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Regional Variation in Chikungunya Viral Infection Prevalence in Meghalaya: A Study from Tertiary Teaching Center from North East India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Aim: The aim of the study is to investigate the sero-prevalence of chikungunya presented within NEIGRIHMS (North Eastern Indira Gandhi Regional Institute of Health and Medical sciences), a regional institute located in Shillong, Meghalaya, India.
Study Design: This was a cross-sectional study.
Place and Duration of the Study: The study was carried out in NEIGRIHMS covering patients within Meghalaya apart from the Garo Hills, India, during the months of June to November, 2023.

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Methodology: Blood samples from patients were collected and were subjected to CHIKV IgM ELISA for detection of chikungunya virus infection. A total of 100 samples (46 males and 54 females; age range: 18 above) from patientswith chikungunya-like symptoms commonly fever, arthralgia, myalgia and headache were recruited for the study.
Results: Out of 100 samples tested for CHIKV IgM Elisa, 10 samples came out positive.
Conclusion: An active surveillance of cases and identification of their sources can help to identify where the resources for chikungunya prevention program should be distributed within the state of Meghalaya for optimum utilization of resources and effective disease control.

Keywords: Chikungunya virus; Chikungunya infection; Chikungunya IgM antibodies; Meghalaya; Shillong; East Khasi Hills District.

ABBREVIATIONS

CHIKV: Chikungunya Virus
CHIKF: Chikungunya Fever

1. INTRODUCTION

Chikungunya virus (CHIKV) is an alpha virus belonging Togaviridae family and are transmitted byaedes mosquitoes [1-3] primarily, Aedes aegypti or Aedes albopictus [4]. Bite from such infected mosquitoes causes chikungunya fever (CHIKF), which was officially documented on the Makonde Plateau, south-eastern Tanzania after its breakout in 1952 [5]. Reports of CHIKF dated as far back as 1825, and re-emergence of the disease have been reported in Africa and Asia at an irregular interval of 2-20 years [6]. In 2005-2006, a first outbreak occurred in occidental countries in the Indian Ocean, including La Reunion, spreading from Eastern Africa [6,2]. The epidemic also then spread into India causing an estimation of 1.5 million cases [6] and was the worst affected country [7]. In 2013, a case of locally transmitted CHIKV was reported in French Guyana, and since then chikungunya cases have been reported in 44 countries in the Americas [7].

In India, the first major outbreak was reported in 1963 in South India and another in 1973, in Central India [8]. There was a pause in the outbreak for 32 years until 2006 [9,8]. Estimation from epidemiology, demographic and geographical data suggested that around 1.38 million people were affected till December of 2006 [8,10]. Most of the cases are from Karnataka amounting to half of the total reported cases and a quarter are from Maharashtra [8]. According to the data from National Vector Borne Disease Control Programme (NVBDCP) for the year 2006, a total of 15,504 samples were screened and 1985 samples came out positive giving a positivity rate of 12.8% for chikungunya [10]. The reported cases of CHIKF have increased to 23 states by the year 2015, 28 states in 2016 and by the year 2019 it was reported in 30 states and Union Territories. Lakshadweep and Dadra and Nagar Haveli Union Territories have not reported any cases of CHIKF till now. Highest number of reported cases was seen in the year 2016, 2017 and 2019 [5].

Chikungunya case in the Northeastern states of India was first reported in Assam in 2008, and in 2010 in Meghalaya [11]. The outbreak of CHIKV in Meghalaya was reported in the Garo Tribe dominating in the West Garo Hills District of Meghalaya of which out of 64 suspected cases 23 were positive for IgM antibodies against the CHIKV. Also, studies show that the northeastern states are hotspots of the Aedes species mosquitoes [12]. In Meghalaya, according to the NCVBDP (National Centre for Vector Borne Diseases Control), 2 chikungunya cases were reported in 2018, 48 cases in 2019 and zero cases in 2020 till 2022. As of 2023, 8 cases were reported till September from the whole state. The aim of this study is to screen for chikungunya in other parts of Meghalaya apart from Garo Hills region by recruiting patients attending the tertiary level referral teaching center situated in Northeastern region of the country i.e. Shillong. This will help to understand its prevalence in the region and increase reporting to NCVBDP.

1.1 Clinical Manifestation

After an incubation of 2-6 days, chikungunya is characterized by onset of high fever and arthralgia [5]. The symptoms relating to CHIKV infection are classified into two stages; the acute phase and chronic phase [5,2]. Sudden onset of fever with arthralgiaare typical initial symptoms of CHIKF which can last upto 15 days and is considered as the acute phase [5,13]. The disease is associated with other symptoms like

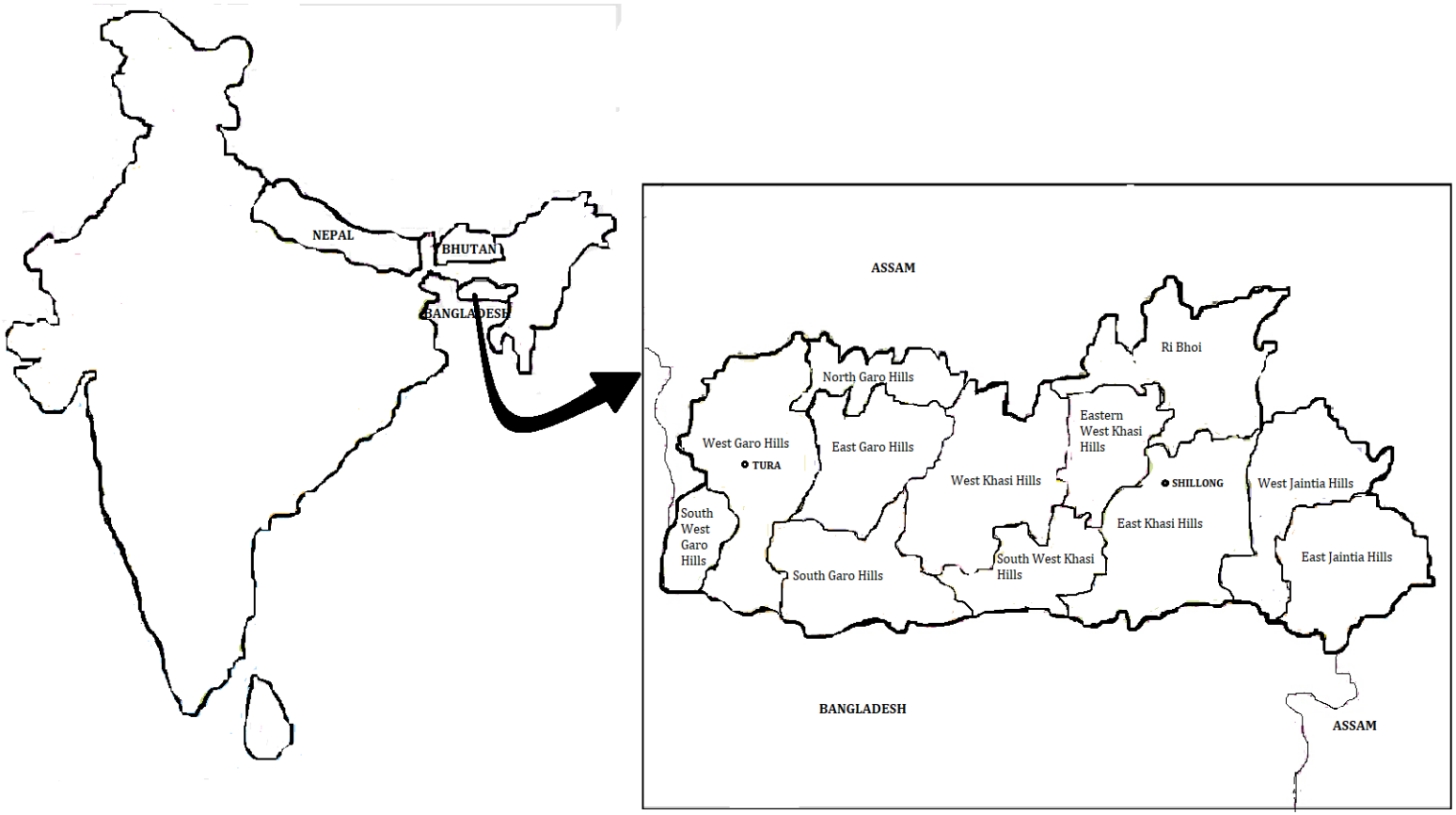

Fig. 1. Map of Meghalaya

Table 1. Classical and non-classical symptoms of chikungunya infection [5]

Clinical manifestations of Chikungunya infection	
Classical features	**Complications**
Fever	Bulbous skin lesions
Arthralgia	Fulminant hepatitis
Rashes on skin	Meningoencephatitis
Headache	Retinitis
Backpain	Uveitis
Nausea	Myocarditis
Vomiting	Nephritis
Joint Swelling	Convulsions
Myalgia	Cranial nerve palsy
Lymphadenophathy	Guillain-Barre Syndrome
Fatigue	Acute Renal failure
Restlessness	Respiratory failure
Anorexia	Meningitis
Abdominal Pain	
Diarrhea	
Leukopenia	
Lymphopenia	

intense fatigue, arthralgia, myalgia, headache, nausea and vomiting in adults [2]. After a short improvement following the acute phase, patients can be impaired by early exacerbation, inflammatory relapses, rheumatism and loss in the quality of life. This long term deterioration is mostly seen in elderly patients of 40 years and above and/ in patients with underlying diseases [2].Additional symptoms are skin maculopapular rashes [13], tenosynnovitis, severe neurologic, cardiac arrest and in some instances, death. These severe clinical features are mostly seen in neonates, adults of more than 65 years old and/orpatients with underlying diseases [14]. Reports have shown that high rate of morbidity occurs in mother-to-infant transmission of CHIKV infection [14].

2. MATERIALS AND METHODS

2.1 Study Area and Sample Collection

During the month of June to November, samples are collected from patients having symptoms similar to CHIKF disease which includes fever, arthralgia, headache, myalgia and fatigue presented within NEIGRIHMS, Shillong. The study has been approved by the ethical community IEC of NEIGRIHMS Vide No.NEIGR/IEC/M14/F16/2021 dated 26/04/2021. A total of 100 samples has been collected and were subjected to CHIKV IgM ELISA after the written consent from each patient was taken and their symptoms were recorded. All patients presented acute symptoms of 3-7 days.

Routine blood test reports like Lymphocyte count, ESR (Erythrocytes Sedimentation Rate), (SGOT) Serum Glutamic Oxalocetic Transaminase and (SGPT) Serum Glutamic Pyruvic Transaminase were collected. All the tests were done and reported within the diagnostic lab of NEIGRIHMS.

2.2 Chikungunya Elisa IgM

Serum samples separated from the 2 ml of blood collected were stored in aliquots at -80C. 1µl of each serum samples was then run for chikungunya IgM using the NIV CHIKUNGUNYA IgM Capture ELISA (National Institute of Virology, Pune, Maharashtra, India) following the manual instructions provided in the Kit.

3. RESULTS

Out of the 100 samples analysed, 10 samples came out positive for IgM. Most common symptoms were fever (100%), myalgia (50%), arthalgia and headache (20%). Geographically, 80% of the positive cases are from the East Khasi Hills District and 30% from Ri-Bhoi.

The routine blood tests reports recorded showed majority were within the normal range, except for 2 cases where there is an elevation in ESR (Erythrocytes Sedimentation Rate) and mild elevation in (SGOT) Serum Glutamic Oxalocetic Transaminase and (SGPT) Serum Glutamic Pyruvic Transaminase.

4. DISCUSSION

Northeastern states have shown to be the hotspots for Aedes mosquitoes which are vectors of chikungunya and dengue, and Meghalaya is one of them [15]. It also shares borders with Bangladesh, which had a chikungunya outbreak in 2008, and soon followed by an outbreak in Tura, Meghalaya in 2010 [15]. However, no outbreak has been reported in or around Tura since then [15]. Moreover, during the dengue outbreak in Guwahati, Assam, in 2015, besides the dengue positive cases many dengue suspected cases came out negative. As both diseases have the same vector (Aedes) and is highly prevalent during the monsoon season [16], a study was done on the dengue negative cases. Out of 42 dengue negative samples, 7 samples have shown amplification for CHIKV RNA instead [12].This proves the silent existence of CHIKV which may have been concealed by dengue [12], therefore requires for an active surveillance with regard to the disease occurrence.

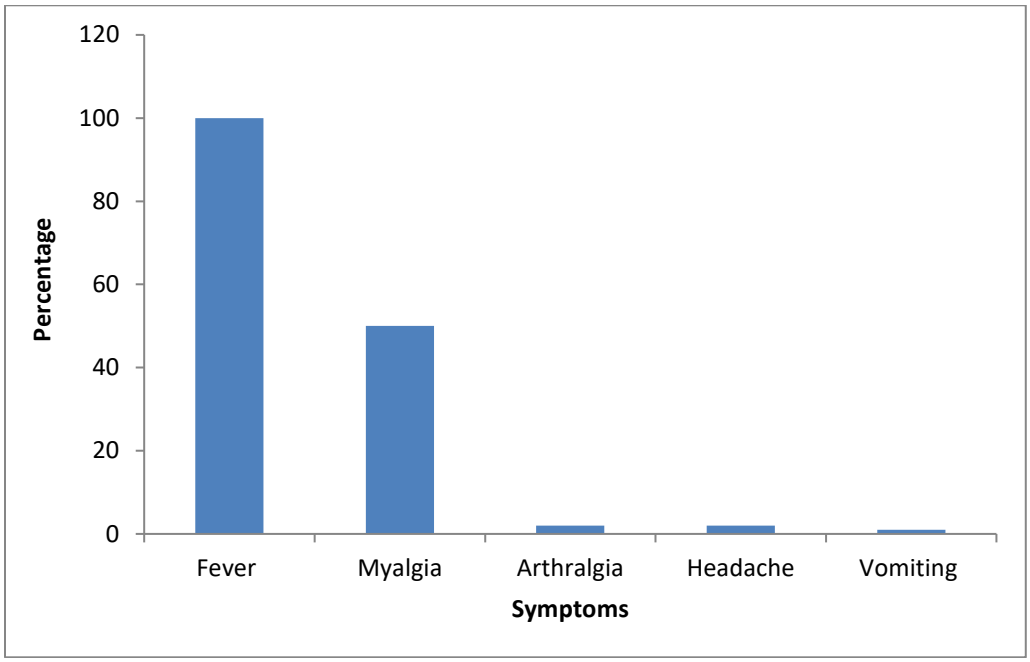

Fig. 2. Percentage of symptoms of the Positive Cases

With available reports of a recent outbreak within Meghalaya, a need for continuous active surveillance is required and with the symptoms being related to dengue, suspicions for chikungunya cases cannot be omitted. This study has shown a prevalence of 10% confirmed by IgM. However, this prevalence may not be presenting the entire study area as only patients attending our tertiary centre have been recruited. There is a need to also screen patients in the community presenting with similar symptoms. Acute symptoms may have been treated symptomatically without diagnosis can also lead to the lower rate of reported positive cases. Absence of chikungunya cases have been reported in literature despite the presence of Aedes mosquitoes, the reason for this could be explained due to the rate of transmission being affected by many factors, such as, the lack of availability of hostin urban areas, such as monkeys, sylvatic vectors (forest dwelling mosquitoes) and low population density and movement [17]. However the rate of transmission in this study area can only be hypothesized due to the scarcity of researches in this regard and additional research is needed.

SML classifiers (Statistical Machine Learning Classifiers) have been known to be a key success in predicting demographic distributions, incidence and prevalence of mosquito-borne diseases in various populations and area [18]. Also, there have been an increasing used of SML tools in diagnosis and grading illness [19] Therefore, SML classifiers can be included for future research [20-22].

5. CONCLUSION

Absence of suitable treatment or vaccine for chikungunya and with recent study showing the prevalence of chikungunya in the state of Meghalaya [11] calls for further continuation of this study to get more evidence into accurate prevalence of chikungunya in the entire state of Meghalaya. Also with the increase in modern transportation makes it easier for viral diseases to be transmitted from remote areas into populated urban areas. The challenges of long term sequelae post chikungunya infection can cause a huge affect on the patient's quality of life. Therefore, an active surveillance of cases and identification of their sources can help to identify where the resources for chikungunya prevention program should be distributed within the state of Meghalaya for optimum utilization of resources and effective disease control.

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CONSENT AND ETHICAL APPROVAL

The study has been approved by the ethical community IEC of NEIGRIHMS Vide No.NEIGR/IEC/M14/F16/2021 dated 26/04/2021. A total of 100 samples has been collected and were subjected to CHIKV IgM ELISA after the written consent from each patient was taken and their symptoms were recorded.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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