



A Massive Cholera Outbreak in Shaheed Benazir Abad, Sindh, Pakistan

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Authors' contributions

This work was carried out in collaboration among all authors. Authors DSM, DGD, DZS, DAB, DNMM conceptualization of the manuscript. Authors DSM, DAB, DMD, MC, DHJ, DZS data curation of the manuscript. Author DSM formal analysis of the manuscript. Author DGD, DAB, DNMM, DSAM funding acquisition of the manuscript. Authors DGD, DAB, DNMM, DSAM funding acquisition of the manuscript. Authors DSM, DSAM, DHJ, DAZ methodology of the manuscript. Authors DGD, DAB project administration of the manuscript. Authors DSM, DSAM, DNMM writing - original draft of the manuscript. Authors DSM, MC, DMD, DZS Writing - review and editing of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Background: A team of Field Epidemiology and Laboratory Training fellows were deputed to investigate the cholera outbreak reported from Village Laiq Rahoo Taluka Daulat Pur of district Shaheed Benazir Abad on 14 June 2016 after reporting of 56 diarrheal cases from the district.

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Methods: The study was conducted from 15-19 June 2016. A case was defined any person who has presented with 3 or more episodes of watery stools or vomiting since last day, with or without; fever, nausea, abdominal cramps, blood or mucous in stool. Active case search was conducted in village. A case control study was carried out preceded by descriptive study. Data was collected on pretested questionnaire. Environmental assessment was done. Stool samples were sent to National Institute of Health, Islamabad.

Results: A total of 132 diarrheal cases were identified with Case Fatality Rate of 3%. Age range was 1 year to 60 years (Mean=18 years). Of all cases males were 73 (56%). Population of village was 3308, so the overall attack rate was 4%. Commonly affected age group was 30-34 years with attack rate of 11% (22/206). Diarrhea n=132 (100%) and vomiting n=47 (45%) were leading symptoms among cases. Water source near the toilets < less than 10 feet > (OR: 11, 95% CI: 6-20, p: <0.001), Eating from common OR=7.3, 95% CI: 4.2-12.6, p<0.001) were the factors associated with outbreak. Vibrio Cholera was detected in 3 out of 5 stool samples and 4 out of 5 water samples revealed coliforms.

Conclusion: Diarrhea outbreak was likely due to close proximity of water and sewage sources. It is recommended that hand pump should be installed away from toilets.

Keywords: Cholera; watery diarrhea; epidemiological; drinking water; outbreak.

1. INTRODUCTION

Cholera is among many causes of acute watery diarrhea. It is caused by *Vibrio cholera* serogroup O1 and O139. [1,2], however the current outbreak showed that O139 is more virulent than O1 serotype. The disease has very short incubation period i.e. from 5 hours to 5 days. [3] Patient with cholera may develop watery diarrhea usually rice water stools, dehydration, abdominal pain and vomiting. There is high rates of mortality associated with the cholera disease because it can kill patients within hours due to complication like kidney decompensation, electrolyte imbalance and sometimes unconsciousness in severe cases leading to deaths. The cholera is mainly transmitted by fecal oral route, therefore the carrier could easily transmit disease by food handling practices. Poor sanitation, open defecation, poor hygiene, seasonal variation, natural disaster and massive movement of population due to calamities are well studied risk factors for cholera transmission. [4]

The seventh pandemic of cholera is in process on this planet which has started in 1961 from Asian continent. [5] Moreover 1.3 to 4 million cases of cholera cases occur worldwide each year, out of which 21000 to 143,000 infected people die due to complication. [6] The reporting of cholera cases, always remained biased due to fear of international embargo, from most of countries of world.

South East Asia is considered as being originator of cholera (Bay of Bengal, India). However the infection have substantially been reported from

whole continent. Bangladesh is the country of South Asia reporting 450,000 cases of cholera yearly. It is also estimated that each reported cholera case has three to five contacts in the country. [7] The high incidence of cholera transmission in Bangladesh is subjected to conducive environment of infection transmitted by fecal oral route.

Cholera infection are consistently been reported in Pakistan since 1988, making the country endemic for infection. The fragile surveillance system of the country has been labelled for under reporting of the cholera infection in Pakistan. However in recent years the trends of case reporting of cholera is increasing in the country.

Medical officer of Taluka Hospital Dolat Pur notified substantial number of cholera cases from village Laiq Rahoo District Benazir Abad in June 2016. The district health authorities sent immediate alert note to the Directorate General Health Office (DGHSS) Hyderabad for investigation of crude increase in the diarrheal cases which were opposing the trends of the district.

1.1 The Outbreak

The unusual increase in acute watery diarrheal cases were seen in the village Laiq Rahoo Taluka Daulat Pur District Shaheed Benazir Abad in mid-June 2016. The index case in this outbreak was a boy of 6 years age named Naseebullah s/o Abdullah. On extensive interview with the parents of index case the

mother and father told that their son was alright on the morning of 11th June. He was playing in the street on the morning of 11th June 2016. After eating the lunch with family members at about 12 pm in the home, he developed the diarrhea on 3 pm of 11 June 2016. By very short time interval of 1 hours his condition worsen and he became lethargic. They sent them to nearby government hospital where they infused him IV Fluids and referred him to People's Univeristy of Medical and Health Sciences (PUMHS) Nawabshah for further management. His father was attending him in hospital. They brought him to PUMHS Nawabshah where he was admitted. On next day his father went back to home. At home his father, sister and 3 more peoples in his family developed same sort of complaints. They were all sent to Daulatpur taluka hospital and admitted for further management. Slowly the cases started to appear in the very next house of Abdullah and so forth in the village. There was not any travelling history found in index case and other family members of Naseebullah. There was not any mass gathering in the village in past two weeks. However the latrine pits were found open in the streets of index case home.

The villager are relative to each other and have strong intermingling culture. They take their meals together at lunch and dinner. They share the food with each other regularly. They have no proper system of sanitation. The sewerage lines were open and pits were dug for the human wastes. The pits were found open in many places in the village.

The water resources are hand pumps. In some houses the hand pumps are located very near to latrines and its open pit. Some houses have implanted the motor machine for obtaining the water for their daily use. The motors are connected to a bore hole and extracting the water which is flown to house through PVC pipes. Pipe line of index case house was leaking at the point where it was crossing the latrine pit hole. When the father of index was asked about the leakage of pipe he said it was alright a week ago when a tanker of mud has crossed the street, however he had no idea about any leakage. There was a rain fall in the village on the morning of 8th June 2016 followed by very hot and humid week. Our outbreak investigation was aimed to know the Magnitude of diarrhea cases, to identify the risk factors and to device control measures in order to halt the further spread of the outbreak.

2. METHODOLOGY

After reviewing literature on diarrhea, the control team Provincial Disease Surveillance and Response Unit (PDSRU) along with District Health Management Team (DHMT) Benazir Abad, planned to visit the affected village on June 15, 2016. Meeting sessions were conducted with community stakeholders and District administration to know epidemiological link to diarrhea cases.

The case definition used was Any person of any age having episodes of loose motions > 3 times or Vomiting in 24 hours, associated with any of the following signs/symptoms Nausea, abdominal cramps, blood in stool, fever, mucous in stool, residing in village Laik Rahoo during the last 15 days.

Water samples, stool for Detail Report and culture has been collected and sent for laboratory diagnosis through the District Health Management Team (DHMT) Benazir Abad. Five samples of fresh stool taken and sent to National Institute of Health (NIH) for culture and sensitivity. Five water sample were sent to People's University of Medical and Health Sciences (PUMH) Nawabshah.

During the active case search, House to House search have been carried out in the village to find out unreported diarrhea cases and information gathered on risk factors associated with diarrhea cases from head of the household by introducing the semi structured questionnaire. The adjoining villages were screened to find any unreported case. The index case was identified by the recall of the villager. The index case was a male baby of 6 years age. The questionnaire catered data on Socio-Demographic information, Clinical Features Information, Risk Factors information, Personal Hygiene/Sanitation status/ water resources with storage and water treatment practices. The risk factors evaluated were source of water, storage of drinking water, any treatment of drinking water prior to use, any travel history, any mass gathering within past one two weeks, habits of hand washing with presence of soap in the latrine.

Descriptive statistics were computed at end of each day of active case search. Time, place and person distribution, clinical spectrum, risk factors information and deaths were figured out in the form of percentages and numbers.

On dated 16 June 2016 a case control study was undertaken in the village. The 132 cases screened were taken as cases for study. The 134 controls were selected from the village Laiq Rahoo and adjoining villages. The control were taken in the ratio of 1; 1.

The inclusion criteria for control were having same sex, same age, not living in the same house as cases and having no diarrhea in past two weeks. The controls were interviewed using a pretested semi structured questionnaire. The data was taken on the risk factors like hand washing, boiling of water, source of water, distance between source of water and latrines etc. The hand washing habits were asked before eating and after using latrines. The response were recorded as yes or no. The distance between latrine and water sources were assessed using a feet meters. The distance were recorded numerically in feet. Source of water were found and boiling habits were recorded. The odds ratio were calculated for distance between source of water and latrine, hand washing and eating from common plate. All the quantitative variable were reported on significance level of 95% and with p value less than 0.05.

All obtained data entered and analyzed by using the Epi-Info software, initial frequency measures have been calculated and reported at CI of 95%.

3. RESULTS

Out of total 132 diarrhea cases identified, District Health authority has reported 43% (n-56) cases with 3 (2%) deaths. However on active search in the filed the investigating team probed 57% (n-76) cases from the village.

The males among identified cases were 56% (n-73) and 44% (n-59) were Females. The cases were 3 months to 60 years of age (Mean=18 years and Median=11 years). Among cases the most affected age group was 6-15 years with a total of 32% cases (n-34).

Most significant symptoms were Diarrhea 100% (n-132), abdominal pain 35% (n-47), Dehydration 29% (n-39), Vomiting 13% (n-18), Mucus in Stool 2% (n-2) and Blood in Stool 2% (n-3) in the reported cases. 14% of cases (n=19) reported hand washing practices, whereas all cases reported that that they had been throwing household waste away from house on daily basis.

The cases were farmers and daily earners with very low literacy rates. The highest earned education level was intermediate (9%). Among households of 132 cases 35% (n=47) cases, reported to have the latrine outlets at a distance of less than 10 feet away from the water sources., however in 45% (n=60) of households of cases the latrines were situated at the distance of more than 10 meters away from the drinking water obstacle.

An overall attack rate was stood at 4% with case fatality rate of 3% (3 death out of 132 cases). However the age specific attack rate were very prominent in cases who were 30 to 34 years of age (11%).

Having water sources at distance of < 10 feet away from toilets were imparting an odds of 11 to get cholera infection with confidence interval of 6-20 and p value < 0.0001 as compared to those whose water sources were 10 or more than 10 feet away from the latrines. Eating from common plate was also a significant factor contributing to outbreak [69% (n=92) of cases and 23% (n-32) of control (*OR*=7.3, 95% *CI*: 4.2-12.6, *p*<0.001)]. Washing hands after latrine use was a protective factor towards getting cholera infection among the cases (*OR* 0.2 *CI* 0.11-0.37 and *p* value < 0.0001). 60% of stool sample yielded Vibrio Cholera poly O1 Serotype inaba biotype E1 Tor and water samples were also signified the presence of coliform colonies in the intensity of more than 5 miu/ml.

3.1 Impact of the Study

We disseminated our study findings with District Administration and Provincial set up. Renovation and repair of the leaking pipe lines of water supply was initiated in the village and water sources were installed away from the latrines.

4. DISCUSSION

This study contributed to the containment of the outbreak in the village. Moreover the rapid response exercised by provincial set up for the outbreak containment was also a miles tone for containment of the outbreak effectively. This is consistent with previous literature that delays in initiation of containment measure make the outbreak more devastating. The delays are mainly related to weak system of the surveillance, notification and inaccessibility [8].

The risk factors analysis was done keeping the best available literature search globally. We identified that water contamination and poor hygiene were the leading cause of the outbreak in the village which are consistent with other studies done in the country [9]. We contradict that majority of cholera surges are reported from the natural calamities like internal shift of population and camps, as is evident from literature search [10], however the current outbreak was reported from settled population. The weather condition of the village were significant factor contributing to cholera outbreak as it has also been documented that warm weather and rainfalls are also among the credible risk factor for Cholera outbreak [11], this finding is consistent with our results.

We concluded that eating the food from common plate and family type serving were also significantly associated with the cholera transmission [12], as this is among well documented causes of the cholera transmission. Moreover our finding of relationship of close proximity of water sources and latrine are widely studied and supported by many studies [13].

The major limitation of our study are the recall bias as data was collected retrospectively so there are chances that controls might have missed to provide robust information [14]. We were also not allowed to observe the food handling, preparation and hand washing practices by women as we could not observe the females of the village due to their culture. We might have missed some cholera cases as the culture and sensitivity of stool samples of all cases were beyond our scope and we had not have Rapid Detection Test kits for Rota Virus diarrhea detection. Since both these diseases share common ways of transmission and symptomology [15].

We concluded that the outbreak was likely associated with close proximity of drinking water source and latrines, lack of hand washing practices and community awareness for cholera.

5. CONCLUSIONS

The cholera outbreak was caused by *Vibrio Cholera* poly O1 Serotype inaba biotype E1 Tor

pathogen due to personal and unhealthy environmental conditions.

ETHICS APPROVAL

This study was approved by the ERB committee of PDRSU Sindh. Approval has been obtained from the DHO of the Health Department Government of Sindh, Pakistan; before the acquisition of data for this study.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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