Epidemiological and demographic characteristics of dengue disease at a tertiary care centre in Saurashtra region during the year 2013

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ABSTRACT

Background & objectives: Dengue is one of the most important vector-borne viral infection which may lead to haemorrhage or even shock. The present study was conducted with an objective to study the epidemiological and demographic characteristics of dengue disease during the year 2013 in Saurashtra region of Gujarat state, India.

Methods: A longitudinal study was conducted at sentinel surveillance centre for dengue disease at microbiology department of tertiary care hospital in Rajkot, Gujarat from 1 January 2013 to 31 December 2013. A total of 4366 blood samples were collected during study period and serologically tested for dengue NS1 antigen and IgM antibody by capture ELISA testing from various districts of Saurashtra region. Patients with acute onset of illness, high grade fever, severe headache, backache, musculoskeletal pain or retro-bulbar pain with or without rashes were considered as clinically suspected case of dengue virus infection. Patient who presented with fever and found positive for Dengue NS1 Ag and/or IgM Ab was considered as a case. A pre-tested structured proforma was used as a tool for data collection. The data was entered into EpiInfo software and analyzed by using appropriate statistical test (chi-square test).

Results: Out of 4366 tested samples, 41.3% samples were found positive for dengue. Majority of samples were tested in age group 16–25 yr (33.9%) and 26–45 yr (31.1%). The ratio of male cases (60.8%) was higher than female cases. Two-third (68.7%) suspected cases were residing in urban areas of Saurashtra region. More than half of the cases (57%) were diagnosed within five days of fever by NS1 antigen test. The reporting of number of cases increased from July 2013, which reached to peak during September 2013 followed by decrease till December 2013.

Interpretation & conclusion: Dengue predominately affected males and urban population. A seasonal occurrence was reported mainly during monsoon season. A long term serosurveillance study may help to provide more information about the intensity, seasonal incidence and seasonal effect.

Key words Demography; dengue virus; epidemiology; Saurashtra region; tertiary care

INTRODUCTION

Dengue is an acute viral disease transmitted by Aedes aegypti and Ae. albopictus mosquitoes and is caused by four virus serotypes (viz. DENV-1, DENV-2, DENV-3 and DENV-4) of the genus Flavivirus¹-³. These infections may be asymptomatic or may lead to classical dengue fever (DF), or dengue hemorrhagic fever (DHF) with/without shock. Around 2.5 billion people, i.e. two-fifth of the world’s population⁴ in tropical and subtropical countries are at risk of the disease. An estimated 50 million dengue infections occur worldwide annually and about 500,000 people require hospitalization each year⁴. Epidemics of dengue are increasing in frequency worldwide⁵. Dengue infection is endemic in more than 100 countries of different WHO regions. The Southeast Asia region (SEAR) and Western Pacific regions are most affected reporting detection of all four serotypes⁶. Based on the endemicity of dengue, World Health Organization (WHO) has kept India under category A, considering the dengue as a major public health problem, leading cause of hospitalization and death among children, hyperendemicity with all four serotypes circulating in urban areas, and spread to rural areas⁷. The risk of dengue has shown an increase in recent years due to rapid urbanization, life style changes and poor water management including improper water storage practices in urban, peri-urban and rural areas, leading to proliferation of mosquito breeding sites⁸. The disease shows seasonal pattern, i.e. the cases peak after monsoon but in the southern states and Gujarat state the transmission is perennial⁹. The dengue is endemic in 31 states/union territories of India. During the year 2013, the highest numbers of cases were reported from Kerala, Odisha, Karnataka and Gujarat states⁷. Western part of Gujarat state is known as Saurashtra region and includes eight districts. The present
study was conducted with an objective to study the epidemiological and demographic characteristics of dengue disease during the year 2013 in Saurashtra region of Gujarat state, India.

MATERIAL & METHODS

The study was conducted at tertiary care teaching institute and civil hospital — Pandit Deendayal Upadhyay Government Medical College, Rajkot from 1 January 2013 to 31 December 2013. Rajkot district is located in centre of Saurashtra region (western part) of Gujarat state. The Saurashtra region also includes other districts like Jamnagar, Bhavnagar, Amreli, Surendranagar, Kutch, Probandar, and Junagadh. As a tertiary care institute, Microbiology department receives blood samples from Rajkot district and also from above mentioned districts for investigation of dengue. Virology section of Microbiology department is one of the sentinel surveillance centres in Gujarat state for dengue under National Vector Borne Disease Control Programme (NVBDCP). It is responsible for taking blood samples from patients with suspected dengue infection, maintaining records of positive cases and capacity building of primary health centres within the districts. Patients with acute onset of illness, high grade fever, severe headache, backache, musculoskeletal pain or retro-bulbar pain with or without rashes were considered as clinically suspected case of dengue virus infection8.

A total of 4366 blood samples were received from patients of all age, suspected of dengue, DHF and dengue shock syndrome during the year 2013. All the patients, who presented with fever and found positive for Dengue NS1 Ag and/or IgM Ab were included in the present study. But patients with other co-infections like malaria, typhoid etc or with any other co morbid diseases were excluded from the study. Demographic and clinical details were obtained and recorded from laboratory request forms like, age, sex, residential status, number of days between onset of fever and diagnosis. A pre-tested structured pro-forma was used as a tool for data collection. The date of onset of fever and the date of blood sample collection were also recorded in the data entry form for calculation of sample age. Sample age is defined as the interval in days between the date of onset of fever and the date of collection of blood sample. It was considered Day 0, if the blood samples were collected on the same day as the date of onset of fever.

As soon as the blood samples with complete laboratory testing forms were received in virology section, the blood samples were allowed to clot at room temperature. As the blood clotted, serum samples were separated and proceed for IgM Ab and NS1 Ag testing according to the days of illness. The patients having history of illness < 5 days were tested for NS1 Ag and the patients having history of illness > 7 days were tested for IgM Ab. Those having history of illness between 5–7 days were examined with both NS1 Ag and IgM Ab method/test. The IgM dengue ELISA capture test kits were supplied by National Institute of Virology (NIV), Pune under the NVBDCP and Dengue NS1 antigen capture ELISA assay was performed by Platelia dengue NS1 Ag (Bio-Rad, Marnes-la-Coquette, France). When a dengue case was confirmed by serological testing, the district vector borne disease control officer, chief district medical officer, concerned medical officer and epidemic medical officers were informed. The data was entered into Epi Info (version 3.5.1) software by Centre for Disease Control, Atlanta, USA, and analyzed by using appropriate statistical test (chi-square test).

RESULTS

A total of 4366 samples were tested for dengue during the study period from Saurashtra region. Suspected dengue cases were reported in all age groups (Table 1). Majority of samples were tested positive in age group 15–24 yr (37.3%) and 25–44 yr (31%). Significant numbers of dengue positive cases (p<0.01) were reported in all age groups, except in 0–4 yr age group. The proportion of male cases (60.8%) was higher than female cases.

Table 1. Basic characteristics of suspected dengue cases tested at a tertiary care centre, Rajkot during the year 2013

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. patients tested</th>
<th>Dengue positive</th>
<th>Dengue negative</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age groups (yr)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–4</td>
<td>168 (3.8)</td>
<td>61 (3.4)</td>
<td>107 (4.2)</td>
</tr>
<tr>
<td>5–14</td>
<td>758 (17.4)</td>
<td>347 (19.3)*</td>
<td>411 (16)</td>
</tr>
<tr>
<td>15–24</td>
<td>1363 (31.2)</td>
<td>673 (37.3)*</td>
<td>690 (26.9)</td>
</tr>
<tr>
<td>25–44</td>
<td>1474 (33.8)</td>
<td>558 (31)*</td>
<td>916 (35.7)</td>
</tr>
<tr>
<td>45–64</td>
<td>483 (11.1)</td>
<td>136 (7.5)*</td>
<td>347 (13.5)</td>
</tr>
<tr>
<td>≥65</td>
<td>120 (2.7)</td>
<td>27 (1.5)*</td>
<td>93 (3.6)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2653 (60.8)</td>
<td>1223 (67.9)*</td>
<td>1430 (55.8)</td>
</tr>
<tr>
<td>Female</td>
<td>1713 (39.2)</td>
<td>579 (32.1)</td>
<td>1134 (44.2)</td>
</tr>
<tr>
<td><strong>Residential status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>3000 (68.7)</td>
<td>1373 (76.2)*</td>
<td>1627 (63.5)</td>
</tr>
<tr>
<td>Rural</td>
<td>1366 (31.3)</td>
<td>429 (23.8)</td>
<td>937 (36.5)</td>
</tr>
<tr>
<td><strong>District</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rajkot</td>
<td>2563 (58.7)</td>
<td>1114 (61.8)*</td>
<td>1449 (56.5)</td>
</tr>
<tr>
<td>Other districts</td>
<td>1803 (41.3)</td>
<td>688 (38.2)</td>
<td>1115 (43.5)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4366 (100)</td>
<td>1802 (41.3)</td>
<td>2564 (58.7)</td>
</tr>
</tbody>
</table>

*p<0.01; Figures in parentheses indicate percentages.
Males were at significant risk (67.9%) ($p<0.01$) of getting dengue cases than females.

Two-third (68.7%) suspected cases were residing in urban areas of Saurashtra region. Residents of urban area were at significant risk (76.2%) ($p<0.01$) than residents of rural area. Only 566 out of 4366 (13%) suspected cases were reported and tested for dengue within two days of onset of illness. Of 566 tested, 217 (38.3%) reported positive for dengue (Table 2). More than one-third (39.2%) cases reported positive with illness of three to five days. Almost half of the suspected cases were diagnosed positive with 5–7 days of illness (47.1%) followed by illness of > 7 days [356/870 (40.9%)].

Figure 1 shows month-wise percentage positivity distribution of dengue positive cases reported in Rajkot and other districts of Saurashtra region during the year 2013. Almost two-third (61.8%) positive cases were reported from Rajkot district (Table 1). District wise percentage positivity distribution of dengue cases shows all districts of Saurashtra region were reporting dengue cases (Fig. 2) with varying positivity.

Cases of dengue were reported throughout the year from Rajkot and other districts of Saurashtra region (Fig. 3). Reporting of dengue positive cases remained low during first six months of year 2013, followed by significant increase from July to September and again during December. Figure 3 shows month wise distribution of total and dengue positive cases reported in Saurashtra region and Rajkot district respectively. Increasing number of cases were reported from July 2013 which reached to peak during September 2013 followed by decrease in December 2013.

Table 2. Distribution of suspected dengue cases tested at a tertiary care centre, Rajkot during the year 2013

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total no. of suspected cases (n=4366)</th>
<th>Dengue positive (n=1802)</th>
<th>Dengue negative (n=2564)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of days between onset of fever and diagnosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 – 2 Days</td>
<td>566 (13)</td>
<td>217 (38.3)</td>
<td>349 (61.7)</td>
</tr>
<tr>
<td>3 – 5 Days</td>
<td>192 (44)</td>
<td>753 (39.2)</td>
<td>1167 (60.8)</td>
</tr>
<tr>
<td>5 – 7 Days</td>
<td>1010 (23.1)</td>
<td>476 (47.1)</td>
<td>534 (52.9)</td>
</tr>
<tr>
<td>&gt;7 Days</td>
<td>870 (19.9)</td>
<td>356 (40.9)</td>
<td>514 (59.1)</td>
</tr>
<tr>
<td>Laboratory testing with NS1 antigen (Illness &lt; 5 days)</td>
<td>2486 (57)</td>
<td>970 (39)</td>
<td>1516 (61)</td>
</tr>
<tr>
<td>IgM antibody (Illness &gt; 7 days)</td>
<td>870 (19.9)</td>
<td>356 (40.9)</td>
<td>514 (59.1)</td>
</tr>
<tr>
<td>Both NS1 antigen and IgM antibody (Illness between 5 and 7 days)</td>
<td>1010 (23.1)</td>
<td>476 (47.1)</td>
<td>534 (52.9)</td>
</tr>
</tbody>
</table>

Number in parentheses indicate percentages.

**DISCUSSION**

Dengue disease continues to expand its geographical distribution and increasing its magnitude and epidemics are very common. Every aspect of dengue viral infection continues to be a challenge; the pathogenesis of severe dengue disease is not yet known, no vaccine is yet avail-
able for protection and the vector control measures are inadequate\(^9\). *Ae. aegypti* mosquito is the primary vector and lives in proximity to human habitations in urban areas and breeds mostly in man-made containers. The vector is mainly a day-time feeder, and its peak biting period is early in the morning and before dusk.

The present study was conducted at a tertiary care centre of Saurashtra region involving 4366 suspected dengue cases during the year 2013. Total 41.3% cases were found positive for dengue during the study period. The reported prevalence of 41.3% is higher than that in other Districts of Gujarat state and also from other states of India\(^8, 10-13\). Significant numbers of dengue positive cases \((p<0.01)\) were reported in different age groups when compared with rest of the dengue tested cases except in 0–4 yr age group. Majority of cases were reported in age group 15–24 yr (37.3%, \(p<0.01\)) and 25–44 yr (31%, \(p<0.01\)). Dengue fever was typically acknowledged to be a disease of early childhood in SEAR countries\(^14\). But, now there are evidences of increase in dengue incidence in older age group (16–45 yr) in India and in other SEAR countries\(^8, 15-20\).

Current study reported significantly higher case positivity rate among male patients \([1223/1802 (67.9\%)]\) like other studies from India\(^10, 12, 17, 21-22\). Higher prevalence among males might be due to their more outdoor activities when compared to females, resulting in more exposure to day-time biting mosquitoes\(^10\). The lower case positivity rates in females may be attributed to lower reporting rate and as they remain at home and are less exposed to risk of vector borne infection\(^23\). Dengue is a disease of urban areas where solid wastes, air conditioners, air coolers, flower pots and so forth are the major contributors to the breeding of *Ae. aegypti*, the principal urban vector of dengue\(^24\). More than two third (68.7%) of suspected cases were from urban areas and 31.3% from rural areas, similar to other studies\(^8, 10, 25\). Significant number of dengue positive cases \((p<0.01)\) were reported from urban areas \([1373/1802 (76.2\%)]\).

Out of 1802 positive dengue cases, only 13% cases were tested within two days of onset of fever in the present study. More number of cases were diagnosed between three and five days of onset of fever \((39.2\%),\) followed by 47.1% in five to seven days and 40.9% cases after seven days of fever. This may be because the patients do not seek immediate treatment for symptoms or the treating physicians are not suspecting dengue in first few days of fever. Awareness about the dengue by use of mass media might improve the patients’ treatment seeking behaviour and early detection of dengue infection.

It was observed that the majority of dengue cases were detected by the presence of viral NS1 antigen as compared to IgM antibodies in patient’s sera. Early detection of dengue infection by NS1 assay helps in diagnosis and confirmation of cases\(^25-26\). Viral antigen detection is particularly useful during the first five days of illness with NS1 assays\(^27-29\). Supporting clinical symptoms along with early detection of viral NS1 antigen can help to speed up diagnosis of dengue cases\(^25\). The IgM antibody testing will show a positive report only when tested after 5–7 days\(^30\). NS1 antigen testing was conducted in patients with history of fever up to five days \((57.0\%\), IgM antibody testing with history of fever > seven days \((19.9\%)\) and both NS1 antigen and IgM antibody testing with history of fever from 5 to 7 days \((23.1\%)\). Different studies reported IgM positivity rate for dengue about 27% \((18.1–35\%\))\(^11, 23, 31\).

As a tertiary care centre, the blood samples of suspected dengue cases were received throughout the year and so present study reports the continuous occurrence of dengue cases with varying severity in the Saurashtra region. Majority of samples received and tested positive for dengue were from Rajkot district. Number of positive cases reported was low from January to June 2013. The rainy season starts by end of June month and present study reported increase in cases from July to November 2013 with significantly highest positive cases reported during September 2013 \((p<0.001)\). Present study reports seasonal occurrence of dengue cases during monsoon and post monsoon season. Similar findings have been reported by various other studies\(^10, 11, 22, 24\). As the monsoon season favours breeding of *Aedes* mosquitoes, effective preventive and control measures need to be taken prior to and with beginning of monsoon to reduce the occurrence of dengue in the community. A long term serosurveillance study may help to provide more information about the intensity, seasonal incidence and seasonal effect.

**Conflict of interest**

There is no any conflict of interest associated with this study.

**REFERENCES**


