Dengue and Chikungunya viruses Co infection: A serological based study from tertiary care center, Ahmadabad, India

Unnati Vaghela, Parul C. Patel**, Nidhi G. Sathwra***, Palak D. Rao***, Dhara J. Modi*****

Abstract:

Introduction: Dengue and Chikungunya (CHIK) infections appear to be increasing in all parts of India. Aedes aegypti mosquitoes are common vectors for dengue virus (DENV) and CHIK virus (CHIKV - Chikungunya Virus). In areas where both viruses co circulate, they can be transmitted together. **Aim:** The present study was undertaken to study the prevalence of dengue–CHIK co infection and compare with monoinfection. **Methods:** IgM antibody capture ELISA (Enzyme linked immunosorbent assay) for dengue IgM and CHIK IgM and ELISA for dengue non structural protein 1 antigen was performed on serum samples obtained from suspected patients. **Results:** Out of total 1071 samples from suspected patients for dengue & chikungunya infection, 212 (19.7%) samples were positive for DENV while CHIK IgM antibodies were positive in 145 (13.53%) patients. Total 44 sera were positive (4.10%) for co-infection of dengue and CHIK. **Conclusion**: Increase in the number of Dengue and Chikungunya infections and their cocirculation is an important public health concern which warrants the implementation of strict control measures.

Keywords : Chikungunya, Co- infection, Dengue, ELISA

Introduction:

Dengue and Chikungunya (CHIK) infections appear to be increasing in all parts of India. Aedes aegypti mosquitoes are common vectors for dengue virus (DENV - Dengue Virus) and CHIK virus (CHIKV). In areas where both viruses co circulate, they can be transmitted together.[1] Arboviruses are a group of viruses that are biologically transmitted by bite of haematogenous insect vector. Ability to multiply in arthropods & transmission are their special characteristic. In India over 40 arboviruses have been detected out of those more than 10 viruses are known to produce human disease.[2] Aedes aegypti is an important vector mainly found in tropical and subtropical areas across the world and is implicated in the spread of several arboviruses; most important of them being dengue virus (DENV) and chikungunya virus (CHIKV).[1]

* Resident,
**** Tutor, Microbiology Department, GMERS Medical College, Sola, Ahmedabad, Gujarat, India
** Assistant Professor - GMERS Medical College, Gandhinagar, Gujarat, India
*** Assistant Professor, GMERS Medical College, Sola, Ahmedabad, Gujarat, India
Correspondence : Dr. Unnati Vaghela
E-mail : drunnativaghela@gmail.com

Dengue fever (DF) is a viral illness caused by Dengue virus.[1]Dengue virus is a flavivirus and it is an enveloped virus,containing ssRNA.[3] It is named after the Swahili word "dinga" meaning fastidious or careful,which would describe the gait of a person suffering from the bone pain of dengue fever.[3] There are 4 major Serotypes DEN-1, DEN-2, DEN-3 and DEN-4 [4] The spectrum of disease ranges from self-limited DF to more severe forms of dengue hemorrhagic fever (DHF) or dengue shock syndrome.[1] The viruses are transmitted by Aedes mosquitoes, principally Aedes aegypti found in urban areas.[3]

The first major epidemic of the DHF occurred in 1953–1954 in Philippines followed by a quick global spread of epidemics of DF/DHF. In India, the first confirmed outbreak occurred in Kolkata in 1963–1964.Since then, there are many reports of dengue outbreaks from various parts of India.[1] Chikungunya fever is a re-emerging disease characterized by acute fever with sever arthralgia.It belongs to family Togaviridae, of genus Alphavirus. It is

an enveloped virus containing ssRNA.[3] The name is derived from the Makonde word "kungunyala" meaning "that which bends up or gets folded" in reference to stooped posture which develops as result of severe joint pain that occurs during the course of illness.[3] CHIK first established its presence during a 1952–1953 epidemic outbreak in Tanzania.In India, CHIKV was first isolated in Calcutta in 1963. The virus disappeared from our country after last reports from Maharashtra in 1973.It then re-emerged in 2006 after a gap of 32 years and caused an explosive outbreak affecting 13 states.[1] Chikungunya causes high fever similar to that produced in dengue,but is more likely to cause severe polyartharalgias[5] In Asia, the CHIKV-affected areas overlap with DENV-endemic areas [6, 7] and provide opportunities for mosquitoes to become infected with both viruses.

Both the diseases have some common signs and symptoms which include fever with chills, swelling of major and minor joints with pain, difficulty in moving limbs, nausea, headache, and vomiting, and sometimes appearance of rashes [8] In India, concurrent isolation of CHIKV and DENV had been reported since 1964 from different states.[7,9] We undertook this study to know the prevalence of dengue, CHIK monoinfection, and their co infection.

Methods:

The study was conducted at tertiary care centre, Ahmedabad, India, during January 2021 to December 2021. Blood samples were collected from patients attending different wards in hospital or visiting the outpatient departments at tertiary care center, Ahmedabad and other districts nearby with typical clinical history of high fever (>39^{0}C) with chills, rashes, joint pain, swelling of joints, nausea/vomiting, headache, myalgia, and retro-orbital pain. Approximately, 2–5 ml of blood was collected, serum separated, and subjected to ELISA. IgM antibody capture (MAC) ELISA was performed using kit provided by National Institute of Virology (NIV), Pune, for dengue on patients presenting with fever >5 days while ELISA for nonstructural protein 1 antigen (fever <5 days) was performed (Microlisa J-Mitra) for patients presenting with fever of <5 days. CHIK IgM ELISA was performed using kit provided by National Institute of Virology (NIV), Pune on those samples in which request was made for testing CHIKV infection. In some samples both CHIKV and DENV were tested because requisition was made by the treating physician to check for both viruses. All tests were carried out following the manufacturer's instruction. Tables/figures were prepared from Excel data sheet. The data collected by this study were tabulated, analysed with Microsoft excel worksheet according to patient's data.

Results:

In the present study,1071 samples from suspected patients for dengue & chikungunya infection, 212 (19.7%) samples were positive for Dengue virus while CHIK IgM antibodies were positive in 145 (13.53%) patients. In addition to this,out of which 44 sera were positive (4.10%) for co infection of dengue and CHIK.

Age-wise distributions of the DENV-infected and CHIKV-infected samples revealed that majority of the patients were in the productive age group of ≥ 19 years. From the gender distribution of the positive samples, it was observed the Co infection was slightly more prevalent in males (52.27%) as compared to the females (47.73%).

Table 1: Distribution of samples as per positive results

Infection	Total Sample Tested	Total Sample Positive	Percentage Positivity
CHIK V	1071	145	13.53%
DENG V	1071	212	19.7%
Co infection	1071	44	4.10%

Discussion:

DF is highly endemic in northern India. CHIK has similar clinical presentation as dengue, so it has remained underreported in this part of the country. Even coinfections may result in illness with overlapping signs and symptoms, making diagnosis and treatment difficult for physicians. As mosquitoes are abundantly present, they may become infected with both types of viruses and often get transmitted to human beings as co infections following the mosquito bite.[1] It is important to diagnose the type of virus with which the patient is infected because it can help the clinician in proper treatment and management of the patient against complications like haemorrhages, ARDS, renal failure and arthritis. Hence, diagnosis of the type of infection can help the clinician in proper management of the patients during treatment and follow-up.[1]

There are few reports on dual infection, reported from other parts of India, showing patients co infected with CHIKV and DENV.[9,10]

Table 2: Age and Gender wise distribution of cases

Age	**≤ 18 years**	**≥19 years**
44 (Total)	4	40
Percentage	10%	90%
Gender	**Male**	**Female**
44(Total)	23	21
Percentage	52.27%	47.73%

In our study, although dengue cases predominated (19.7%), it was observed that the prevalence of CHIK cases (13.53%). Co-infected cases were not reported earlier but our study reported a prevalence of 4.10 %. Maximum number of cases belonged to the age group of >19 years, in all types of infections as this group is maximally involved in outdoor activities, and being occupationally active has higher chances of exposure to arthropod-borne viruses. The co-infection was slightly more prevalent in males (52.27%) as compared to the females (47.73%)

Both types of infections were seen more during and subsequent to the monsoon months. The climatic conditions during this period favour vector-breeding places, thereby increasing the number of mosquitoes; resulting in a rise of dengue and CHIK. Breeding of A. aegypti is highest during pre- and post-monsoon period.[1]

Understanding the true extent of chikungunya-dengue co-infection is hampered by current diagnosis largely based on their similar symptoms. Heightened awareness of chikungunya among the public and public health practitioners in the advent of the ongoing outbreak can be expected to improve diagnostic rigour.[11] The current study emphasises the likelihood of misdiagnosis of chikungunya infections among background dengue transmission (and vice versa). Critically, misdiagnosis not only hampers epidemiological understanding of both diseases but can profoundly affect the clinical picture of, and outcome for, infected patients. For example, misdiagnosis of dengue fever as chikungunya (or missing a dengue infection when coinciding with chikungunya) risks delaying or disrupting dengue-specific intensive

Table 3: Comparison of results of currents research with similar studies

Dengue chikungunya co-infection in current research study	**Dengue chikungunya co-infection Reported in similar study**	**Details of respective similar study**
4.10%	4.5%	study done by Furuya-Kanamori et al. [11]
4.10%	7.64%	Study done by Carrillo-Hernández MY et al. [12]
4.10%	3.8%	Study done by Vandana, Ravikanti, Narmada S et al. [13]
4.10%	6.8%	Study done by Deeba, F.et al. [14]
4.10%	3.68%	Study done by Suwanmanee S, Surasombatpattana P, et al. [15]

supportive treatment, which can have a ten-fold impact on likelihood of progression from dengue fever to severe disease. It also risks inappropriate prescription of arthralgia-alleviating nonsteroidal anti-inflammatory drugs (often employed in treating chikungunya patients) which could lead to severe bleeding in patients with thrombocytopenia or DHF. The opposite and potentially more likely scenario in which chikungunya infection is misdiagnosed as dengue (or missed in a co-infected individual) masks the true geographical extent of CHIKV and population at risk of infection. It also obscures the likelihood of progression to severe disease in chikungunya patients.[11]

Conclusion:

Repeated outbreaks of dengue, recent activity of CHIKV, and CHIKV/DENV co-infections in this region of Gujarat suggest that the epidemiology of these viruses is changing in this region and that these viruses are becoming endemic to this region. Thus, in clinically suspected cases of dengue or CHIK fever, it is advisable to test for both viruses as they co circulate. The widespread emergence of DENV and exponential increase in CHIK cases warrant the need for more effective surveillance to monitor the spread of these deadly arboviruses so that timely control strategies can be implemented.

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Conflicts of interest:

There are no conflicts of interest.

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