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Research Article

Epidemiological Investigation of a Cholera Outbreak in Nerlii Village, Nanded District, Maharashtra, India

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ABSTRACT

Background: Cholera continues to be a major public health problem in developing countries, often presenting in epidemic forms due to poor water sanitation and hygiene practices. A sudden surge of acute diarrhoeal cases was reported in Nerlii village, Nanded district, Maharashtra, necessitating an urgent epidemiological investigation.

Objectives: To provide a comprehensive overview of a rural cholera outbreak, identify the source of infection, strengthen surveillance, and recommend timely public health responses for outbreak containment.

Materials and Methods: A descriptive epidemiological investigation was conducted following an outbreak reported late night on 27 September 2024 in Nerlii village (population 2657). An 18-member multidisciplinary team conducted house-to-house surveys, sanitary inspections, and spot mapping. Clinical assessment, line listing, and stool and water sample collections were performed to confirm the aetiology.

Results: A total of 502 cases were identified, yielding an overall attack rate of 18.6% with a 0% case fatality rate. Among the 95 cases admitted to the Government Medical College (GMC), the 0–10 years age group constituted the largest single category (31/95). Overall, males accounted for 55.2% of the cases. The outbreak peaked on 28 September 2024 and was linked to contaminated pipe water valves surrounded by stagnant drainage pits. Stool samples from GMC admissions demonstrated darting motility suggestive of Vibrio cholerae O1 biotype El Tor. While 13 water samples were deemed unsatisfactory for drinking, effective clinical management mitigated mortality.

Conclusion: The outbreak was driven by contaminated water infrastructure and poor environmental hygiene. Prompt surveillance, timely rehydration, and coordinated public health interventions effectively contained the outbreak.

Keywords: *Cholera, outbreak investigation, public health measures, spot map, sanitary survey, Vibrio cholerae.*

INTRODUCTION

Cholera, an acute diarrhoeal disease caused by the bacterium Vibrio cholerae (primarily serogroups O1 and O139), remains a formidable global health threat, particularly in developing nations. According to the World Health Organization (WHO), cholera infects 1.3 to 4 million people worldwide annually, resulting in 21,000 to 143,000 deaths1,2,3. In India, cholera is endemic and frequently manifests in sporadic, epidemic, and pandemic forms, often exacerbated by rapid urbanization, inadequate water supply, and poor sanitation infrastructure4,5. Despite being predictable, preventable, and treatable, the disease continues to cause significant morbidity and mortality, although the true burden is likely underreported due to limitations in epidemiological surveillance and laboratory capacities4.

The pathogenesis of cholera involves the secretion of an enterotoxin that binds to intestinal enterocytes, leading to massive fluid and electrolyte loss. Because the incubation period ranges from 2 hours to 5 days, outbreaks can escalate rapidly, necessitating an immediate public health response1. Prompt oral or intravenous rehydration can reduce the case fatality rate (CFR) to below 1%, whereas untreated severe cases can be fatal within hours1.

In late September 2024, a sudden and unusual increase in acute diarrhoeal cases was reported from the rural Nerlii village in the Nanded district of Maharashtra State. Patients presenting to the casualty department of Dr. Shankarrao Chavan Government Medical College (GMC), Nanded, exhibited frequent episodes of loose stools, vomiting, abdominal cramps, and severe dehydration. A multidisciplinary rapid response team was formed within 24 hours to investigate the outbreak. The primary objectives were to confirm the aetiology, ascertain the source of infection, assess the risk of spread, and implement urgent control measures.

MATERIALS AND METHODS

A descriptive epidemiological outbreak investigation was conducted in Nerlii village, located approximately 10 km from Nanded city in Maharashtra. The village comprises 442 households with a total population of about 2657. The inhabitants are predominantly farmers and farm labourers, with some working as labourers in Nanded city. Livestock are commonly kept in and around human dwellings, and open field defecation is widely practiced. The village's domestic water supply is divided into two zones. The old area relies on an open dug well with 2-foot side walls, accessed via a common water pump. The new (rehabilitation) area is supplied by an overhead tank that draws water through pumps from another dug well, also with 2-foot side walls.

The outbreak was first recognized late at night on 27 September 2024. A standard WHO-based case definition was utilized: in an area where the disease is not known to be present, a patient aged 5 years or more developing severe dehydration or dying from acute watery diarrhoea; or, during an epidemic, a patient aged 5 years or more developing acute watery diarrhoea with or without vomiting1. Two investigation teams comprising 18 personnel were deployed. The teams included 9 medical college faculty members, 2 postgraduate medical students, 2 interns, 2 auxiliary nurse midwives (ANMs), 2 social workers, and 1 sanitary inspector. The teams operated in close collaboration with local Accredited Social Health Activists (ASHA), ANMs, the Medical Officer (MO) of the Primary Health Centre (PHC), the Assistant District Health Officer (ADHO), and the District Health Officer (DHO).

Active case finding and line listing were conducted through house-to-house visits. Detailed interviews were conducted in 50 households, covering a population of 300. Data on demography, socioeconomic status, environmental conditions, and clinical history were collected using a pretested schedule. Stool samples were obtained from probable cases for microbiological confirmation. Immediate treatment was initiated with oral rehydration solution (ORS) and antibiotics, with severely dehydrated patients referred to higher centres. A systematic sanitary survey was performed, evaluating water sources under aseptic conditions. Spot mapping using Global Positioning System (GPS) techniques was utilized to identify spatial clustering of cases relative to water supply infrastructure.

RESULTS

The outbreak investigation identified a total of 502 affected cases, yielding an overall attack rate of 18.6%. The case fatality rate (CFR) was 0%, reflecting the timely medical response. The epidemic curve indicated that the first case occurred on 27 September 2024, peaked rapidly on 28 September 2024, and exhibited a gradual decline by 30 September 2024. There was no history suggestive of food poisoning or any large public gatherings in the week preceding the outbreak.

Among the 502 cases, 149 presented with mild dehydration and were managed at the Nerli subcentre or at home. The remaining cases required hospitalization for severe dehydration: 13 were admitted to private hospitals in Nanded, 245 to the District Hospital in Nanded, and 95 to Dr. Shankarrao Chavan GMC, Nanded (Table 3).

Table 1. Age and sex distribution of cholera-affected patients admitted at Dr SC GMC Nanded

Age (years)	Male	Female	Total
0-10	16	15	31
11-20	8	14	22
21-30	10	5	15
31-40	3	5	9
41-50	4	3	9
51-60	5	3	8
61-70	2	2	4
Total	48	47	95

Detailed line listing was performed for the 95 cases admitted to GMC. The age of these admitted patients ranged from 3 to 65 years. The 0–10 years age group formed the largest single category among admitted patients, accounting for 31 of 95 cases (Table 1). Regarding the total affected population (N=502), a mild male predominance was observed, with males constituting 55.2% (277 cases) and females 44.8% (225 cases) (Table 2).

Table 2. Sex distribution of total affected population

Gender	Number of cases	Percentage
Male	277	55.2
Female	225	44.8
Total	502	

Table 3. Institutional distribution of total patients

Category	Number
OPD and household treatment at Nerli Subcentre	149
Patients admitted at private hospital Nanded	13
Patients admitted at District Hospital Nanded	245
Patients admitted at Dr SC GMC Nanded	95
Total	502

The sanitary survey and spot mapping revealed a distinct spatial clustering of cases in the rehabilitation area of the village. The clusters were concentrated around pipe water supply valves that were surrounded by stagnant drainage pits. Inspection revealed that these valves were dug open, facilitating contamination. Almost all family members residing near these specific valve spots were affected.

Laboratory investigations of stool samples from the IPD cases at GMC exhibited darting motility suggestive of Vibrio cholerae biotype El Tor. The outbreak documents reported that all stool samples tested were positive for V. cholerae O1 biotype El Tor. Environmental testing of 13 water samples collected up to 30 September 2024 indicated they were unsatisfactory for drinking. While the field report noted that these 13 suspected water samples were positive for V. cholerae, it concurrently recorded that the ortho-toluidine test was negative for all samples, and the presumptive coliform count based on the multiple tube method was surprisingly reported as satisfactory

DISCUSSION

This investigation underscores the persistent vulnerability of rural Indian communities to cholera outbreaks due to deficient water and sanitation infrastructure. The isolation of Vibrio cholerae O1 biotype El Tor is consistent with the aetiological pattern observed in numerous Indian outbreaks over the past decades5,7,15,16. The El Tor biotype, often the Ogawa serotype, has been responsible for outbreaks in diverse geographical regions including Gujarat, Wardha, Ambala, Assam, and North Karnataka6,7,8,10,11.

The demographic profile of this outbreak revealed a substantial burden among children, with the 0–10 years age group forming the largest single category among GMC admissions (31/95). This paediatric involvement has been mirrored in other studies, reflecting the heightened susceptibility of young children in endemic settings6. A mild male predominance was noted in the total affected population, with 277 of 502 cases (55.2%) occurring in males, aligning with findings from investigations in Bengaluru and other regions6,9. The epidemiological curve demonstrated a classic point-source or continuous common-source pattern with a rapid peak and subsequent decline, characteristic of waterborne transmission1. The utility of GPS and spot mapping was paramount in this investigation, definitively linking the disease clusters to compromised pipe water valves situated near stagnant drainage pits. Similar spatial clustering techniques have proven highly effective in tracing contamination sources in outbreaks in Bengaluru and urban Wardha6,9. The contamination of pipe water is a recurrent theme in Indian cholera epidemiology, as documented in outbreaks in West Bengal and Pondicherry12,14. Furthermore, the pervasive practice of open field defecation in Nerlii village provided the critical environmental reservoir for the pathogen to enter the compromised water supply6,11.

Remarkably, despite an attack rate of 18.6% and 502 affected individuals, the case fatality rate remained at 0%. This highlights the efficacy of the rapid multidisciplinary response, the immediate deployment of ORS, and prompt referral for intravenous rehydration and antibiotic therapy. Such outcomes demonstrate that while infrastructural deficits facilitate outbreaks, robust surveillance and clinical management can avert mortality13.

Public Health Recommendations

- Inform the Gram Panchayat and associated higher authorities regarding the unsatisfactory nature of the water supply and sanitation systems.

- Promote health awareness among villagers focusing on hygienic conditions and water sanitation.
- Encourage rigorous handwashing practices, particularly after defecation and before meals.
- Take definitive steps to eradicate open field defecation.
- Accelerate the construction and utilization of sanitary latrines.
- Ensure regular inspection and prompt repair of pipe water valves to prevent cross-contamination from drainage.
- Implement routine and adequate chlorination of water sources, especially during the rainy season.
- Distribute Information, Education, and Communication (IEC) materials and erect hoardings regarding environmental cleanliness.

CONCLUSION

The cholera outbreak in Nerlii village serves as an alarming indicator of the systemic weaknesses in rural water and sanitation infrastructure, compounded by poor hygiene practices such as open defecation. The epidemiological investigation successfully identified contaminated water supply valves as the source of transmission. The coordinated multidisciplinary response, characterized by rapid case detection, aggressive rehydration therapy, and targeted environmental interventions, successfully contained the outbreak with zero mortality. Long-term prevention necessitates sustained investments in safe drinking water networks, improved sanitation facilities, and continuous community health education.

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