



Research Article

SERO-PREVALENCE OF DENGUE AND CHIKUNGUNYA, THEIR CO-INFECTION AND SEASONAL TRENDS OF THESE INFECTIONS AT A TERTIARY CARE HOSPITAL, AHMEDABAD, GUJARAT

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Abstract-Background: Dengue and chikungunya are an important mosquito-borne viral diseases of humans. There has been a recurrent phenomenon throughout the tropics in the past decade. *Aedes aegypti* mosquitoes are the common vectors for both dengue and chikungunya virus. In areas where both viruses co-circulate, they can be transmitted together. **Aims & Objectives-**This study was conducted to know the prevalence of dengue and chikungunya, their co-infection, Seasonal trends of these infections. **Material and Methods-** Study was performed at a tertiary care hospital Ahmedabad, Gujarat from July 2013 to July 2014. Blood samples collected in plain tubes were tested for dengue Ig M antibody, NS1 antigen and Chikungunya Ig M antibodies. The month wise laboratory records were analyzed for seasonal variations. **Results-** In our study we tested total 8148 samples for dengue, chikungunya and its co-infection. Out of 8148 test requests, 4683 were requested for dengue and 1265 were requested for chikungunya alone while 1100 were requested for both dengue and chikungunya. A total of 992 samples were found positive for dengue out of 5783 total samples. Over all prevalence of dengue in our study was 17.15% (992/5783). In our study out of 4683 samples for dengue, overall prevalence of dengue was 20.26% (949/4683). Samples received for chikungunya were 2365 from which 795 were found positive. Over all prevalence of chikungunya was 33.61% (795/2365). Out of 1100 samples that were requested for both, 220 (20.0%) were positive for dengue, 231 (21.0%) were positive for chikungunya and 43 (3.9%) were positive for both. Seasonal trend showed a gradual increase in dengue and chikungunya positive started from August with a peak in September. **Conclusion-** Dengue and chikungunya viruses can cause dual infections in humans. Co-infections may result in illness with overlapping signs and symptoms, making diagnosis and treatment difficult. Hence, clinically suspected cases should be tested for both the pathogens in the endemic areas. With the urbanization that is occurring in India, the incidence of dengue infection is increasing theatrically. With assumption that cases of co-infection with dengue and chikungunya will become more prevalent in the future due to increased transmission of both viruses in various areas of India, enhanced and continuous surveillance for both dengue and chikungunya viruses is essential in the endemic areas for identification and characterization of these viral pathogens. This information will also help in the execution of proper measures to control the outbreaks caused by these emerging viral pathogens.

Keywords- Dengue, Chikungunya, Co-infection, *Aedes aegypti*, Seasonal trend, ELISA test.

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Introduction

Dengue and chikungunya are important mosquito-borne viral disease of humans. There have been a recurrent phenomenon throughout the tropics in the past decade. Annually, there are estimated 100 million dengue virus infections worldwide [1]. Dengue and Chikungunya are arboviral infections. Chikungunya is a self-limiting and nonfatal acute illness, whereas dengue has severe complications[2].

In India, dengue and chikungunya are widespread and endemic in most major states like Goa, Gujarat, Karnataka, Kerala, Haryana, Madhya Pradesh, Punjab, Maharashtra, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, Chandigarh, Delhi and Puducherry [3]. In 2011 total cases of dengue and chikungunya reported in India were 18,860 and 20,402 respectively, out of which 1693 and 1042 cases reported respectively in Gujarat only.[4]

The symptoms of dengue fever nearly resemble the symptoms of chikungunya. They include fever, joint and bone pain, nausea, vomiting, headache, and fatigue. A rash may also occur about three to four days after the onset of fever. Increasingly, cases of the more severe and potentially lethal dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) are reported with children bearing much of the disease burden[2]. The mortality rate of

dengue haemorrhagic fever in most countries is 5%, primarily among children and young adults. In several Asian countries, this virus is the leading cause of hospitalization and death[5].

As many risk factors for chikungunya virus (CHIKV) and dengue virus (DENV) infections are the same or similar so in areas where Dengue virus circulates, Chikungunya remains undiagnosed. This mandates laboratory tests to distinguish between these two diseases [6-8]. Also according to a recent investigation, patients having co-infection with the Dengue and Chikungunya viruses present a clinically severe disease with a high death rate when compared to mono-infection with these viruses[9]. Hence, the timely diagnosis of the dual infections is essential for better patient management.

Aims of our study is to know the prevalence of dengue, chikungunya and their co-infection along with epidemiological trends of these infections.

Materials and Methods

This retrospective study was performed at a tertiary care hospital, Ahmedabad, Gujarat from July 2013 to July 2014. Blood samples were collected in plain vacuette from patients having signs and symptoms of suspected dengue (sudden onset of fever, headache, retro-orbital pain, and back pain along with the severe

myalgia etc.) and/or chikungunya (fever and severe arthralgia accompanied by chills, migratory polyarthritides mainly affects the small joints and constitutional symptoms such as headache, photophobia, conjunctival injection, anorexia, nausea, and abdominal pain, etc.) & were received at the Microbiology department. A total of 8148 samples comprising of 5783 samples for dengue and 2365 samples for chikungunya were received from suspected cases. Out of total samples, 1100 samples were received for the presence of dengue and chikungunya both. Diagnosis was done by using Bio-Rad Platelia Dengue NS1 antigen detection kit (if duration of illness was ≤ 5 days) and remaining samples by using NIV DEN IgM Capture ELISA (MAC ELISA) kit (if duration of illness was > 5 days). Diagnosis of chikungunya was done by using NIV CHIK IgM Capture ELISA (MAC ELISA) kit.

Result

In our study we tested total 8148 samples for dengue, chikungunya and its co-infection. Out of 8148 test requests, 4683 were requested for dengue and 1265 were requested for chikungunya alone while 1100 were requested for both dengue and chikungunya. A total of 992 samples were found positive for dengue out of 5783 total samples. Over all prevalence of dengue in our study was 17.15% (992/5783). Out of 992 samples positive for dengue, 233 were positive by NS1 Ag detection test and 759 were positive by IgM Ab detection test from 2741 and 3042 samples requested for NS1 Ag and IgM Ab detection respectively. Over all seropositivity of NS1Ag and IgM Ab detection test was 8.5% (233/2741) and 24.95% (759/3042) respectively. Samples received for chikungunya were 2365 from which 795 were found positive. Over all prevalence of chikungunya was 33.61% (795/2365). Out of 1100 samples that were requested for both, 220 (20.0%) were positive for dengue, 231 (21.0%) were positive for chikungunya and 43 (3.9%) were positive for both. [Table-1] shows prevalence of dengue, chikungunya and their co-infection. Dengue and chikungunya co-infection prevalence among the various studies carried out in India were shown in [Table-2]. Adults in the age group of 16 years to 30 years were affected higher than any other age group in both. Age wise distribution is shown in [Table-3]. Males were affected higher than female in dengue infection while in chikungunya, females were more affected more than males. Gender distribution is shown in [Table-4]. Maximum cases were found in post monsoon period. Seasonal trend

for dengue and chikungunya and its co-infection is shown in [Chart-1].

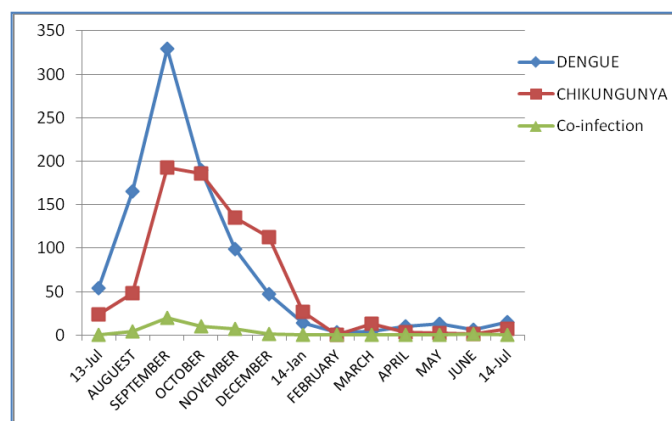


Chart-1 Seasonal trend of dengue and chikungunya and its co-infection

Table-1 Prevalence of dengue, chikungunya and their co-infection

	Total dengue	Total chikungunya	Dengue & chikungunya co-infection
Positive samples	992(17.15%)	795(33.61%)	43(3.90%)
Negative samples	4791	1570	1057
Total samples tested	5783	2365	1100

Discussion

Arthropod-borne viruses or arboviruses are one of the major public health issue worldwide. Out of many arboviruses, chikungunya virus (CHIKV) and dengue virus (DENV) are the two most speedily spreading arboviruses [8]. The most prominent feature of chikungunya infection is the severe joint pain, which sometimes can persist for a few months to a year. A severe chikungunya viral infection can cause neurological and optical manifestations. Thus, chikungunya viral infection is usually nonfatal while dengue fever may result in severe complications including death [9].

Table-2 Prevalence of dengue and chikungunya co-infection among the various studies conducted in India

Location	Year	Samples tested for dengue and chikungunya	Samples positives for dengue and chikungunya	Prevalence of co-infection	References
Tamilnadu	2010	73	4	5.5 %	[20] Gunasekaran P et al
South India	2011	72	2	2.7%	[19] Kalawat U et al
Southern Odisha	2011-12	191	2	1.2%	[16] Mohanty I et al
Mumbai	2010-15	300	20	6.7%	[11] Vikram et al
Gujarat	2013	1100	43	3.9%	Present study

Table-3 Age distribution of dengue and chikungunya positive cases

Age group	Dengue	Chikungunya	Co-infection	Total
0-15 years	281 (28.33%)	38 (4.78%)	2 (4.65%)	321 (17.54%)
16-30years	478 (48.19%)	279 (35.09%)	24 (55.82%)	781 (42.68%)
31-45years	145 (14.61%)	217 (27.29%)	9 (20.93%)	371 (20.27%)
46-60years	67 (6.75%)	198 (24.91%)	6 (13.95%)	271 (14.80%)
>60 years	21 (2.12%)	63 (7.93%)	2 (4.65%)	86 (4.71%)
Total	992	795	43	1830

Table-4 Gender distribution of dengue and chikungunya cases

	Dengue	Chikungunya	Co-infection	Total
Male	644 (64.92%)	338 (42.52%)	19 (44.20%)	1001 (54.70)
Female	348 (35.08%)	457 (57.48%)	24 (55.80%)	829 (45.30)
Total	992	795	43	1830

In present study, we tested a total of 8148 samples for presence of dengue, chikungunya and both. Over all prevalence of dengue in our study is 17.15%. A study carried out by Patankar M. et al showed dengue prevalence 20.26 % in their study[10]. Our study is well correlated with this study. Chikungunya has shown a

pattern of affecting immune naïve population once in every 30years as with the first outbreak of the virus witnessed in 1963 in Kolkata followed by epidemics in Tamil Nadu, Andhra Pradesh and Maharashtra. However, after a gap of more than thirty years, chikungunya reemerged in several Indian states in 2005 and by the

latest report in 2010, has spread to more than 18 states/union territories within our country[11]. Prevalence of chikungunya in present study is 33.61% which is well correlated with Barve S et al and Chattopadhyay S. et al studies which showed prevalence of chikungunya 32.8% and 36.89% respectively[12,13]. Both Patankar M et al and Barve S et al study shows geographical correlation in prevalence of dengue and chikungunya respectively with present study.

The vectors for transmission of dengue and chikungunya are *Aedes aegypti* and *Aedes albopictus* mosquitoes[11]. Since both dengue and chikungunya viruses are transmitted through a common vector, they frequently co-circulate in the mosquito and are transmitted to human beings as co-infections following the mosquito bite [11]. In India, concurrent isolation of chikungunya (CHIKV) and dengue(DENV) had been reported since 1964 from different States. In 1967, co-infections with dengue and chikungunya viruses were reported from Kolkata. Subsequent serological investigations in Southern India indicated that the two viruses can co-exist in the same host [6-8]. We tested 1100 samples for presence of dengue and chikungunya both. Out of these samples 220 (20.0%) were positive for dengue, 231 (21.0%) were positive for chikungunya and 43 (3.9%) were positive for both. Various studies were conducted in India to identify co-infection of dengue and chikungunya. [Table-2] shows dengue and chikungunya co-infection prevalence among the various studies carried out in India, which shows that it ranges from 1.1% to 6.7%. Our prevalence (3.9%) lies within this range. In India, *Aedes aegypti* mosquitoes are primary vectors for dengue(DENV) and chikungunya (CHIKV), and opportunities for co-infections in humans are increased by the feeding behavior of the mosquito, low socioeconomic conditions, and high population density. [14]

As shown in [Table-3], in our study highest prevalence of dengue is seen in adult age group of 16-30 years (48.19%), followed by 0-15 years (28.33%), 31-45 years (14.61%), 46-60 years (6.75%) and >61 years (2.12%). Study carried out by Mehta K D et al showed similar trend [15]. Age ranged for dengue is between 0 to 80 years (mean age 32.1±16.8). For chikungunya also, prevalence rate is higher in 16-30 years of age group (35.09%) followed by 31-45 years (27.29%), 46-60 years(24.91%),>60 years (7.93%)and 0-15 years (4.78%) respectively. Pediatric age group 0-15 years is affected least which is correlating with study of Mohanty I et al [16] Patients' age ranged for chikungunya is between 0 to 95 years (mean age 30.17±16.96).

[Table-4] shows gender distribution of dengue, chikungunya positive patients. Male were affected more than female in dengue infection, which is reverse in case of chikungunya and dengue chikungunya co-infection. Sex ratio of male and female suffering from dengue, chikungunya and co-infection was 1.85:1, 0.74:1 and 0.79:1 respectively. Gender distribution of dengue fever in our study is correlating with Thunguturthi S et al study, in which sex ratio of male and female was 1.85:1 [14, 17]. Mohanty I et al and Barve S et al in their study also showed female preponderance over male in case of chikungunya infection with sex ratio of male and female for chikungunya 0.85:1 and 0.55:1 respectively which is correlating with our study [16, 12]. Women have been notably more affected than men, which may be explained with the cultural custom of women to work at home, where the main vector (*Aedes aegypti*) of chikungunya (CHIKV) sets, usually associated with deposits of water which have day biting habit [18,12].

Seasonal trend was observed as per month wise data of samples, which shows, there was a gradual rise of the cases during the post monsoon period. Positive cases started rising gradually from August month and decline in the February month with peak in the month of September in both infections. This is shown in the chart 1. Our study data correlate with study carried out by Mohanty I et al study, which was conducted in 2011-12[16]. These seasonal pick indicating that pre-monsoon and monsoon periods public awareness, vector control and improvements in sanitation and hygiene are needed to be taken up seriously for necessary action by the concerned authority [17] The number of cases were more in the months of July to December and only sporadic cases occur during the months of January to June. This type of seasonal variation was seen in most of the studies, because transmission intensifies at the start of the rainy season, when infected vector mosquitoes are more abundant as higher

humidity lengthens their life span and increased temperatures shorten the extrinsic incubation period [8]. As mosquitoes are sensitive to changes in temperature and available moisture, they decrease in number in dry and cool seasons so cases declined in first half of the year[19].

Conclusion

Dengue and chikungunya viruses can cause dual infections in humans. Co-infections may result in illness with overlapping signs and symptoms, making diagnosis and treatment difficult. Hence, clinically suspected cases should be tested for both the pathogens in the endemic areas. With the urbanization that is occurring in India, the incidence of dengue infection is increasing theatrically. With assumption that cases of co-infection with dengue and chikungunya will become more prevalent in the future due to increased transmission of both viruses in various areas of India, enhanced and continuous surveillance for both dengue and chikungunya viruses is essential in the endemic areas for identification and characterization of these viral pathogens. This information will also help in the execution of proper measures to control the outbreaks caused by these emerging viral pathogens.

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Abbreviations: CHIKV: chikungunya virus, DENV: dengue virus, DHF: dengue hemorrhagic fever, DSS: dengue shock syndrome, ELISA: Enzyme-linked immunosorbent assay.

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