aedes albopictus are the primary effective vectors for the dengue virus in India. The disease is conveyed through the bite of infected mosquitoes of the Aedes species and is the most quickly expanding vector-borne viral disease globally, putting an increasing number of locations at risk.
Methods: We looked at the laboratory surveillance data and reported the percentage of dengue cases that were confirmed in the lab by month, location (urban vs. rural), and individual (age vs. gender) factors.
Results: The maximum no. of suspected cases as well as found positive were in the monsoon and post-monsoon period from July to November. The dengue suspected cases were significantly more in the adult age group than in the pediatric age group. More cases were seen in urban areas than the rural areas.
Conclusions: Serology confirmed positive dengue cases were maximum in the adult group residing in an urban area in the period of monsoon and post-monsoon period from July to November.

Keywords: Western India, Dengue, Aedes, Vector-borne, Laboratory surveillance

INTRODUCTION

Dengue is an acute systemic viral disease that has established itself globally in both endemic and epidemic transmission cycles. Dengue virus infection in humans is often inapparent but can lead to a wide range of clinical manifestations, from mild fever to potentially fatal dengue shock syndrome.[1] Dengue virus, the causative agent of dengue fever belongs to the Flavivirus genus and has four serotypes (DEN-1, DEN-2, DEN- 3, and DEN-4). In 2013, a fifth serotype of the dengue virus was detected in Malaysia.[2] Dengue, transmitted through the bite of infected mosquitoes of Aedes species, is the most rapidly spreading vector-borne viral disease globally, with an increasing number of areas at risk.[3] Both Aedes aegypti and Aedes albopictus are the main competent vectors for the dengue virus in India. There has been a 30-fold increase in dengue cases over the past 50 years in 119 countries.[4] The World Health Organization (WHO) estimates 390 million dengue infections annually and approximately 3.9 billion people live in dengue-endemic countries. Most cases approx 75% are reported from the Americas, South-East Asia, and Western Pacific regions of WHO (World Health Organization, 2009).[2,5] In India, dengue is endemic in almost all states and is the leading cause of hospitalization and inflicts significant health, economic, and social burdens on the people.[2] Although dengue is a notifiable disease in India, studies and modeling estimates suggest that the disease is grossly under-reported. Using surveillance data, the WHO estimated that 12 484 dengue cases occurred in India in 2010, whereas 32 million apparent cases were estimated based on mathematical models. Another study reported that the actual number of cases in the country was 282

times the number reported by the national vector-borne disease control programme.[6] The total number of dengue cases has significantly increased in India since 2001. In the early 2000s, dengue was endemic in a few southern (Maharashtra, Karnataka, Tamil Nadu, and Pondicherry) and northern states (Delhi, Rajasthan, Haryana, Punjab, and Chandigarh). It has recently spread to many states, including the union territories.[7] Dengue notification reflects seasonal patterns, which over the years have increased in frequency as noticed in Dengue surveillance conducted through a network of more than 600 sentinel hospitals under the National Vector Borne Disease Control Program (NVBDCP, 2018) and the Integrated Disease Surveillance Program (IDSP) (National Centre for Disease Control, 2018).[2,8] In addition to the increased number of cases and disease severity, there has also been a major shift in the geographical range of the disease. Dengue had been restricted to urban areas, but it has now spread to rural regions. The expansion of dengue in India has been related to unplanned urbanization, changes in environmental factors, host–pathogen interactions, and population immunological factors. Inadequate vector control measures have also created favorable conditions for dengue virus transmission and its mosquito vectors.[7] As case detection, case management, and vector control are the main strategies for prevention and control of dengue virus transmission so this study was done to estimate the dengue burden, pattern of disease, and health-seeking behavior in urban and rural as well in both genders[9].

Objective

To analyze laboratory surveillance data and report the proportion of laboratory-confirmed dengue by time (month), place (urban and rural), and person (age and gender) characteristics using nonstructural protein 1 (NS1 antigen) or IgM antibodies (by MAC ELISA method) against dengue virus by enzyme-linked immunosorbent assay (ELISA) as per NVBDCP/ IDSP guidelines.

METHODS

A retrospective analysis of confirmed dengue patients was done at the tertiary care hospital (SSGH Hospital). Demographic, clinical, and laboratory details from the patients enrolled in the surveillance are analyzed for a period of one year from 1st January 2018 to 31st December 2018 i.e. one year. Acute phase blood/ serum samples collected from suspected dengue fever patients (fever, fever with rash/arthralgia, or fever with hemorrhagic manifestations) reporting to tertiary care center attached to serology laboratory or samples from suspected dengue outbreaks referred by district public health authorities or hospital authorities to serology laboratory were investigated for the presence of nonstructural protein 1 (NS1 antigen) or IgM antibodies (by MAC ELISA method) against dengue virus using enzyme-linked immunosorbent assay (ELISA) as per NVBDCP/ IDSP guidelines. We analyzed the laboratory surveillance data and reported the proportion of laboratory-confirmed dengue by time (month), place (urban and rural), and person (age and gender) characteristics. The selection criteria were patients with suspected dengue having symptoms like fever, fever with rash/arthralgia, or fever with hemorrhagic manifestations. The data was collected and simplified using an Excel sheet. The statistical analysis was done in the Medcalc application. Ethical approval was not required. This was a time-bound study and all the patients were taken with the inclusion criteria during this one-year duration.

RESULTS

Analysis of data received from the serology laboratory shows that the cases are seen throughout the year among all age groups and both gender.

Table 1: Month-wise dengue distribution of suspected and % positive cases.

Month	Total number of suspected cases	Positive cases (%)
January	357	27 (7.6)
February	316	16 (5.0)
March	312	12 (3.8)
April	234	5 (2.1)
May	193	6 (3.1)
June	185	1 (0.5)
July	303	13 (4.3)
August	432	35 (8.1)
September	942	147 (15.6)
October	1850	355 (19.1)
November	1130	188 (16.6)
December	657	63 (9.6)
Total	6911	868(12.6)

A total of 6911 serum samples collected in the whole year from acute phase dengue patients were tested for the presence of dengue NS1 Ag or anti-dengue IgM antibodies by ELISA test and dengue positive for NS1 Ag or IgM antibodies were 868 (12.6%) of the total. Although, suspected cases and positive cases were reported throughout the year the maximum no. ($p<0.01$) of suspected cases 4657 (67.4%) as well as found positive 738 (85.0%) were in the monsoon and post-monsoon period from July to November still the highest no. ($p<0.01$) of suspected cases seen in October and November 2980 (43.11%) with positive being 543 (62.6%).

The dengue suspected cases were significantly more in the adult age group (>14 years) 5075 (73.4%) than in the pediatric age group ($p<0.01$) as well number of positive cases was 617 (71.1%) ($p<0.01$). The number of suspected cases 3774 (54.6%) and positive cases 578 (66.6%) were more in males than females ($p<0.01$).

More cases were seen in the urban areas (4714 suspected and 509 confirmed) than the rural areas (2197 suspected and 359 confirmed), the difference was significantly higher ($p<0.05$).

Table 2: Dengue cases distribution among age and gender.

Gender	Suspected cases			Positive cases		
	Pediatric age group (<14 years)	Adult age group (>14 years)	Total (%)	Pediatric age group (<14 years)	Adult age group (>14 years)	Total (%)
Male	1071	2703	3774 (54.6)	152	426	578 (66.6)
Female	765	2372	3137 (45.4)	99	191	290 (33.4)
Total	1836 (26.6)	5075 (73.4)	6911	251 (28.9)	617 (71.1)	868

Table 3: Suspected and positive dengue cases distribution in urban and rural population.

Place	Urban	Rural
Suspected no. of cases (%)	4714 (68.3)	2197 (31.7)
Positive cases (%)	509 (58.6)	359 (41.4)

DISCUSSION

Dengue is endemic in this part and cases suspected of dengue as well as confirmed for dengue virus were seen throughout the year but the numbers increased significantly from the month of August to November corresponding to monsoon and post-monsoon season as it is breeding season for Aedes mosquito. Findings are very much similar to other studies.[2,9,10,11]

Among the patients investigated by the Serology laboratory, dengue-suspected cases, as well as positivity, were statistically higher in males as compared with females in both pediatric as well adult age groups. The male-to-female ratio was 1.20:1. Similar findings were reported by Sharma et al and Premkumar et al.[10,11] The pattern of male predominance is consistent with the reports from several other countries and could be on account of (i) greater exposure of males to dengue-carrying mosquitoes or (ii) differences in the healthcare-seeking behavior of males and females.[2,11]

An excess of male patients for most diseases and conditions was observed among young children. Unlike adolescents and young adults, such an excess of young male patients was observed for both outpatients and inpatients with no indication that boys were preferentially being brought to health care. Studies indicate potential gender differentials in exposure-associated behaviors and activities. In addition, once becoming infected (and assuming all other things are equal), there may be biological differences between the sexes such that males may have a more severe outcome to disease relative to their female counterparts. There has been a growing recognition that biological differences between males and females based on genetic, immunological, and hormonal factors may determine the susceptibility to disease and clinical outcomes including for dengue infection. Females may mount a more vigorous immune response to infection than males.[12]

Though the cases are seen among all ages numbers are significantly higher in adults 73% of the total suspected and 71% of the confirmed cases. This finding is consistent with the meta-analysis of published studies from India until 2017 which reported the mean age of laboratory-confirmed dengue patients to be 22 years (Ganeshkumar et al).[2,9]

More no. of cases are reported from urban areas as compared to rural areas with suspected cases having urban to a rural ratio of 2.1:1. The difference is statistically significant and may be attributed to the reason that the serology laboratory is situated in metro city so the numbers seeking treatment are from urban areas, though other factors like unplanned urbanization, poor implementation of vector control measures, general public unawareness also contribute significantly to the numbers.[2-4]

CONCLUSION

The suspected cases and positive cases were reported throughout the year, but the maximum no. of suspected cases as well as found positive were in the monsoon and post-monsoon period from July to November. This suggests that more vector control measures and general public awareness should be done to reduce the transmission of dengue. The dengue suspected and positive cases were significantly more in the adult age group (>14 years) than in the pediatric age group. The number of suspected cases and positive cases was more in males than females. This is due to more exposure to men with dengue-carrying mosquitoes and differences in health-seeking behaviors. More cases were seen in the urban areas than in the rural areas. This shows that poor sanitation and unplanned urbanization have caused more cases in urban with respect to rural areas.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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