

Seroprevalence of Dengue chikungunya mono infection and co-infection: A hospital-based study from Jabalpur, India

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Abstract

Introduction: Dengue and chikungunya infections are one of the most common arboviral infections affecting people globally, including India. Both are vector born viral infections sharing common vector. Hence in areas where both viruses co-circulate, they can be transmitted together. There are few reports discussing the dengue-chikungunya coinfection from central India, so present study was planned to study the prevalence of dengue chikungunya monoinfection as well as coinfection from this part of the country.

Materials and methods: All the samples received in the laboratory were subjected to Enzyme Linked Immunosorbent assay (ELISA) test to detect the presence of immunoglobulin M (IgM) antibodies against both CHIKV and DENV.

Results: Out of total 2009 samples from suspected patients for dengue infection, 192 (9.5%) samples were positive for DENV while CHIK IgM antibodies were positive in 157 (7.8%) patients. Co-infection was seen in 68 (3.4%) cases.

Conclusion: Present study suggests co-infections with dengue and chikungunya virus occur in areas where both viruses co-circulate. Both the illness present with overlapping signs and symptoms, making diagnosis and treatment difficult. Repeated outbreaks of both the infections suggest that the epidemiology of these viruses is changing. Thus, in clinically suspected cases it is advisable to test for both viruses for better patient care

Keywords: Dengue; Chikungunya; Coinfection; *Aedes aegypti*; ELISA

1 Introduction

Infections caused by arboviruses are a major public health problem especially in tropical and sub-tropical parts of the world. They are transmitted by mosquito vectors. Out of various vectors implicated in transmission, *Aedes aegypti* is an important vector which is associated with transmission of many arboviral infections like dengue virus (DENV) and Chikungunya virus infection (CHIKV).¹ An unexpected seasonal rise and spread of Dengue and Chikungunya cases has been observed recently.² Due to vector sharing chances of co-infection are higher in areas where both these viruses co-circulate. Since both DENV and CHIKV infection present with common clinical features during acute phase like fever, rash, arthritis, joint and bone pain, nausea, vomiting, headache and fatigue, it is very difficult to differentiate between the two infections based on clinical picture.³ Based on clinical presentation dengue infections are divided into mild to severe forms that includes Dengue Fever, Dengue Hemorrhagic Fever, Dengue Shock Syndrome and expanded dengue syndrome.^{3,4} Chikungunya viral infection is comparatively milder but may be associated with severe joint pain that can persist for months to a year.⁴ At times neurological and optical complications can also occur.⁵

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Dengue Chikungunya co-infection is not an uncommon entity. The first case of DENV and CHIKV co-infection was reported long back in 1969 by Nimmannitya et al from Thailand.⁶ Since then many studies have been conducted globally and now it is a well-known fact that patients with co infection are at increased risk for complications. Therefore, correct diagnosis of infection is important for proper treatment and management of the patient against complications like hemorrhages, DHF, DSS, ARDS, renal failure and arthritis.^{4,5}

A wide variety of laboratory tests are available for diagnosing DENV and CHIKV infections. These tests are based on the principle of virus isolation, viral nucleic acid identification, virus antigen detection or specific antibody (IgG/IgM) detection. Based on these principles various serological (enzyme-linked immunosorbent assay (ELISA), indirect immunofluorescence assays (IFA), hemagglutination inhibition (HI), and microneutralization test) and molecular tests (reverse transcriptase polymerase chain reaction (RT-PCR), real time RT-PCR, or isothermal amplification methods.) are available.⁷⁻⁸ Among the tests available, ELISA is inexpensive, quick and simple test to perform. It is a good screening test with high sensitivity and specificity. Detection of IgM antibody to dengue virus and chikungunya virus by ELISA has become one of the most widely used method for diagnosis. Detection of these antibodies alone suggests mono-infection while together indicates coinfection.¹ There have been very few studies from our part of the country so we undertook this study to know the prevalence of DENV, CHIKV mono infection and their co-infection.

2 Material and methods

The study was conducted in Virology Laboratory, NSCB medical college, Jabalpur (M.P.) during May 2022– November 2022. Blood samples were collected from patients admitted in different wards in hospital or visiting the outpatient departments at NSCB medical college and Hospital, Jabalpur with clinical history of high fever with chills, rashes, joint pain, swelling of joints, nausea/vomiting, headache, myalgia, and retro-orbital pain. Approximately, 2–5 ml of blood was collected and serum separated. All the samples were subjected to Enzyme Linked Immunosorbent assay (ELISA) test to detect the presence of immunoglobulin M (IgM) antibodies against both CHIKV and DENV using kit provided by National Institute of Virology (NIV), Pune following manufacturer's instructions. OD values were recorded and results were interpreted as per the kit literature.

3 Results

In the present study, 2009 samples collected from suspected patients were tested. Out of these 994 samples were collected from male patients while 1015 were received from female patients. Out of 2009 samples 417 (20.7%) were sero positive while 1592 (79.3%) were sero negative. Among positive samples, 192 (9.5%) samples were positive for dengue virus, 157 patients (7.8%) were positive for chikungunya viral infection and 68 (3.4%) samples were positive for both dengue and chikungunya viral infection. This is shown in table 1.

Table 1 Proportion of laboratory confirmed dengue, chikungunya mono infection and co-infection

	POSITIVE SAMPLE	PERCENTAGE
Dengue V	192	9.5
Chikungunya V	157	7.8
Coinfection	68	3.4
Total	417	20.7

Age-wise distributions of the positive samples revealed that majority of the patients were in the productive age group of 21–40 years followed by 41–60 years age group (table 2).

Table 2 Age wise distribution of positive and total samples

Age range	Total samples tested	Positive samples	Percentage
0-20	332	27	8.1
21-40	847	289	34.1
41-60	469	60	12.8
>60	361	31	08.5
TOTAL	2009	417	20.7

From 994 male samples, 120 were positive for dengue and 62 were positive for chikungunya. Among samples received from females, 95 were positive for chikungunya and 72 were positive for dengue. Thus dengue was more prevalent in male patients (12.1%) while chikungunya was more common in females (9.5%). In co-infection no gender predominance was seen as 36 males and 32 females were positive for both DENV and CHIKV IgM antibodies. This is shown in table 3.

Table 3 Gender wise distribution of positive samples

	MALE			FEMALE		
	Total	Positive	%	Total	Positive	%
Dengue	994	120	12.1	1015	72	7.1
Chikungunya	994	62	6.2	1015	95	9.3
Co-infection	994	36	3.6	1015	32	3.1

4 Discussion

Dengue and chikungunya viral infections are endemic in India. Many factors like favorable climatic conditions, vector prevalence, immune status, poor drainage system, artificial water collection spots and presence of large susceptible population results in frequent seasonal outbreaks of these viral illnesses across the country. Most of the cases are of mild infection and patient complains of few symptoms which subside spontaneously in 2-3 weeks.^{3,4} As Dengue is associated with fatal complications, symptomatic patients are mostly tested for DENV only and in rare cases for chikungunya viral infection. This may result in under diagnosis of CHIKV cases. However in clinically suspected cases, it is better to test for both viruses due to overlapping of symptoms but different line of management.⁹ As per CDC, while treating a patient of CHIKV with NSAIDs for fever and arthralgia, dengue should be ruled out. This is because these drugs have anti-platelet effect which can further complicate dengue infection. Similarly, only treating Dengue in a case of dual infection can lead to severe arthralgia and other complications of chikungunya. Thus, it is very important to diagnose the type of viral illness with which the patient is affected to guide the treating physician for appropriate primary care.¹⁰

In our study, dengue and chikungunya prevalence were found to be 9.5% and 7.8%, respectively. These findings are comparable with that of Singh *et al*, Kalawatet *al*, M. Murhekaret *al*.^{3,10,15} Co-infection was found in 68 (3.45%) cases. Other studies by Shaikh *et al*, Kalawatet *al*, Omarjeeet *al* and Naidu *etal* have reported co-infection rate as 2.7% to 5.7%.⁹⁻¹² In our study, CHIKV was slightly more prevalent in females while DENV was more commonly seen in males. This is similar to findings by Kaur *et al*, Omarjeeet *al*, Naidu *etal* and Balasubramaniamet *al*.^{1,12-14} Present study showed higher infection rate (34.1%) in 21-40 yrs age group. This may be due to the fact that they are more exposed to mosquito bite due to higher outdoor activities. Similar findings were reported in several studies.^{1-3,10,15,16}

5 Conclusion

India is a hyperendemic region for arboviruses like dengue and chikungunya which share common mosquito vector. Presence of susceptible host, co circulation of vector and favourable environmental conditions plays a key role in seasonal peaks every year throughout the country. Both of these viral illnesses initially present with common signs and symptoms, it becomes difficult for the physician to make the diagnosis clinically. Chikungunya although is less fatal than

dengue but may cause severe and prolonged arthralgia leading to poor quality of life. So, it becomes a necessity to timely and correctly diagnose and manage such patients. Although serological tests especially ELISA are most widely used technique for diagnosing cases but in order to rule out cross reactivity molecular techniques should be used. Repeated outbreaks of dengue, chikungunya and coinfection suggest a change in epidemiology of these viruses. Thus, in clinically suspected cases of dengue or chikungunya fever, it is recommended to test for both the viruses. Also, an active effective surveillance is needed to monitor the spread of these infections so that control strategies can be implemented in time.

Compliance with ethical standards

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Limitations

Major limiting factor for our study was we did not employ any molecular techniques to identify possible cross-reactivity.

Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of informed consent

This is a retrospective study and data was collected from lab with no direct or indirect patient involvement. Hence informed consent was not taken.

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