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Epidemiological Investigation of a Chikungunya Fever Outbreak in a Tribal Population of Dakshin Dinajpur, West Bengal, India

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ABSTRACT

Introduction

Chikungunya is a re-emerging viral fever transmitted by the bite of infected Aedes mosquitoes. We investigated the outbreak with the objective of finding out the cause of fever with joint pain and recommended preventive measures.

Methods

This outbreak investigation was done at the village of Gangarampur block of Dakshin Dinajpur district, West Bengal, India. House-to-house search for active cases was conducted at the village during October - November 2024. The outbreak was described by time, place, and person distribution. Epidemic curve, spot maps, and analytical tables were constructed to determine the relation of the outbreak. Blood samples were tested for dengue, chikungunya, malaria, and scrub typhus. Entomological surveys were also done to measure larval index.

Result

A total of 35 cases were identified, with an overall attack rate of 2.97%. Majority of the cases were female (57.2%) and age group of 31 - 50 years (48.8%). In almost all cases, patients developed fever with joint pain. The epidemic curve showed maximum cases in the month of November 2024. Chikungunya, dengue & scrub typhus positivity was 51.7% (15/29), 3.4% (1/29) & 6.9% (2/29) respectively. No such significant entomological findings were observed.

Discussion

We initiated the investigation on the presumption of a dengue outbreak, but after blood samples reporting, it was revealed that cases were predominantly (51.7%) Chikungunya, 6.9% were Scrub Typhus and mixed infections of Scrub Typhus with Chikungunya and 3.4% were Dengue. Without any complications, almost all cases were managed at home. Extensive awareness generation programmes were conducted for the prevention and transmission of fever.

Key-words: Chikungunya, Outbreak, Dakshin Dinajpur, West Bengal, India.

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INTRODUCTION

Chikungunya is a viral disease (RNA virus, genus Alphavirus, family Togaviridae). The virus is transmitted to humans by the bite of infected Aedes mosquitoes.[1,2] The first case of chikungunya was identified in Tanzania, there after cases were found in Africa and Asia.[3] The first chikungunya outbreak in India was identified in 1963, and cases were detected in several states of India up to 1970.[4] In 1963, the outbreak of chikungunya was also recorded in Calcutta.[5,6] Over more than 30 years, again chikungunya outbreak was found in Andhra Pradesh (2005), and in 2006 outbreak of chikungunya occurred in Central and Southern States of India. [4] Thereafter, chikungunya fever occurred in India every year, with more than 13 States and 1.4 to 6.5 million estimated cases reported.[7] West Bengal is one of the States of India where chikungunya cases are reported every year.[8] The health workers of the Gangarampur Block informed district surveillance teams that there was an increased number of fevers with joint pain in Dafarpur village of Gangarampur block. We investigated the cases to (i) find out the causes of fever and joint pain in the village, (ii) control the cases, and recommended the preventive measures.

Methods

Study Setting:

There was an increased number of fever cases with joint pain reported from the Dafarpur village (Figure 1) of Nandair Health Wellness Center (HWC) under Gangarampur block, District Dakshin Dinajpur, West Bengal, India during the month of October – November 2024.

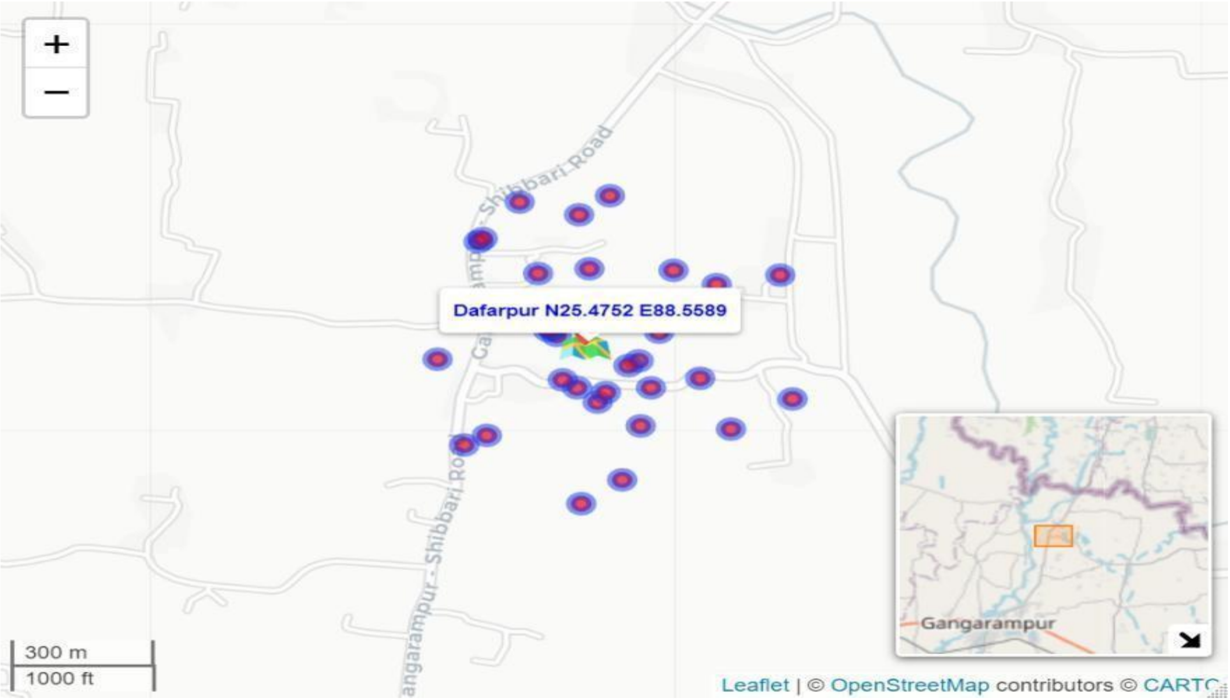

Figure 1: Geographic Information System (GIS) Plotting of the Cases of Dafadarpur village, Dakshin Dinajpur district, West Bengal, India.

The Nandair Health and Wellness Center (HWC) supports a population of 3920, including four villages named (i) Dafarpur (population 1181), (ii) Nandair (population 1932), (iii) Sultanpur (population 740), and (iv) Rashidpur (population 67).[9] Auxiliary Nurse Midwives (ANM) of this HWC observed that a cluster of cases of fever, joint pain, rash, and body aches went to the HWC for treatment. The ANM reported the cases to the Block Health Team and the district. We suspected that the cases may be due to dengue. We searched for dengue cases in the village. Among the four villages of this HWC, the cases were reported only from the village named Dafarpur. While there exists a mixed population of Hindu and Muslim residents, Dafarpur is predominantly inhabited by Scheduled Tribe members. Many cultivate and rear animals. Most of the houses have tin roofs, mud walls, and tidy interiors. There is no pipe water supply, but a deep tube well is available for drinking water. Small and large water bodies and ponds are located nearby.

Data Collection:

We constructed a data collection format for the survey. Health workers of Nandair HWC were trained for data collection. We conducted a door-to-door case search for fever with joint pain and rash. We used the World Health Organization (WHO) case definition for the study mentioned below:

Case definition of dengue: [10]Probable case (with or without warning signs):

Fever and two or more of the following: (nausea/vomiting, rash, aches and pains, tourniquet test positive, leukopenia);

Fever and two or more of the following: (nausea/vomiting, rash, aches and pains, tourniquet test positive, leukopenia) and any warning sign.

Confirmed case:

A probable case with laboratory confirmation:

Highly suggestive of Immunoglobulin M (IgM) positive in a single serum sample;

Immunoglobulin G (IgG) positive in a single serum sample with a house index (HI) titre of 1280 or greater; or detection of viral antigen NS1+ in a single serum sample (by enzyme-linked immunosorbent assay (ELISA) or rapid tests). Confirmed:

Polymerase chain reaction (PCR) positive; or virus culture positive;

IgM seroconversion in paired sera; or IgG seroconversion in paired sera or fourfold IgG titre increased in paired sera.

Case definition of Chikungunya: [11]

Suspected Case: Any person with acute onset of fever >38.5°C and severe arthralgia/arthritis not explained by other medical conditions.

Probable case: A patient meeting both the clinical and epidemiological criteria.

Confirmed case: A suspected case with laboratory confirmation. We collected the data from the symptomatic and asymptomatic patients. We also collected data from the immediate caregivers in the case of a minor. Written informed consent was obtained before data collection. Data was collected at the community using the data collection format. We included candidates for the study who were willing to participate, with a symptomatic or epidemiological link to the case definition. Irrespective of participation in the study, appropriate healthcare support and treatment were provided to all affected individuals. We supplied medicine as per their requirement and advised the patient and their relations on the prevention of dengue & chikungunya fever. We described the outbreak in time, place, and person distribution, and the attack rate was calculated. Socioeconomic status is also checked. We investigated whether the case patient was admitted to the nearby hospital or any nursing home. We searched for any gatherings such as festivals, worship festivals, or any other social settings in the locality during September, October 2024. We also searched for any migration of population in the village and out-migration to other states or districts where chikungunya has been endemic for the last three months. We determined the index case was a civic volunteer working in Gangarampur Police Station with a migration history from another district.

Laboratory diagnosis:

Blood samples were collected from all the case patients. Samples were tested first for malaria with the rapid diagnostic test kits (RDK) at the field level. We collected 4 - 5 ml of blood from the case patient for testing of (i) Dengue, (ii) Chikungunya, and (iii) Scrub typhus. Dengue and scrub typhus were tested at Gangarampur Super-speciality Hospital (SSH), Dakshin Dinajpur, West Bengal, India, and Chikungunya was tested at Raiganj Medical College Hospital, Uttar Dinajpur district, West Bengal, India. Serum was separated at the SSH laboratory at Gangarampur, Dakshin Dinajpur district. One part of the serum was sent to Raiganj MCH for chikungunya testing, maintaining cold chain. The samples were stored at 2–8 °C immediately after separation and transported in insulated vaccine carriers with ice packs, ensuring uninterrupted temperature control during transit to preserve sample integrity and prevent sample degradation. All these three tests were tested by ELISA (Enzyme Linked Immunosorbent Assay (ELISA) method.

Data analysis:

The collected data was entered in Microsoft Excel for analysis. Outbreak curves were analyzed using "R" software.

Entomological assessment:

We collected information related to mosquitoes, eggs and larvae of mosquitoes, and breeding sites. We counted containers as breeding sources, noting whether the containers were dry or wet. We searched the larvae & eggs in wet containers.

We calculated the entomological index, including,(i) House Index (HI), (ii) Container Index (CI), and (iii) Breteau Index (BI). We also observed the sanitary status of the village. This is an outbreak investigation as per standard protocol, and did not require ethical approval. We used numbers instead of names for data analysis to maintain confidentiality.

Result

A total of 35 cases were identified for the study as clinically and epidemiologically compatible with the Chikungunya case. Among the total case patients, 57.2% (20/35) were female and 42.8 % (15/35) were male. The overall attack rate was 2.97% (35/1182). Age and gender wise distribution of the chikungunya cases in Dafarpur village, Gangarampur block, Dakshin Dinajpur, Wes Bengal; India is summerised in Table-1.

Table-1: Age and gender wise distribution of chikungunya cases in Dafarpur village, Gangarampur block, Dakshin Dinajpur, West Bengal, India.

Age in Years	Male	Female	Total	%
2 - 15	2	1	3	8.6
16 - 30	2	4	6	17.1
31 - 50	6	11	17	48.8
> 50	5	4	9	25.7
	15	20	35	100
Percentage (%)	42.8	57.2		
Population	615	567	1182	
Attack Rate (%)	2.4	3.5		2.97

All the cases had joint pain, mainly in the knee and ankle joints. Among them 97% (34/35) had fever followed by headache 83% (29/35), fatigue 77% (27/35), and nausea 23% (8/35). Only 11% (4/35) of the case patients developed rash (Table-2). Most chikungunya cases were managed at home, except for one case that required institutional care, and no deaths were reported during the outbreak.

Table 2: Signs and symptoms of Chikungunya outbreak in Dafarpur village, Gangarampur block, Dakshin Dinajpur, West Bengal, India

Signs & Symptoms	No. of Patient	Percentage (%)
Fever	34	97
Joint Pain	35	100
Headache	29	83
Nausea	8	23
Fatigue	27	77
Skin rash	4	11

Epidemic curve (Figure-2) showed that cases started in the month of October 2024 and with the maximum number of cases found in the second week of November 2024. The block and district epidemiological response was taken during this period. After this time, cases were reduced. No cases were found after the third week of November 2024.

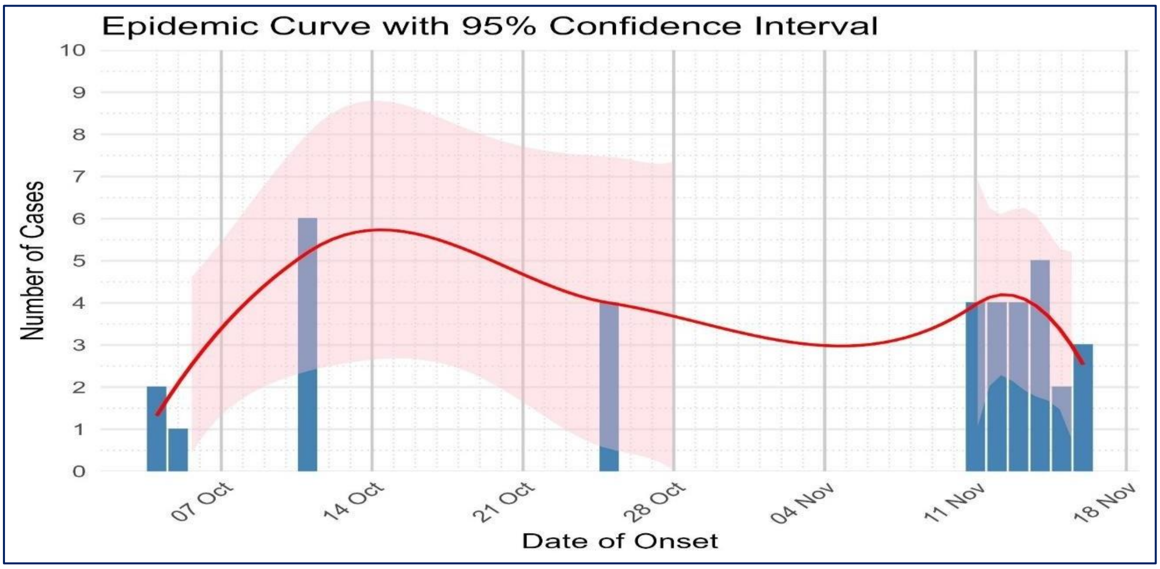

Figure 2: Epidemic Curve with 95% Confidence Interval, at Dafadarpur village, Dakshin Dinajpur district, West Bengal, India

The plotted epidemic curve shows the daily number of cases (bars in steel blue) over time, with a smooth red trend line and shaded pink area representing the fitted curve and its 95% confidence interval. The pattern highlights the rise and fall of cases over the outbreak period, with the smooth curve providing a clear visualization of the overall trend and uncertainty around it.

The effective reproduction number (R_t) is a time-dependent measure that indicates how many secondary cases are generated by a single infected individual under the current conditions of an outbreak. Unlike R_0, which assumes a fully susceptible population, R_t reflects the impact of factors such as immunity, behavioral changes, and control interventions. This makes R_t a crucial metric for monitoring the real-time dynamics of an epidemic and evaluating the effectiveness of public health measures.

Figure 3 shows the estimated effective reproduction number (R_t) of the outbreak over time, based on the observed epidemic curve. The displays the R_t estimates (blue line) with a shaded band representing the 95% confidence interval. When R_t is above 1, it indicates sustained transmission and potential epidemic growth. However, as time progresses, the R_t gradually declines after around day 40. From that point onward, the curve sustains a downward trend, with the lower bound of the 95% confidence interval approaching zero. This pattern suggests that transmission is no longer self-sustaining, and the outbreak is being brought under control.

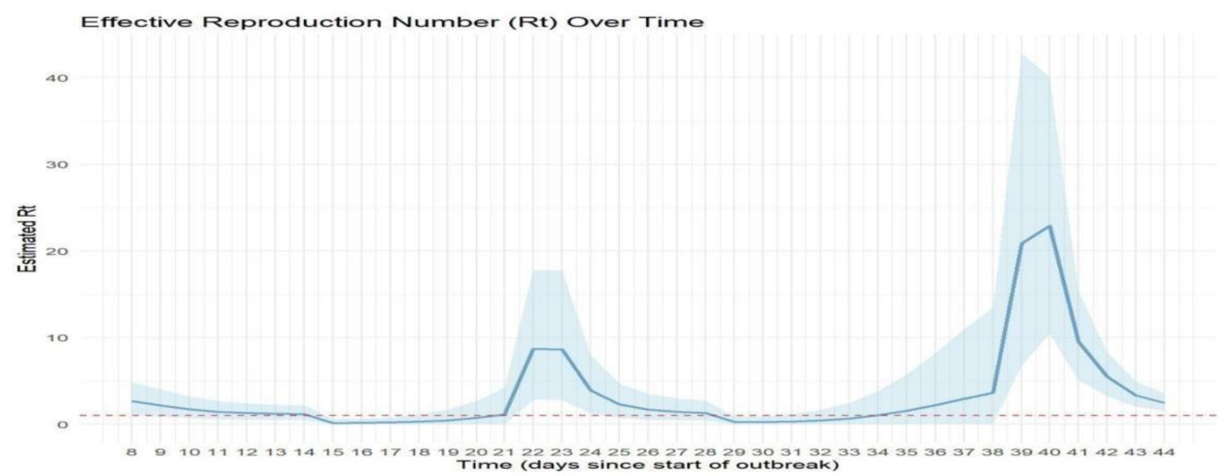

Figure 3: Effective Reproduction Number of the of the outbreak overtime, at Dafadarpur village,

Dakshin Dinajpur district, West Bengal, India

Laboratory findings:

Test positivity rate for chikungunya was 51.7 % (15/29). We also tested dengue and scrub typhus with positivity rates of 3.4 % (1/29) and 6.9 % (2/29), respectively. Two cases were both dengue and chikungunya positive. All 35-case patients were tested for Malaria parasites, and all were negative (Table-3).

Table 3: Laboratory findings of outbreak of chikungunya, in Dafarpur village, Gangrampur block, Dakshin Dinajpur, West Bengal, India

Blood samples for test	Total Test	Positive	Negative	Positivity Rate (%)
Chikungunya	29	15	14	51.7
Dengue	29	1	28	3.4
Scrub Typhus	29	2	27	6.9
Scrup typhus & Chikungunya	29	2	27	6.9
Malaria	35	0	35	0.0

Entomological Findings:

There were 280 households in Dafarpur village. Of these, 37 households were inspected for mosquito breeding during the entomological survey. A total of 75 containers were examined in the inspected households, of which only one water-holding container was found to be positive for mosquito larvae, while the remaining containers were dry. Accordingly, the House Index (HI) and Breteau Index (BI) were both 2.7, and the Container Index (CI) was 1.33, indicating a low level of mosquito breeding in the area. (Table 4).

Table 4: Entomological findings of chikungunya outbreak at Dafarpur village, Gangarampur block, Dakshin Dinajpur, West Bengal, India

Sl No:	Indicators	Result (%)
1	House Index (HI)	2.7
2	Container Index (CI)	1.33
3	Breteau Index (BI)	2.7

During the outbreak period, we observed a large worship festival near the village that was attended by a substantial number of people from the village.

DISCUSSION

This was a new chikungunya outbreak, as there was no previous data of chikungunya fever in the community. The outbreak started during the post-monsoon months. Women were affected in higher numbers than men. All the cases developed joint pain. Nearly 100% of the cases developed fever. Headache developed among 83% cases. The outbreak was investigated to find out any dengue cases in the village, but the majority of the cases were chikungunya, so the outbreak was labeled such. Some cases of dengue and scrub typhus were also identified. In this study, the Chikungunya positivity was 51.7%. A study conducted at different hospitals (Indoor & Outpatient cases) in West Bengal (2011) showed a positivity rate of only 36.89%.[12] Studies by Chennai & Odissa showed an increased number of cases in the age group of 20 - 30 years.[13, 14] But in this study, it is revealed that cases were maximum in the age group of 31 - 50 years. The scrub typhus and chikungunya virus were co-infections in the same host in two cases in this study. Similarly, a study done in Srilanka showed dengue and chikungunya cases were co-existed in the same person in two cases.[15]

While the presentation of the cases was suggestive of dengue fever initially, and accordingly we started searching for any dengue cases in the village, only one case was detected as dengue fever. The rest cases were chikungunya and scrub typhus. All the clinical and sub-clinical chikungunya cases were treated at home and with spontaneously relief of symptoms without the need for major intervention. The study done by Cebu et al (2012-13) also showed chikungunya fever was self-limiting and mild symptomatic disease.[16] On the basis of fever surveillance, all the case patients were tested for malaria parasites, but none of them tested positive. Symptoms of our study showed that almost all cases developed joint pain and fever. This contradicts a study done at Kerala (2020-21), India, where only fever occurred 51.5% and joint pain 20% of the time.[17] Entomological indices were not found to be significant. This may be due to the variety of containers found. Additionally, all containers except one were found to be dry. The index case was a civic volunteer working at a nearby police station within the same block. A large public gathering (mela) was held in a neighboring village for approximately twelve days prior to the onset of the first case. During the mela, people from different areas congregated closely for two to three days, which may have facilitated increased exposure to Aedes mosquitoes and contributed to transmission of chikungunya.

Conclusion

Fever surveillance was conducted for dengue fever. We found a mixed outbreak where chikungunya, dengue, and scrub typhus cases were identified and chikungunya predominated. Most chikungunya cases were managed at home, except for one case that required institutional care, and no deaths were reported during the outbreak. The entomological indices indicated no significant mosquito breeding, and no malaria cases were detected during the investigation. Extensive house-to-house information, education, and communication (IEC) activities were conducted on the prevention of dengue, chikungunya, malaria, and scrub typhus. In addition, fever surveillance activities were strengthened across the villages.

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