INNSPUB

International Journal of Microbiology and Mycology | IJMM |
pISSN: 2309-4796
http://www.innspub.net
Vol. 15, No. 2, p. 13-18, 2022

Open Access RESEARCH PAPER

A study on detection of dengue-chikungunya co-infection in and around Chamarajanagar District, Karnataka

C. Pooja*[1], JV. Sathish[2], Mita D. Wadekar[3], S. Jayashree[4]

Department of Microbiology, Chamarajanagar Institute of Medical Sciences, Chamarajanagar, India

Keywords: Dengue, Chikungunya, Co-infection, IgM antibody capture ELISA

Publication date: August 20, 2022

Abstract

Both Dengue and Chikungunya fever are arboviral infections of global importance. The two diseases share a common mode of transmission, i.e. through different species of mosquitoes. Therefore, these infections are normally present in the same geographical locations. Human co-infection with DENV and CHIKV have been reported in India since 1967. Since DENV and CHIKV share a seasonal transmission cycle and have a number of similarities in clinical presentation, they are difficult to distinguish without specialized serologic or molecular diagnosis. The Objective Of the Study is to evaluate Dengue and Chikungunya Co-infection in and around Chamarajanagar. Two years retrospective study was conducted from January 2017 to December 2018. Samples from patients of all age group who presented with fever, and were clinically suspected to have Dengue and Chikungunya were included. Testing method will be done by IgM antibody capture ELISA kits produced by NIV (Arbovirus Diagnostic NIV, Pune, India). The tests will be carried out following the manufacturer's instruction. In 2017, Of 1664 samples tested for Dengue IgM, 158(09.49%) were positive. In 2018, of 737 samples tested for Dengue IgM, 48 (6.51%) were positive. In 2017, Of 1439 samples tested for Chikungunya, 147(10.21%) were positive. In 2018, of 711 samples tested for Chikungunya IgM, 90 (12.6%) were positive. 12 patients from 2017 and 19 patients from 2018, Total 31 patients were characterized with coinfection involving CHIKV and DENV infection respectively. The serological tests (ELISA) clearly establish the etiology and also help in initiating appropriate treatment and preventive measures in community.

* **Corresponding Author:** C. Pooja ✉ pooja360d@gmail.com

Introduction

Cases of simultaneous infections involving different arboviruses are becoming common in areas where they circulate concomitantly. Vector density and environmental changes, along with migration and immigration contribute to the spread of these viruses. They are endemic in the tropical and subtropical regions of the world and are the main causative agents of infectious diseases of importance in public health (S. Marinho *et al.*, 2020).

Dengue and chikungunya are important mosquito-borne viral disease of humans. There have been a recurrent phenomenon throughout the tropics in the past decade (KP. Modi *et al.,* 2017).

Dengue fever (DF) is a viral illness caused by a flavivirus and spreads by bite of highly anthropophilic *A. aegypti* mosquito (Luis Furuya-Kanamori *et al.,* 2016; Dayaraj Cecilia *et al.,* 2014). The name dengue originated from the Swahili word for "bone-breaking fever" or the word for "the walk of a dandie" in Spanish. The spectrum of disease ranges from self-limited DF to more severe forms (Dayaraj Cecilia *et al.,* 2014).

CHIK fever is a viral disease caused by an alpha virus that is also spread by bite of *A. aegypti* mosquito (Dr. Narayan Shrihari *et al.,* 2012). The name is derived from the Makonde word meaning that which bends up in reference to the stooped posture developed as a result of the arthritic symptoms of the disease. CHIK first established its presence during a 1952–1953 epidemic outbreak in Tanzania (Shashi sharma sudhan *et al.*, 2017; Ms. Akanksha Tomar *et al.,* 2017; Braira Wahida *et al.,* 2017). In India, CHIKV was first isolated in Calcutta in 1963 (Shashi sharma sudhan *et al.*, 2017). 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 (Maninder Kaur *et al.,* 2018; Isabel Rodríguez-Barraquer *et al.,* 2015).

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 monoinfection with these viruses. Hence, the timely diagnosis of the dual infections is essential for better patient management (Dr. Banwari Lal *et al.,* 2020).

In India, concurrent isolation of CHIKV and DENV had been reported since 1964 from different States. In 1967, co-infections with dengue and CHIK viruses were reported from Kolkata. Subsequent serological investigations in Southern India indicated that the two viruses can co-exist in the same host. The first case report of CHIK and dengue co-infection confirmed by molecular assays was from Sri Lanka In 2010, a hospital-based study revealed co-circulation of CHIKV and DENV in some areas of West Bengal, India with high morbidity (Dr. Karthik, R *et al.,* 2014). The present study was planned to observe the prevalence of Dengue-Chikungunya co-infection in this region in the calendar year 2017-2018.

Materials and methods

The retrospective study was done at a District hospital attached to Chamarajanagar institute of medical sciences, Chamarajanagar for a period of two years i.e, from January 2017 to December 2018. Blood samples were collected from suspected cases of Dengue and/or Chikungunya infections. In 2017 out of 3103 samples, 1664 samples were subjected to Dengue testing and 1439 samples for Chikungunya and in 2018 of 1448 samples received, 737 samples were tested for dengue infection and 711 samples for Chikungunya. Total of 4,551 samples of both dengue and chikungunya from 2017 and 2018, were tested for both Dengue and Chikungunya to detect co-infection. Of this total, 31 cases were identified with co-infection. Samples were subjected to IgM antibody capture ELISA kits produced by NIV (Arbovirus Diagnostic NIV, Pune, India). Tests were carried out according to manufacturer's instruction. Data were collected from microbiology lab registers.

Statistical analysis

Analysis was done using MS Excel.

Ethical considerations

Ethical clearance was obtained from Institutional Ethical Clearance Committee, Chamarajanagar Institute of Medical Science, Chamarajanagara.

Results

In our study, we tested total 4551 samples for Dengue and Chikungunya. Overall seroprevalence of Dengue in our study in 2017 and 2018 was 09.50% (158/1664) and 6.51% (48/737) respectively and of Chikungunya was 10.21% (147/1439) and 12.65% (90/711) respectively. Seroprevalence of Co-infection in 2017 and 2018 was 12 (0.38%) and 19 (1.31%) respectively. (Table 1) shows seroprevalence of Dengue and Chikungunya and their co-infection of the year 2017 and 2018. Males 06 (19.35%) and females 06 (19.35%) were equally affected with co-infection in the year 2017 and females 11 (35.4%) were affected higher than males 08 (25.80%) in the year 2018 respectively. Gender-wise distribution is shown in (Table 2).

In 2017 and 2018, Adults in the age group of 21 to 30 years i.e, 04 (12.90%) and 06 (19.35%) were affected higher than any other age group which is shown in (Table 3). In 2017 Co-infection was peak in the month of May 08 (66.6%) and in 2018 Co-infection was peak in the month of April 11 (57.89%) which is shown in the (Table 4) respectively.

Table 1. Seroprevalence of Dengue, Chikungunya and their Co-infection.

Samples	2017			2018		
	Dengue IgM no.s (%)	Chikungunya IgM no.s (%)	Co-infection	Dengue IgM no.s (%)	Chikungunya IgM no.s (%)	Co-infection
Positive samples	158 (9.50%)	147 (10.21%)	12 (0.38%)	48 (6.51%)	90 (12.65%)	19 (1.31%)
Negative samples	1506 (90.50%)	1292 (89.79%)	3091 (99.62%)	689 (93.49%)	621 (87.35%)	1429(98.69%)
Total samples tested	1664(100%)	1439 (100%)	3103 (100%)	737 (100%)	711(100%)	1448(100%)

Table 2. Gender distribution of Dengue - Chikungunya Co-infection.

Gender	2017 nos (%) –	2018 nos (%) –	Total
Male	06 (19.35%)	08 (25.80%)	14 (45.16%)
Female	06 (19.35%)	11 (35.4%)	17 (54.83%)
Total	12 (38.7%)	19 (61.29%)	31 (100%)

Table 3. Age-wise distribution of Dengue - Chikungunya Co-infection.

Age group (years)	2017	2018	Total
0-10	01 (3.22%)	01 (3.22%)	02 (6.45%)
11-20	01 (3.22%)	05 (16.12%)	06 (19.35%)
21-30	04 (12.90%)	06 (19.35%)	10 (32.2%)
31-40	03 (9.67%)	05 (16.12%)	08 (25.80%)
41-50	01 (3.22%)	01 (3.22%)	02 (6.45%)
51-60	02 (6.45%)	00	02 (6.45%)
61-70	00	00	00
>71 yrs	00	01 (3.22%)	01 (3.22%)
Total	12 (38.67%)	19(61.29%)	31 (100%)

Table 4. Month wise distribution of suspected Dengue - Chikungunya Co-infection 2017 & 2018.

Month	Co-infection		Total
	No. (%) Of positive samples 2017	No. (%) Of positive samples 2018	
January	00	02 (10.52%)	02 (10.52%)
February	00	00	00
March	00	02 (10.52%)	02 (10.52%)
April	00	11 (57.89%)	11 (57.89%)
May	08 (66.6%)	01 (5.26%)	09 (71.86%)
June	00	01 (5.26%)	01 (5.26%)
July	00	01 (5.26%)	01 (5.26%)
August	00	01 (5.26%)	01 (5.26%)
September	00	00	00
October	02 (16.66%)	00	02 (16.66%)
November	02 (16.66%)	00	02 (16.66%)
December	00	00	00
Total	12 (100%)	19 (100%)	31 (100%)

Discussion

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 coinfections following the mosquito bite. 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 (Acute Respiratory Distress Syndrome), 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.

In our study total of 4551 samples were tested for both Dengue and Chikungunya to detect co-infection. Overall seroprevalence of Dengue in our study in 2017 and 2018 was 9.50% (158/1664) which correlates with the study of Marlen Yelitza Carrillo-Hernández et.al, and 6.51% (48/737) in 2018 which correlates with the study of Marcela Mercado-Reyes *et. al.,* 2018.

In our study Chikungunya prevalence in 2017 was 10.21% (147/1439) which correlates with the study of Dr. Karthik, R *et. al.*, 2014 and 12.65% (90/711) in 2018 which correlates with the study of Marcela Mercado-Reyes *et. al.*, 2018.

In our study Seroprevalence of Co-infection in 2017 and 2018 was 12 (0.38%) and 19 (1.31%) which gives the total of 31 (0.99%) respectively (Table 1) which correlates with the study of Indrani Mohanty et.al. who reported Co infection with CHIK and dengue was found to be 1.15% (Indrani Mohanty *et al.,* 2013).

In our study Co-infection positivity was predominantly in the females i.e, 17 (54.83%) (Table 2) which correlates with the study of Thomas Edwards *et al.,* who reported the majority of cases in females i.e, 25/46 (54.34%)(Thomas Edwards *et al.,* 2016).

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 (Modi K.P. *et al.,* 2017).

In our study Co-infection positivity was predominantly between the age group of 21-30 i.e, 04 (12.90%) and 06 (19.35%) in 2017 and 2018 and total of 10 (32.2%) respectively (Table-3) which correlates with the study of Dr. Banwari Lal *et al.,* 2020 who reported the majority of the co-infection cases between the age group of 21 to 30 years i.e, 125/327 (38.22%) (Dr. Banwari Lal *et al.,* 2020).

In our study, the Dengue Chikungunya co-infection was peak in the pre-monsoon season i.e. in the month of May in 2017 and followed by April in 2018 i.e, 08 (66.6%) and 11 (57.89%) (Table 4) respectively.

The reason may be due to prime occupation of the people being agriculture, and breeding of *A. aegypti* is highest during pre and post-monsoon period (Maninder Kaur *et al.,* 2018).

Conclusion

With the urbanization that is occurring in India, the incidence of dengue infection is increasing dramatically. With the expectation that cases of co infection with DENV and CHIKV will become more prevalent in the future due to increased transmission of both viruses in various areas of India, enhanced surveillance to clinically and diagnostically differentiate CHIKV and DENV infections is needed for early recognition of virus invasion and local transmission, better patient care, and timely control measures. With clinical examination of CHIKV/DENV coinfected patients has not y*et al*lowed the identification of specific or severe symptoms, such observations should be interpreted with caution. Our findings may add to the recognition of CHIKV/DENV coinfections and suggest that tests to detect the presence of both viruses should be carried out in individuals showing clinical signs of an infection with either CHIKV or DENV.

Acknowledgments

The author extends gratitude to all the colleagues who helped in the study.

Conflict of interest

The authors declare that there is no conflict of interest.

Authors Contribution

PC drafted the manuscript, compiled the information and designed the tables. MDW and JS gathered information. SJV supervised and reviewed the manuscript and tables.

Funding

None.

Data Availability

All datasets generated or analyzed during this study are included in the manuscript.

Ethics Statement

This article does not contain any studies with human participants or animals performed by any of the authors.

References

Braira Wahida, Amjad Alia, Shazia Rafiquea, Muhammad Idrees. 2017. Global expansion of chikungunya virus: mapping the 64-year history International Journal of Infectious Diseases **58,** 69-76

Dayaraj Cecilia. 2014. Current status of dengue and chikungunya in India. WHO South-East Asia Journal of Public Health **3(1),** 22-27

Dr Banwari Lal, Dr Geeta Parihar, Abhila Parasar, Dr VL Rastog, Dr Shailendra Garg, Dr Ganpat Kumawat. 2020. Sero-prevalence of dengue and chikungunya coinfection with seasonal variations in tertiary care hospital, Ajmer, Rajasthan. International Journal of Scientific Research **9(3).** DOI : 10.36106.

Dr Karthik, R Dr Vineetha KR, Dr Raut, CG, Dr Nazim Shaik, Manjunatha. 2014. Seroprevalance of dengue and chikungunya co infection and its clinical correlation in bangalore city hospitals. International Journal of Current Research **6(12),** 11040-11044.

Dr Narayan Shrihari, Dr Kumudini TSD, Bact Dr, Mariraj J, Dr Krishna S. 2012. The prevalence of chikungunya arboviral infection in and around bellary district, Karnataka. Journal of Evolution of Medical and Dental Science **1(5),** 678.

Dr Saswati Chattopadhyay. 2016. A Study on Chikv-Denv Co-Infection in West Bengal, India. Journal of Dental and Medical Sciences **15(8),** 66-69.

Indrani Mohanty, Muktikesh Dash, Susmita Sahu, MV Narasimham, Pritilata Panda, Sanghamitra Padhi. 2013 Seroprevalence of Chikungunya in Southern Odisha. Journal of Family Medicine and Primary Care **2(1).**

Isabel Rodríguez-Barraquer, Sunil S Solomon, Periaswamy Kuganantham, Aylur Kailasom Srikrishnan, Canjeevaram K Vasudevan, Syed H Iqbal, Pachamuthu Balakrishnan, Suniti Solomon, Shruti H Mehta, Derek AT. 2015. Cummings, The Hidden Burden of Dengue and Chikungunya in Chennai, India, PLOS Neglected Tropical Disease.

Luis Furuya-Kanamori. 2016. Co-distribution and co-infection of chikungunya and dengue viruses, BMC Infectious Diseases **16,** 84.

Maninder Kaur, Kanwardeep Singh, Shailpreet K Sidhu, Pushpa Devi, Manpreet Kaur, Sapna Soneja, Nacchartarjit Singh. 2018. Coinfection of chikungunya and dengue viruses: A serological study from North Western region of Punjab, India Journal of Laboratory Physicians **10 (4)**

Marcela Mercado-Reyes. 2018. Dengue, chikungunya and zika virus coinfection: Results of the national surveillance during the zika epidemic in Colombia **147, e77,** 1–7

Marlen Yelitza Carrillo-Hernández, Julian Ruiz-Saenz, Lucy Jaimes Villamizar. 2018. Sergio Yebrail Gómez-Rangel and Marlen Martínez-Gutierrez. Co-circulation and simultaneous coinfection of dengue, chikungunya, and zika viruses in patients with febrile syndrome at the Colombian-Venezuelan border. BMC Infectious Diseases **18,** 61

Modi KP, Patel DA, Vegad MM, Mistry AU, Padaria NJ, Rathod AB. 2017. Sero-Prevalence of Dengue and Chikungunya, their Co-Infection and Seasonal Trends of These Infections at a Tertiary Care Hospital, Ahmedabad, Gujarat. International Journal of Microbiology Research **9(1),** 819-822.

Ms Akanksha Tomar, Dr Anahita V, Bhesania Hodiwala Dr, Deepashri D, Khiste. 2017. Prevalence of Chikungunya Viral Infection in a Tertiary Care Hospital, Navi Mumbai Maharashtra. Journal of Medical science and medical research **05(01),** 15948-15951.

Robson dos Santos S, Marinho. 2020. Detection of coinfection with Chikungunya virus and Dengue virus serotype 2 in serum samples of patients in State of Tocantins, Brazil. Journal of Infection and Public Health **3(2020),** 724-729.

Shashi Sharma Sudhan, Monika Sharma, Preeti Sharma, Rajiv Kumar Gupta, Sorabh Singh Sambyal, Sonali Sharma. 2017. Serosurveillance of Dengue, Chikungunya and Zika in Jammu, a Sub-Himalayan Region of India. Journal of Clinical and Diagnostic Research **11(11),** DC05-DC08

Thomas Edwards, Leticia del Carmen Castillo Signor, Christopher Williams, Evelin Donis, Luis E Cuevas, 1 Emily R Adams. 2015. Co-infections with Chikungunya and Dengue Viruses, Guatemala, 2016 Emerging Infectious Diseases **22(11).**