Original Article

Investigation of jaundice outbreak in a rural area of Odisha, India: Lessons learned and the way forward

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ABSTRACT

Background and Objectives: Hepatitis, a condition with liver inflammation, mostly follows hepatitis virus infection of different types A, B, C, D, and E. Each year, numerous outbreaks of hepatitis virus are being reported from around the country, more so from the "Empowered Action Group (EAG) States." The present outbreak investigation was performed in Odisha, India to study the epidemiology, explore the reasons behind it, and suggest preventive measures for the future. **Materials and Methods:** A team consisting of public health doctors from All India Institute of Medical Science (AIIMS), Bhubaneswar, Odisha, India investigated the hepatitis E outbreak as per standard guidelines in one of the villages of Tangi block in the state of Odisha, using a questionnaire between January 1, 2015 and January 15, 2015. The data were entered and analyzed in Microsoft Excel 2007. Time, place, and person analysis were performed for all case patients. **Result:** Hepatitis E outbreak occurred between November 16, 2014 and January 1, 2015, affecting 22 individuals. The attack rate was 44/1,000 in the population and young males were mostly infected. Spot map of the outbreak probably points toward point source epidemic. Most of the infected cases had visited allopathic doctors as well as traditional healers. Less than 50% people had some knowledge about the prevention and control of hepatitis virus infection. Open defecation was highly prevalent in the village. The well was the commonest source of drinking water and the condition of wells was non-sanitary. Less than 2% started hand-washing after the end of the outbreak in the community. **Conclusion:** Focus of outbreak investigation should not restrict only to immediate control but should rather lead to intervention by the health system in the area for construction of community toilets, improved drinking water facilities, and sustained information, education, and communication (IEC) activities to promote personal hygiene and water safety behavior in the community.

Key words: Environmental sanitation, jaundice, outbreak investigation, viral hepatitis E infection, waterborne disease

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INTRODUCTION

Hepatitis refers to liver inflammation secondary to any cause but is most often encountered following infection with hepatitis virus of type A, B, C, D, and E. The outbreak potential is maximum with hepatitis virus type A and E due to feco-oral mode of transmission.[1] Globally, hepatitis E virus (HEV) affects more individuals as compared to hepatitis A (estimated 20 million vs. 1.4 million).[2] East and South East Asia alone contributed to 65% of the total mortality and 60% of the total global burden due to hepatitis E as per a survey conducted in 2008 by the Centers for Disease Control and Prevention (CDC), Atlanta.[3,4]

In the absence of an effective vaccine and definitive treatment, interruption of transmission remains the best available strategy against viral hepatitis E infection. Early recognition of warning signs, prompt outbreak investigations, and application of specific control measures would check the spread and also reduce mortality due to the disease. Recently, the Government of India has initiated a "National Program on Prevention and Control of Viral Hepatitis in India" under the 12th Five year Plan (2012-2017), which would focus on ascertaining the prevalence, establishing laboratory networks, and support capacity-building activities in outbreak investigation.[5]

Historically, HEV infection was first reported in India in the 1980.[6] Since then, there has been a rising trend and HEV infection is currently responsible for 10-40% of acute hepatitis cases and 15-45% of acute liver failures in the country.[3,7] Every year, numerous outbreaks due to hepatitis virus get reported from across the country, particularly from the "Empowered Action Group (EAG) States."[8,9]

Odisha, one of the EAG states in India reportedly had only three outbreaks of hepatitis in 2012-13, as per the state Integrated Diseases Surveillance Program (IDSP).[10] This data grossly differed from that released by the regional Indian Council of Medical Research (ICMR) center for the same period.[11] This is a major cause of concern as underreporting can undermine the true burden and negatively influence the implementation of prevention and control activities.

Thorough outbreak investigation is necessary to understand the epidemiology and explore the reasons behind its occurrence and suggest measures for its prevention in the future. With this objective in mind, we decided to investigate a jaundice outbreak in one of the villages of our field practice area in the state of Odisha, India to understand why each year numerous outbreaks occur in spite of repeated attempts made by the district level rapid response teams (RRTs) to investigate and control them.

MATERIALS AND METHODS

Kantalbai, a remote village in Bhusandapur sector of Tangi block, Odisha, India has 88 households and a total population of 502. Here, a jaundice outbreak occurred in November 2014. Subsequently, the district level RRT performed the investigation and determined it to be due to HEV.[10]

Our team consisting of two doctors and one paramedical staff from the Department of Community and Family Medicine at AIIMS Bhubaneswar visited the village between January 1, 2015 and January 15, 2015 after receiving the information of the occurrence of a jaundice outbreak in order to understand the factors that lead to it and the measures to be undertaken to prevent its occurrence in the near future.

A case of jaundice for the purpose of investigation was defined as "any case with acute onset of illness having following clinical features: Dark urine, anorexia, vomiting, malaise, yellowish discoloration of the sclera, right upper quadrant pain with elevated serum aminotransferase level" between November 2014 and January 2015 [adaptation of the World Health Organization (WHO) case definition of suspected case].[12]

Line listing of the cases and census of the entire village according to age and sex was performed. An interviewer-administered questionnaire was used to collect data regarding the source of drinking water, defecation habits, knowledge of preventive measures, and awareness regarding visits and activities of health personnel during the outbreak. Respondents included members of the household available at the time of visit. Overall, 291 eligible villagers were interviewed during the study period.

In addition, for those who satisfied the case definition of hepatitis, data regarding the date of onset of jaundice, reports of laboratory investigations [bilirubin level, aspartate transaminase (AST), alanine transaminase (ALT)] performed by the RRT, the place of treatment and type of treatment, history of hospital admissions, any traditional healing practices, etc., were collected.

We personally inspected all the available water sources in the village and prepared a resource map. During the survey period, we also provided health education regarding hepatitis, and referred any new cases to the nearby primary health center for further management.

The data were entered and analyzed in Microsoft Excel 2007. Time, place, and person analysis were performed for all case patients. The typical water source, wells, have been photographed and shown. Continuous variables and categorical data were summarized mean and standard deviation, and using proportions, respectively. Attack rates were calculated using standard definitions. Informed consent was taken from all the participants before the interview and confidentiality of the data was maintained in the department. All the ethical principles were observed during the conduct of the study.

RESULTS

Epidemiological characteristics of the outbreak

Time

We investigated the outbreak retrospectively and our investigation revealed a total of 22 jaundice cases with an attack rate of 44 per 1,000 in the population. The outbreak spread between November 16, 2014 and January 1, 2015. Maximum clustering of the cases took place during the 1st and 2nd weeks of December 2014 [Figure 1].

Place

Clustering of cases occurred around two wells (well 2 and well 3) and most consumed water from these wells as they were situated close to the villagers' residence. This is shown in the spot map using a red circle [Figure 2]. Other infected cases were scattered throughout the village.

Figures 3 and 4 display the real-time picture of the two wells as shown within the red circle in Figure 2, from where the maximum cases had consumed water during the outbreak. Surface level, the color of water, absence of overhead protection, and unclean surroundings indicated the nonsanitary condition of these wells.

Persons

There were no cases below 9 years of age. Maximum number of cases belonged to the 20-29 years age group with an attack rate of 64.5/1,000 in the population. Males were affected more than females and had higher attack rates ($P = 0.021$) [Table 1].

The most common symptoms among the affected cases were passing of high colored urine (100.0%), fever (90.9%), and yellowish discoloration of sclera (86.4%). The less common symptoms were loss of appetite, vomiting, malaise, fatigue, and upper right abdominal pain. Laboratory investigation details were available for 17 (77.3%) cases. Analysis of their laboratory report showed a mean bilirubin of 6.26 ± 3.93 mg/dL, mean AST of 150.3 ± 47 IU/L.18, and mean ALT of 139.5 ± 42.4 IU/L.

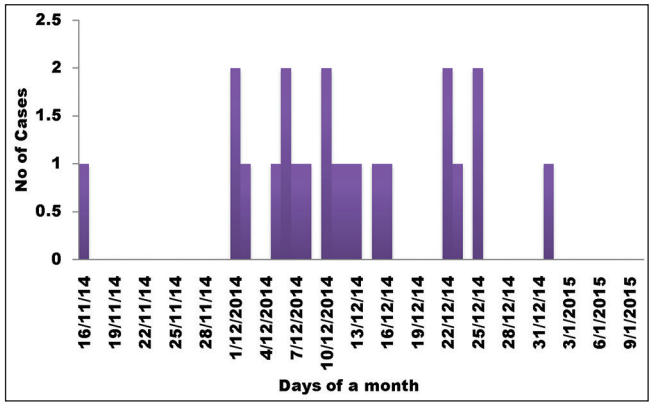

Figure 1: Outbreak of hepatitis E in Kantalbai village of Khurda district, Odisha, India from November 2014 to January 2015

Knowledge, attitude, and practices of the villagers

Two out of five knew and thought that open defecation was responsible for the spread of hepatitis infection. Few knew that avoiding contact with the infected persons (36.0%), washing hands with soap after defecation (30.9%), washing hands before eating (29.6%), and drinking boiled water (24.7%) were major preventive measures for waterborne hepatitis infections. One out of six (16.7%) villagers did not have any knowledge about the prevention of hepatitis.

There were 24 shallow wells and four hand pumps in the village. Two hand pumps were not functioning and one started functioning after the epidemic was over. During the epidemic, 98.4% of the villagers were using wells as source of drinking water and the usage dropped by 4% after the epidemic. All the infected cases were drinking well water. Association between the source of drinking water and reporting of cases was highly significant for well 2 and well 3 [Table 2 and Figure 2]. The association between open defecation and jaundice [odds ratio (OR) = 3.11, 95% confidence interval (CI) 0.411-23.56) was not statistically significant.

Table 1: Age-and sex-wise distribution of the 22 jaundice cases in Kantalbai, Odisha, India from November 2015 to January 2015

Variable	Group	No. of cases	Population	Attack rate per 1,000 in the population
Age (years)	0-9	0	76	0.00
	10-19	5	104	48.10
	20-29	6	93	64.5
	30-39	2	65	30.7
	40-49	4	71	56.3
	>50	5	91	54.9
Gender	Male	17	266	63.9
	Female	5	234	21.4
Total		22	500	44.0

Table 2: Drinking water source and toilet habit of the villagers in Kantalbai, Odisha, India from November 2015 to January 2015

Exposure variable	Infected cases	Noninfected	Odds ratio	95% CI†	*P* value
Source of drinking water					
Well 1	3	13	27.46	2.65-283.52	0.054
Well 2	6	6	119.00	12.29-1152.2	<0.001
Well 3	7	19	43.84	5.10-376.58	0.0006
Well 4	2	7	34.00	2.73-421.99	0.0061
Well 6	1	13	9.15	0.54-155.17	0.1252
Well 7	2	17	14.00	1.2036-162.83	0.035
Well 13	1	119		Reference	
Toilet habit					
Open defecation	21	418	3.11	0.411-23.56	0.271
Latrine	1	62			

†CI: Confidence interval

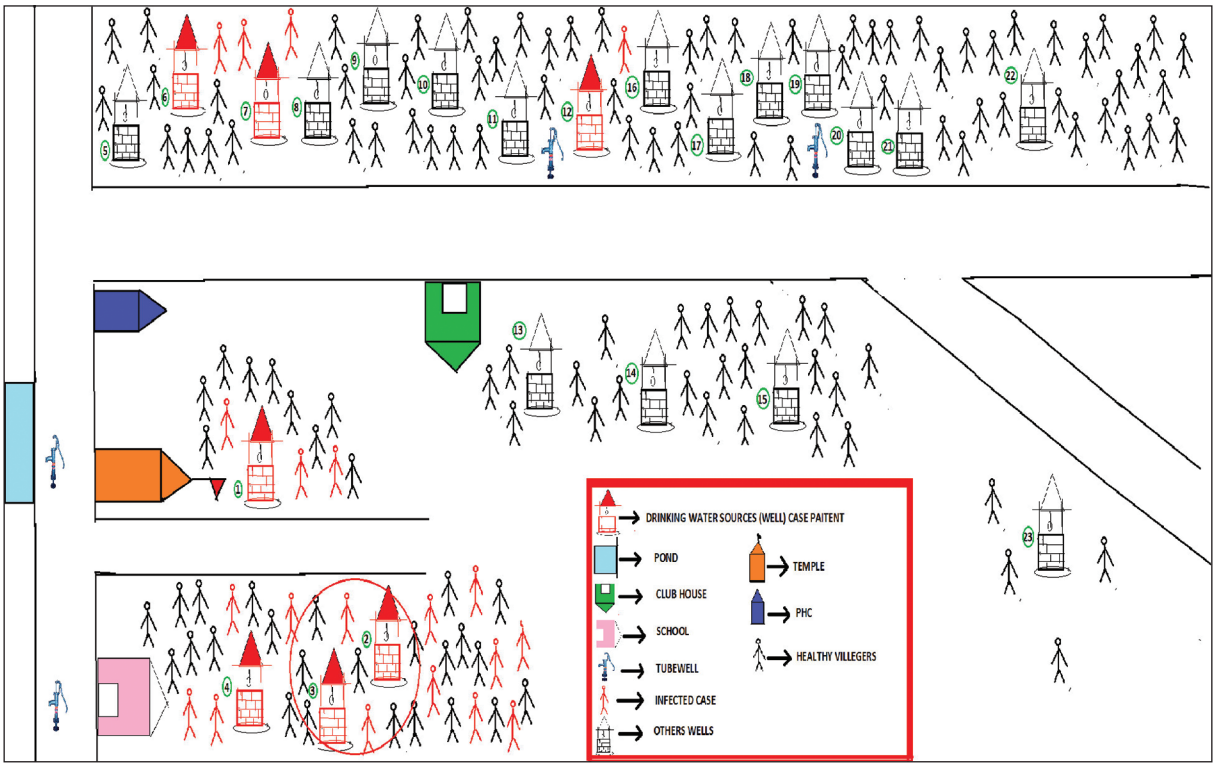

Figure 2: Cases of jaundice by households in Kantalbai, Bhusandapur, Tangi, Odisha, India, from November 2014 to January 2015

Among the affected cases, 15 had taken allopathic treatment and the remaining seven had preferred home treatment for jaundice. Only seven affected individuals went to the nearby primary or secondary health care centers and among them, two had to be hospitalized. The RRT had prescribed some medicines (multivitamins) to all the affected cases during their visit to the village. Almost all the cases (21) had practiced some local rituals irrespective of their attitude toward the allopathic treatment. Some of these local practices are mentioned in Box 1.

Box 1: Local practices among the infected cases*

Practice 1: *A bowl of mustard oil is kept on the head of the affected person and then it is stirred with a stick until it turns completely yellow. They say that mustard oil turns yellow because affected person is being relieved from the yellowness of jaundice [14 (64%)]*

Practice 2: *A local traditional healer gives three bananas with some mantra and the infected person has to take these bananas for 3 consecutive days in the morning [12(54.5%)]*

Practice 3: *Some wear a specific type of head gear made of crystal after chanting some mantra and the girth is expected to gradually increase in size and slips down and finally falls out from the foot [11(50.0%)]*

Practice 4: *Some believe that taking arhar dal (red gram) regularly can relieve the symptoms [10(45.5%)]*

Practice 5: *Bathing more than five times daily is also believed to be useful [9(40.9)]*

*Value in bracket shows number and percentage of each practice performed by affected individuals

Awareness of the villagers about the major activities of the state health service

The RRT visited Kantalbai village, Odisha, India on December 22, 2014. But half of the villagers interviewed during our visit in January 2015 did not seem to know about it. The rest that included case patients and their neighbors were aware and had received some health advice from the RRT. The most common health advice given was to visit the hospital when someone had yellowish discoloration of urine (37.8%). Only one-fourth of the villagers were aware that some medicines had been distributed during the visit by health officials. We observed that these medicines were in fact multivitamin tablets, which the villagers had mistaken to be a source of cure for jaundice. Only 10 infected cases (2% of the village population) had started using soap for hand-washing after the infection. Information about the number of wells that had been chlorinated by the health workers was sketchy as some of them mentioned that chlorination was performed every year while others mentioned it to be a half-yearly phenomenon. After the outbreak, chlorination of all the wells of the village was performed by the RRT. Most of the villagers mentioned that halogen tablets were only distributed after the outbreak and they also raised concern that this was not a regular activity in the village. There was no alternate arrangement for water supply during the epidemic.

DISCUSSION

Hepatitis E is a leading cause of enterically transmitted viral hepatitis in India and can affect a few to several thousand people.[6,13] The present outbreak was one of the many

Figure 3: Picture of a shallow well in Kantalbai, Bhusandapur, Tangi, Odisha, India, 2015

Figure 4: Photograph of a nonsanitary well in Kantalbai, Bhusandapur, Tangi, Odisha, India, 2015

outbreaks Odisha has been facing in the last few years.[14] During this time, the cases appeared within a short span (2 weeks) and clustered around few wells, indicating a possibility of point source outbreak. The attack rate was similar to other outbreaks reported from different parts of India (1-15%).[15] Though it was 44/1,000, it only reflected the tip of the iceberg as usually the ratio of symptomatic to asymptomatic cases ranges from 1:1 to 1:20.[16] The other possibility is existence of few susceptible people as jaundice outbreaks are a common phenomenon in these areas. The maximum number of cases was seen in young males. Usually hepatitis remains asymptomatic among children and so in our study area, they might have remained undiagnosed due to the unavailability of serological studies. There is also the possibility that since HEV antibody does not give lifelong protection like anti-hepatitis A virus, probably their levels have diminished in people in the young or middle age group thereby making them susceptible.[13,16,17] Epidemiological features of the present outbreak were similar to other outbreaks of HEV in different parts of the country.[18]

According to the census in 2011, 95% of the wells in rural areas were uncovered and 85% of the rural population practiced open defecation in Odisha, India.[19] Our study findings also reflected the same. All the wells in the study area were shallow in nature. In such a scenario, there is always a possibility of fecal contamination of well water whenever infected people practice open defecation within its cone of filtration. In spite of having fair knowledge about the health hazards of open defecation and unsafe water, most of the villagers were practicing it. Apart from this, there was no visible behavioral change in spite of repeated prevention and control activities in terms of hand hygiene. Low socioeconomic status of villagers and apathy of the state government toward such villages have also compounded the effect. All these factors might have perpetuated the outbreaks all these years.[20]

Primarily the outbreak investigations that are performed by the RRT in India focus on immediate control measures of the outbreak. They hardly take measures to prevent such occurrences in the future.[18] During the present outbreak, the RRT had visited the place when the outbreak was declining and most of the villagers were ignorant about their visit, which shows the inefficiency and lack of impact of their activities. One of the important steps in outbreak investigation is to provide effective control measures. The role of chlorination in viral diseases is minimal but there is sufficient evidence that chlorination of drinking water sources in high doses provides some beneficial effect in waterborne hepatitis.[21] However, accredited social health activists (ASHAs), male multipurpose workers (MPWs), and auxiliary nurse midwives (ANMs) were unable to perform or guide the process of chlorination of wells in the affected village. Our observations indicated that not a single household practiced any sort of pretreatment of water (boiling/filtration/chlorination, etc.) prior to consumption. Moreover, the local culture and practices prevalent in the community could have hampered the control measures. Merely chlorinating well water, distributing halogen tablets, soaps, and multivitamin tablets at the time of epidemic will not be sufficient, particularly in the case of viral infections unless sustained attempts are also made in inducing behavioral changes in the population for safeguarding their health from waterborne diseases. Many success stories on behavioral change have already been demonstrated in the past.[22]

Government of India had launched many programs over the years for improving the sanitation and safe drinking water facility and the latest inclusion in this list is "Swacch Bharat Abhiyan" since October 2, 2014.[23] We hope that this flagship program of the present government through its organized efforts and dedicated fund allocation will provide the necessary momentum for controlling waterborne diseases in India. Regular surveillance of the water sources as per WHO guidelines is necessary.[24] Simultaneously, improvement in the knowledge about viral hepatitis is required and this is possible through sustained IEC activities that have to be particularly intensified during the transmission season.

Along with this, construction of community toilets and provision of piped water to the villagers could be some of the other community level interventions that may prove to be an effective long-term measure for preventing this kind of outbreak in the future. It is imperative that the village health sanitation committee and panchayat members take an active step forward to mobilize the existing and mostly unutilized funds and tap the available schemes to improve the overall sanitation and hygiene in the villages.

Expenditure on waterborne diseases has a major share in India's health-spending. According to the survey, down-to-earth, rural people in India spend at least ₹100 each year for the treatment of water/sanitation-related diseases.[25] Early reorganization, timely investigation, and appropriate control measures will not only decrease the morbidity and mortality but also the avoidable health expenditure associated with these diseases.

Prevention of hepatitis E requires improving the bacteriological quality of water at the household level, better sanitation, proper sewage disposal, and public education. The health authorities should focus on the long-term measures of sanitation and take lessons that emerge from the investigation of such outbreaks.

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Conflicts of interest
There are no conflicts of interest.

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