

# A Comprehensive Study of Epidemiological Pattern of Dengue and Comparison of Dengue Rapid Diagnostic Tests versus Dengue ELISA Tests

R Patel<sup>1\*</sup>, B Patel<sup>2</sup>, P Patel<sup>3</sup>, A Thakur<sup>4</sup>, N Shethwala<sup>5</sup>, A Shah<sup>6</sup>, J Uperiya<sup>7</sup>

{<sup>1</sup>Assistant Professor, Department of Microbiology} {<sup>2</sup>Assistant Professor, Department of Pathology}

GMERS Medical College, Himmatnagar, Gujrat, INDIA.

Email: [drroshnipatel@gmail.com](mailto:drroshnipatel@gmail.com)

## Abstract

**Background:** Dengue is the most important arthropod-borne viral disease of public health significance. It has become endemic in India with outbreaks occurring almost every year. **Aim and Objectives:** To analyze the epidemiological pattern of dengue disease along with clinical study and to compare the result of the dengue rapid diagnostic test with standard ELISA test. **Materials and Methods:** The laboratory records of dengue positive cases of year 2013 were analyzed retrospectively for epidemiological data & dengue diagnostic tests. **Results:** The study shows predominant younger age group involvement with male predominance. Among the positive dengue rapid diagnostic tests, only 80% tests were positive when compared to standard ELISA tests. **Conclusions:** The epidemiology pattern of dengue is changing in some areas with predominant younger age group involvement. Though rapid diagnostic tests shows false positive results sometimes, it can offer early detection of outbreak.

**Key words:** Dengue, epidemiological pattern, rapid diagnostic tests, ELISA.

## \*Address for Correspondence:

Dr. R Patel, 76, Somnathpark society, Behind Sarthak Mall, Sargasan cross road, Kh-0, Kh road, Gandhinagar-382421, Gujrat, INDIA.

Email: [drroshnipatel@gmail.com](mailto:drroshnipatel@gmail.com)

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## INTRODUCTION

Dengue is a most rapidly spreading mosquito borne viral disease in the world. An estimated 50 million dengue infections occur annually<sup>14</sup>. Now a days, the epidemiology of dengue was found changed in some studies done in India as compared to majority of studies, with predominant involvement of younger age group.<sup>1,2,3</sup> Several commercially available rapid dengue diagnostic tests are quick and easy method for use. But, sometimes they show false positive result when compared to standard ELISA test. Although it can offer the early

detection of dengue outbreaks and early diagnostic help to the physician. The study is aimed to analyze the epidemiological trend of dengue disease along with clinical features and to assess the performance of commercially available dengue rapid diagnostic test by comparison with standard ELISA test.

## MATERIALS AND METHODS

The study was done by retrospective analysis of the laboratory data of year 2013 at Himmatnagar Civil Hospital. All the suspected dengue cases were first tested by dengue rapid diagnostic test for early aid to diagnosis. Then, the result were confirmed by standard dengue ELISA test. The dengue suspected case with positive dengue ELISA test result was considered as confirmed dengue case. The laboratory data of confirmed dengue positive cases were studied to analysis the epidemiological pattern & clinical features. The laboratory data of positive dengue rapid diagnostic test results were compared with the results of dengue ELISA of the same cases.

## RESULTS

Out of total 75 cases which were dengue positive by rapid test, only 60 were positive by standard dengue ELISA test.

**Table 1:** Age profile of dengue cases

Age(years)	No. of dengue cases	% of dengue cases
0-10	17	28%
11-20	26	43%
21-30	9	15%
31-40	7	12%
>40	1	2%

Out of total 60 cases, 39 cases were male. Thus, male-to-female ratio was 1.9:1.

**Table 2:** Total duration from the onset of symptoms to the blood collection for dengue

No. of days from onset of symptoms to the blood collection for dengue	Total cases(no.)	Total cases(percentage)
1-3	22	36.7%
4-6	27	45%
7-9	7	11.7%
≥ 10	4	6.7%

**Table 3:** Clinical manifestation

Symptoms	% of cases having the symptoms
Fever	100%
Myalgia	71.4%
Headache	42.9%
Joint pain	26.5%

**Table 4:** Profile of Platelet count

Platelet count(/cumm)	% of cases
<50,000	24%
<1,00,000	62%
1,00,000-1,50,000	19%
>1,50,000	19%

**Table 5:** Weakly positive\* dengue in rapid test

	positive by ELISA (true positive)	negative by ELISA (false positive)	Total Weakly positive*
Weakly positive * NS1 Dengue	0	1	1
Weakly positive * IgM Dengue	7	10	17
Total	7	11	18

\*Weakly positive includes light band in rapid test.

**Table 6:** False positivity

NS1 false positive	7
IgM false positive	7
Both NS1 & IgM false positive	1
Total false positive	15

## DISCUSSION

Dengue virus is transmitted by mosquitoes of the genus *Aedes*. Infection with any of the types of dengue virus causes a spectrum of illness ranging from no symptoms or mild fever to severe and fatal hemorrhage and shock depending largely on the patient's age and immunological condition.<sup>6</sup> Transportation, industrialization, movement of infected human population/mosquitoes and the changing ecology have facilitated its spread to newer areas.<sup>12</sup> India is one of the seven identified countries in the South-East Asia region regularly reporting incidence of DF/DHF outbreaks and may soon transform into a major niche for dengue infection in the near future.<sup>8</sup> The majority of dengue cases were below 20 years which suggest pediatric patients are predominantly affected in our study, which is correlated by study done by Atul Garg et al., 2011<sup>1</sup>. Although these findings are not consistent with other Indian studies, as most of the other Indian studies have reported 15 to 45 years as the most affected age group. (Kumar et al., 2010<sup>2</sup>, Gupta et al., 2005<sup>3</sup>). The study done by Adriana *et al.* in Brazil<sup>5</sup>, Ooi *et al.*<sup>12</sup>, and Yew *et al.* in Singapore<sup>4</sup>, Anker *et al.* in six Asian countries<sup>7</sup>, also reveals that adult age group shows the predominance in dengue fever. This predominance of adults may be due to involvement of adult groups in outdoor works compared to low age group as they have the more chances of exposing infected mosquitoes than the low age groups. Our study shows fever, myalgia & headache in 100%, 71.4% & 42.9% of dengue cases respectively which correlate with study done by A Kumar et al.<sup>2</sup> which shows fever in 99.1%, Myalgia in 64.6%, Headache in 47.6% cases & study done by A Abrol<sup>13</sup> which shows fever in 100%, Myalgia in 63.2%, Headache in 52.6% cases. But study done by KN Tewari<sup>10</sup> shows lower % of cases having myalgia (21.73%) & headache (27.39%). In our study 24% dengue cases shows <50,000/cu mm & 19% dengue cases shows >1,50,000/cu mm platelet count. These findings do not correlate with study done by R Mehboob<sup>11</sup> which shows only 6% dengue cases with platelet >1,00,000/cu mm & 72% of dengue cases with very low <50,000/cu mm platelet count. Out of 75 rapid dengue diagnostic tests, only 60 were positive by dengue ELISA test. Considering dengue ELISA as a standard test 80% of the tests were true positive & 20% tests were false positive. Out of total 18 weak positive (light band in rapid diagnostic test), only 7 were positive by standard ELISA test, while 11 were negative by ELISA (false positive). Weakly positive were

occurred mainly in dengue IgM rapid test. Out of 18 weak positive, only 1 weakly positive was found in NS1. Total false positives were same for NS1 & IgM test individually, but only 1 was false positive for both NS1 & IgM. Evaluation Series No.3. World Health Organization describes the studies done to evaluate the performance of rapid & ELISA dengue diagnostic tests. Overall, the rapid dengue diagnostic tests showed lower agreement with the reference standard assays for both sensitivity and specificity than the ELISA-based tests. Differences in sensitivity were statistically significant for all comparisons with different company rapid diagnostic tests. Malaria and anti-DENV IgG samples caused the highest false positive IgM rates in both ELISA & rapid.<sup>9</sup>

## CONCLUSION

The epidemiology pattern of dengue is changing in some areas with predominant younger age group involvement. The ELISA test is laboratory gold standard diagnostic test for dengue, but the rapid diagnostic tests are field friendly, with the results available in a short timeframe. Although the rapid diagnostic tests sometimes give false positive results, it can offer early detection of outbreak.

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