

Epidemic Investigation of Water Sources as Cause of Acute Watery Diarrhoea Outbreak in District of Mathura, India

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Abstract :

Introduction: Cholera is one of the most important diarrheal diseases in India and continues to be an important health problem in India. Cholera is an acute intestinal infection caused by toxigenic strains of *Vibrio cholera* serogroups O1 and O139. *V. cholerae* O1 belonging to the El Tor biotype is the most common serogroup in India. Recently there was an outbreak of acute watery diarrhea in Mant and Nauhjheel Blocks of Mathura district, in May 2017. **Objectives:** To determine the cause, source and extent of the acute diarrheal disease outbreak in district of Mathura by conducting environmental and microbiological investigations **Method:** The study was carried out in the department of Microbiology, S.N. Medical College, Agra in association with Department of Community Medicine, S.N. Medical College, Agra. This study was conducted on the water and stool samples collected from Mant and Nauhjheel blocks of Mathura district. Water samples from 2 ice candy factories and 7 Stool samples from suspected cases were collected from areas reporting the maximum number of cases of acute watery diarrhoea, and tested for diarrhoeagenic pathogens in the laboratory. Isolation and identification of pathogen was done according to the standard methodology. **Results:** Of the 2 water samples and 7 stool samples tested 2 stool samples were found to be positive for *V. cholerae*. The major reason for the outbreak was traced to be consumption of contaminated water. **Conclusion:** Provisions of better sanitation and safe drinking water with adequate knowledge of proper hygiene is necessary to avoid recurrence of outbreaks due to cholera. Also continuous surveillance of the outbreak is necessary to avoid the spread of transmission.

Keywords: Acute Watery Diarrhoea, Outbreak, *Vibrio cholerae*.

Introduction:

Cholera is one of the most important diarrhoeal diseases in India and a major illness of public health importance is an acute infectious disease caused by toxigenic strains of *Vibrio cholera*.^[1] The disease poses a lesser threat to developed countries which have appropriate standards of hygiene while it remains a challenge in India and other developing countries where access to safe drinking water and adequate sanitation facilities are often limited.^[2] Cholera, essentially being a disease of poor sanitation, is linked to consumption of water and

food from unsafe sources, such as, drinking water from tube-wells or river, drinking or bathing in lakes.^[3] Although in humans, several pathogens may be responsible for causing acute diarrhoea, it is essentially important to investigate *vibrio cholerae* as the causative agent, because it can be fatal, causing severe dehydration and death within several hours and it is highly contagious.^[4] Recently there was an outbreak of acute watery diarrhoea in Mathura district, during late October-November 2016, involving more than thousand people. We conducted an environmental and microbiological investigation to

determine the cause, source and extent of this outbreak. As contaminated water plays an important role in the transmission of pathogens associated with acute watery diarrhoea, the current study mainly aimed to detect these diarrhoeagenic pathogens in water collected from various public water sources, which could be responsible for the diarrhoea outbreak.

Method:

The study was carried out in the Department of Microbiology, S.N. Medical College, Agra in association with Department of Community Medicine, S.N. Medical College, Agra. This study was conducted on the water and stool samples collected from Mant and Nauhjheel blocks of Mathura district. In May 2017 on instructions of CMO, Mathura, a team of Integrated Disease Surveillance Project (IDSP) along with local healthcare professionals visited the affected villages. The Mant and Nauhjheel block is having population of 31,000 and 40,000 respectively. Epidemiologist IDSP Mathura and state IDSP team along with local healthcare workers searched actively for cases door to door in the villages under outbreak of acute watery diarrhea. They collected personal history including symptoms from cases and created a line listing by using predesigned proforma.

A case of diarrhoea was defined as the occurrence of more than 3 watery stools a day. This case definition was consistent with the case definition of the IDSP in India.^[5] The incidence was calculated by age and sex using population denominators collected during the house to house search. An epidemic curve was constructed to describe the distribution of cases overtime. Ice candy factories and nearby tanks were visited to inspect and review the water supply and sanitation.

Water samples were collected from Ice candy factories in the affected locality of Mathura district, following an outbreak of acute watery diarrhoea. Stool samples were collected from suspected cases

having acute watery diarrhoea and tested for diarrhoeagenic pathogens. Isolation and Identification of diarrhoeagenic pathogens was done according to standard methodology.

Water samples were collected in 500 mL bottles and transported immediately to the referral lab of microbiology department of SN Medical College, Agra for analysis. From each water sample, some water was directly poured into Mac Conkey broth and alkaline peptone water, respectively for enrichment. Mac Conkey broth was incubated for 18-24 hrs and alkaline peptone water for 4-6 hrs at 37°C.

Rest of the water sample was divided into two parts equally and each part was filtered through 0.22µm filter papers separately. The membrane filters were then enriched in 50 ml of modified MacConkey broth at 37°C for 18-24 hrs and alkaline peptone water (APW) (pH 8.4) at 37°C for 4-6 hrs, respectively and then cultured on selective media.^[6] Thiosulphate citrate bile salt sucrose (TCBS) agar was used as selective media and subculture was also done on blood agar and MacConkey, incubated at 37°C for 18 to 24 h and processed for isolation of bacterial pathogens. Cultures were preliminarily screened by Hanging drop technique and colony morphology and the colonies with the characteristic appearance of *V. cholerae* were confirmed by biochemical tests as per the standard methods.^[2] We interviewed the various persons like health workers and food safety department regarding information of water supply, drainage system and any recent events of watery diarrhoea.

Results:

Total 527 cases were reported from Block Mant and 589 cases from Block Nauhjheel. Age wise male female distribution of cases in affected villages of block-mant and Nauhjheel are given in Table 1 and 2 respectively.

Table 1: Age wise Male-Female distribution of cases in affected village in block-Mant (Mathura)

Age in Years	Male	Female
1-10	90(33%)	99(39%)
11-20	62(23%)	45(17%)
21-30	30(11%)	23(9%)
31-40	28(10%)	29(11%)
41-50	23(8%)	20(8%)
51-60	22(8%)	23(9%)
61-70	16(6%)	17(7%)
Total	271	256

Table 2: Age wise Male-Female distribution of cases in affected village in block-Nauhjheel (Mathura)

Age in Years	Male	Female
1-10	109(33%)	88(34%)
11-20	71(21%)	67(26%)
21-30	48(14%)	30(12%)
31-40	37(11%)	18(07%)
41-50	24(07%)	22(08%)
51-60	22(07%)	18(07%)
61-70	20(06%)	15(06%)
Total	331	258

The data shows that in block mant, both, male and female are equally affected. In block Nauhjheel 331 males and 258 females are affected. In both blocks most common age group affected is 1-10 yrs followed by 11-20 yrs. In Mant block 33% males and 39% females are affected in 1-10 yrs followed by 23% males and 17 % females 11-20 yrs age group. In Nauhjheel block 33% males and 34% females are affected in 1-10 yrs followed by 21% males and 26 % females 11-20 yrs age group. Figure 1 and 2 shows

the time-wise distribution of cases in both Mant and Nauhjheel block. There was an initial case on 18 May 2017 and the last case was on 03 June 2017. The curve shows that the peak cases were reported on 19 May 2017.

Figure 1: Time-wise distribution of cases in block Mant, District- Mathura

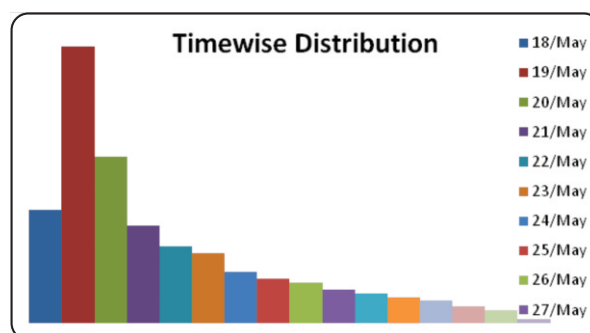
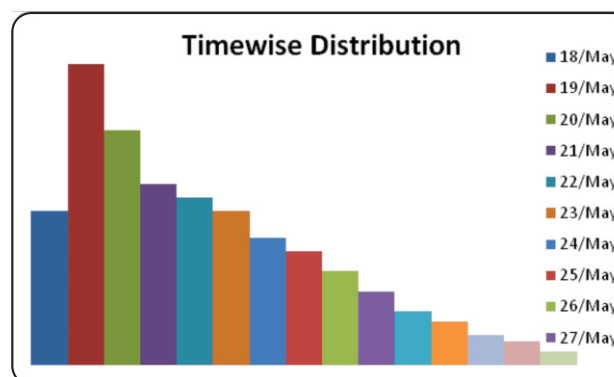


Figure 2: Time-wise distribution of cases in block Nauhjheel, District- Mathura



Discussion:

In this study overall males were more commonly suffered from cholera as compared to females, as evident from previous studies^[7,9-10]. Both genders and all age groups were affected by cholera as comparable with the findings of Chander J et. Al.^[8]

Of the 7 stool samples tested, 2 were found to be positive for V. cholerae. The diarrhoea cases were clustered around and using the water sources that have been found positive for V.cholerae in the present study, thus suggesting that, contaminated water from these public water sources played an important role in the transmission of this pathogen, leading to an

outbreak of cholera in Mathura district. Ranjbar et al, also stated in their study that an outbreak of cholera occurred due to contaminated well water as all the patients had consumed well water before the onset of outbreak and the cultures of stool also yielded *V. cholera*.^[3] Mahanta et al, in their study, reported a cholera outbreak due to consumption of the contaminated water of piped water supply, along with inadequate sanitation as 94.6% were practicing open field defecation and later spot mapping of cases was done and about 120 suspected cases were line listed.^[11] Similarly, in the study of Kaistha et al, contaminated water of the public water sources, such as hand pumps, was an important source of cholera outbreak in the affected area which was confirmed by culture of faecal specimens from acute gastroenteritis cases and simultaneously water samples from the areas reporting the maximum number of cholera cases, both of which were positive for *V. cholerae*.^[1] Bhunia et al. also reported an outbreak of cholera that affected a high-risk slum supplied by an old piped water supply with no regular chlorination and the probable source of infection was contaminated municipal piped water supply that had sucked the nearby sewage been contaminated by an index case-patient suffering from cholera.^[12] In the present study, we also feel that recent outbreak of acute watery diarrhoea probably by *V. Cholerae* (As evidenced by clinical history but not confirmed microbiologically as *V. cholerae*) is due to contamination of water supply by sewerage system, as all the water supply and sewerage arrangement in this holy place was quite old and there was no regular chlorination of water as it was supplied by the tube wells. As a result of our investigation, the local authority closed the tube wells for water supply. Therefore, water sources and sanitation need to be improved and proper management of the excreta is necessary to avoid contamination of water sources. Low level of personal and domestic hygiene may have also led to extensive environmental contamination, resulting in contamination of these water sources.

Conclusion:

Our findings demonstrated that water supply of the public water sources, possibly contaminated by the nearby sewerage system, was the probable cause of acute watery diarrhoea outbreak in district of Mathura and the etiological agent was found to be *V. cholerae*. Cholera is a serious public health threat, especially in a highly populated urban setting like Mathura district, where poor water and sanitation conditions are favorable for transmission of *V. cholerae*.

Limitation of the study: Water samples were not collected from the hand-pumps and public wells as well as toilets. This research was conducted in resource limited setting, due to which we could not use serological and molecular methods to confirm our results.

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Declaration:

Funding: Nil

Conflict of Interest: Nil

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