

ORIGINAL RESEARCH

Hepatitis A outbreak investigation at a residential school in Kerala

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ABSTRACT

Background: An outbreak of jaundice at a residential school in Palakkad was reported to the district health authorities from a self-administrative unit of the district in the end of March 2019. Subsequently, an epidemiological investigation was carried out with the aim to ascertain the etiological agent, describe epidemiological features and recommend control measures. **Material and Methods:** Inspection of the school and hostel premises, kitchen, water source and sanitary assessment were done. The total line list of affected students and people was made. Cases and unaffected people living in houses nearby the school were interviewed using a structured questionnaire. Water samples, soil samples, serum and stool samples from new cases were collected and tested for Hepatitis A. Descriptive statistics was used to depict the results. **Results:** The outbreak affected 565 people including 529 students, 30 staff and 6 others. The symptoms reported by the cases were tiredness, vomiting, fever and jaundice. Based on the onset of symptoms, the epidemic curve drawn showed two peaks, suggesting secondary cases. The majority of the cases occurred among those studying in class VIII (11.7%). All water, serum and stool samples from patients tested positive indicating Hepatitis A infection. The attack rate of Hepatitis A among students of the school was calculated to be 22.09%. The soil samples and blood samples from food handlers tested negative for Hepatitis A. The distance of the well from the septic tank was measured to be 11.5m. **Conclusion:** The possibility of such a widespread contamination occurring could be the result of 2018 Kerala floods and/ or a major breakdown in the underground sewerage system leading to contamination of well waters with sewage. On the basis of this, various remedial measures like super-chlorination of wells, installation of better water purification system at the school, vaccination of students against Hepatitis A and widespread awareness regarding hepatitis A were suggested to be done.

Keywords: Hepatitis A, Outbreak investigation, Vaccination, Water contamination, Water supply

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INTRODUCTION

Hepatitis A, an acute infectious disease caused by Hepatitis A virus is primarily spread when an uninfected and unvaccinated person ingests food or water that is contaminated with the faeces of an infected person. It is closely associated with consumption of unsafe drinking water or food, inadequate sanitation and poor personal hygiene¹. Once infected, the virus is shed in the feces and may survive for months in the environment under favourable conditions^{2,3}. The incubation period of Hepatitis A is 10-50 days (average 14-28 days)¹ depending on the dose of the virus ingested. It is characterized by non-specific symptoms like fever, chills, headache, fatigue, generalized weakness, aches and followed by anorexia, nausea, vomiting, dark coloured urine and jaundice. Anicteric hepatitis is more common. Hepatitis A resolves completely in 98% of the cases. The case fatality rate of icteric cases is less than 0.1% and death is usually from acute liver

failure and mainly affects older adults. Improved sanitation, food safety and immunization are the most effective ways to combat hepatitis A. The spread of Hepatitis A can be reduced by adequate supplies of safe drinking water, proper disposal of sewage within communities, personal hygiene practices such as regular hand washing with safe water and vaccination.^{1,4}

Several outbreaks of hepatitis A have been recorded in the past with anti-HAV positivity varying from 26 to 85% in various parts of India.⁴ Outbreaks of hepatitis A have been reported from different parts of Kerala also over the years.⁵⁻⁷

An ongoing outbreak of jaundice at a residential school in Palakkad was reported to the district health authorities from a self-administrative unit of Palakkad district in the end of March 2019. The outbreak had started in February and cases were still being reported in March end. Subsequently, an epidemiological investigation was carried out to ascertain the

etiological agent, describe epidemiological features and recommend control measures.

METHODOLOGY

The team first visited the Community Health Centre catering to the area and was briefed that most cases of the outbreak occurred during the last week of February 2019 and continued to be reported in the last week of March and April. The team then visited the school premises and met with the school authorities.

The first suspected case was reported on January 15th 2019. The school annual day function was held on January 26th when food and drinking water were supplied by school canteen to the children, volunteers, teaching and non-teaching staff. It was found that most of the cases were reported from those who had canteen food. First confirmed case of Hepatitis A was reported on February 14th and last case was reported on April 17th 2019. During the month of February, 437 students were also taken for class excursions to 2 water theme parks in Kerala. The wells were apparently not regularly chlorinated and also the area had been flooded during the floods in Kerala in the month of August-September 2018.

Upon inspecting the school premises it was observed that there were 3 sources of water supply – a large sanitary well, a tube well and a smaller open well. The smaller well was located at a lower elevation within the school premises. There are 10 water storage tanks of 2000 litre capacity each in the Montessori building. From the storage tanks, water goes into the Ultra Violet filtration tank and then into water distribution system. A similar system was there in the main building as well. The toilets were inspected and the sanitary assessment was found to be satisfactory. The kitchen was also inspected. According to the main cook, purified water from the tap was used for all cooking purposes after boiling for more than 1 hour. The utensil washing area was separate. Raw food was kept in containers. There was a separate work area also adjacent to the main kitchen. There were 4 cooks

in the kitchen and none of them had any symptoms of hepatitis A and their medical certificates were inspected. The total line list of affected people was made. The team visited houses nearby the school and interviewed cases and unaffected people individually using a structured questionnaire (Annexure 1)

Water samples were collected from all the water sources of the school (suspect well, tube well, larger well, storage tank, filtration tank and kitchen tap water) and boys' hostel well. Two soil samples from near the open well and septic tank were collected. Serum samples from seven new cases and stool samples from five new cases out of the seven were collected. Samples were tested in RDC lab at District Hospital and NIV Pune for viral isolation.

ETHICAL CONSIDERATION

Institutional Ethical Committee clearance was obtained post conducting the outbreak investigation. Anonymity of the patients and food handlers were maintained throughout the process of the investigation. Neither the school authorities nor the patients did not have to encounter any monetary expenses for testing of the samples. Written informed consent was obtained from parents/legal guardian of children prior to collection of their blood and stool samples.

RESULTS

Blood samples taken from 7 hospitalized students prior to the team's epidemiological investigation visit had confirmed diagnosis of Hepatitis A. The distance of the well from the septic tank was around 11.5m. The spot map of the school and its adjacent areas was made.

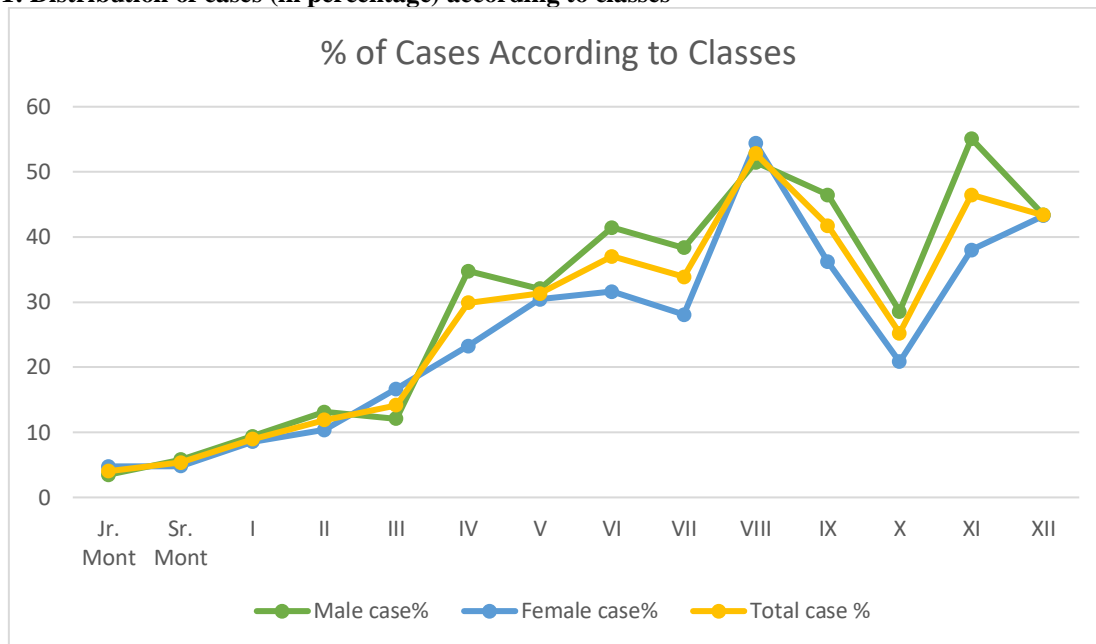
The outbreak affected 565 people including 529 students (320 males and 245 females), staff (total 30: 5 males, 25 females) and others (total 6: 4 males, 2 females), of which 322 cases were reported under the block CHC. The distribution of cases is given below in Table 1 and Fig 1.

Table 1: Distribution of cases according to classes

Particulars	Males	Females	Total Affected	Total case %
Jr. Mont	5	5	10	1.8
Sr. Mont	9	6	15	2.7
I	12	11	23	4.1
II	19	12	31	5.5
III	14	16	30	5.3
IV	41	20	61	10.8
V	25	21	46	8.1
VI	29	18	47	8.3
VII	28	16	44	7.8
VIII	35	31	66	11.7
IX	26	17	43	7.6
X	18	10	28	5.0
XI	27	19	46	8.1
XII	23	16	39	6.9
Staff	5	25	30	5.3

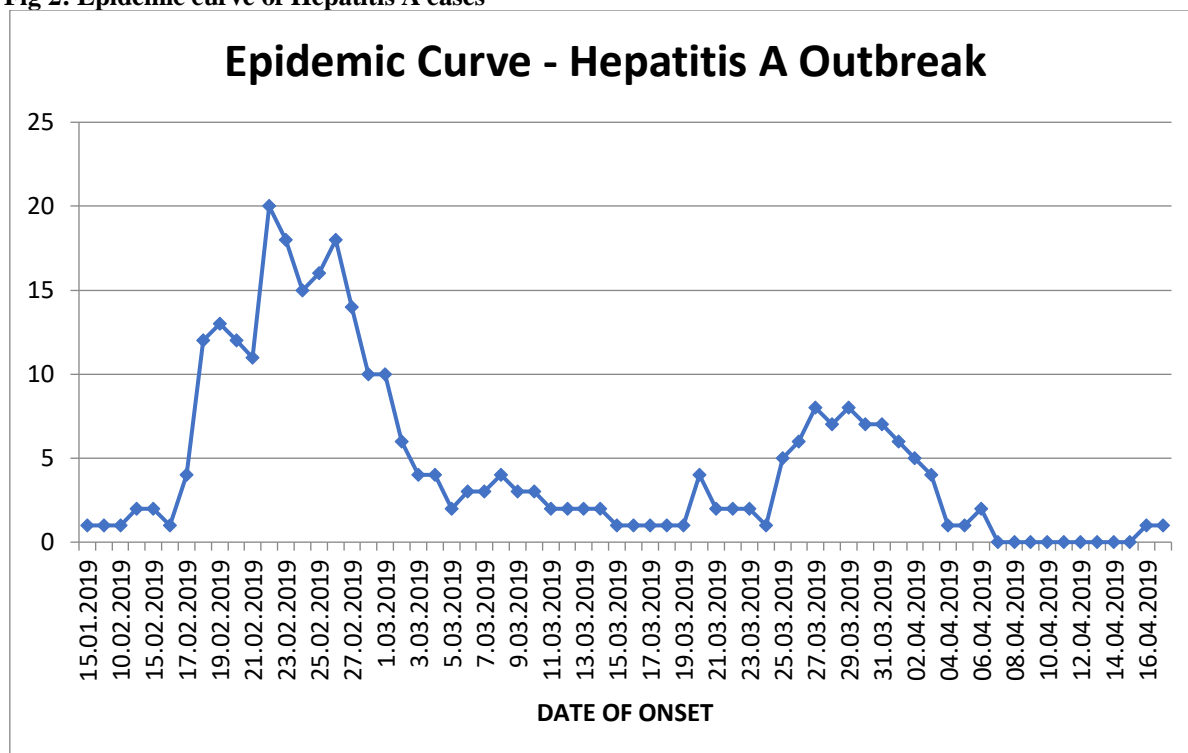
Others	4	2	6	1.1
Total	320	245	565	100.0

Fig 1: Distribution of cases (in percentage) according to classes



The majority of the cases occurred among those studying in class VIII (11.7%). The symptoms reported by the cases were tiredness, vomiting, fever and jaundice. Based on the onset of symptoms, the epidemic curve (Fig 2) drawn showed two peaks, suggesting secondary cases.

Fig 2: Epidemic curve of Hepatitis A cases



The attack rate of Hepatitis A among students of the school was calculated to be 22.09% (529 cases out of 2394 students)

All water (Table 2) and stool samples (Table 3) sent to NIV Pune tested positive for HAV RNA (Hepatitis A virus Ribonucleic Acid). The soil samples were tested negative for HAV RNA (Table 2).

Table 2: Test result of water and soil samples

Sl.No	Sample details	HAV RNA
1	Sanitary well water	Positive
2	Open well water	Positive
3	Tube well water	Positive
4	Filter tap water	Positive
5	Storage tank water	Positive
6	Kitchen tap-drinking water	Positive
7	Kitchen tap-cooking water	Positive
8	Boys' hostel water	Positive
9	Soil Around the open well	Negative
10	Soil around septic tank	Negative

Table 3: Test result of stool samples from symptomatic patients

Patient No.	Age	Gender	HAV RNA
1	12	Male	Positive
2	14	Male	Positive
3	8	Female	Positive
4	9	Male	Positive
5	6	Female	Positive

All seven serum samples (Table 4) tested positive for HAV IgM ELISA (Hepatitis A virus Immunoglobulin M Enzyme Linked Immunoassay).

Table 4: Test result of serum samples from symptomatic patients

Patient No.	Age	Gender	HAV IgM ELISA
1	12	Male	Positive
2	14	Male	Positive
3	8	Female	Positive
4	9	Male	Positive
5	6	Female	Positive
6	12	Male	Positive
7	7	Male	Positive

The blood samples taken from food handlers tested negative for HAV IgM ELISA.

DISCUSSION

The possibility of such a widespread contamination occurring could be as a result of the floods and/ or a major breakdown in the underground sewerage system leading to contamination of well waters with sewage. The distance of the well from the septic tank was around 11.5 m. Contamination of wells by adjacent septic systems and the subsequent outbreaks of Hepatitis A have been widely reported.^{8,9,10}

Following the investigation various short term, medium term and long term recommendations were suggested to the school and health authorities of the area. The short-term recommendations included continued surveillance for new cases, not using water from existing sources for any purposes until it was confirmed to be negative for Hepatitis A and alternative arrangements for water supply to be made in the meantime, daily super-chlorination of all water sources and consuming boiled water, cleaning/repair of water storage tanks and water purifiers. The medium-term recommendations included assessing chlorine demand of water/residual chlorine, rebuilding the septic tank to over 15 m away from all water sources and sanitary surveys. The long-term recommendations included giving health education

about food, water and hand hygiene to the students, parents, staff and food handlers by the health authorities, notifying the health authorities prior to conducting any large functions/gatherings and if any diseases occur following the gathering and issuing health cards to the students.

CONCLUSION

As per the epidemiological analysis, laboratory results and environmental assessment, Hepatitis A outbreak was confirmed. All the water sources from the school were tested positive for Hepatitis A virus. The possibility of such a widespread contamination occurring could be as a result of the floods and/ or a major breakdown in the underground sewerage system leading to contamination of well waters with sewage. On the basis of this various remedial measures were suggested to be done during the school vacation and following frequent super-chlorination of the school water sources and installation of silver ionization water purification system at the school near the well, further such epidemics were prevented so far. Widespread awareness regarding hepatitis A along with other public health measures need to be taken to prevent further such outbreaks.

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REFERENCES

1. World Health Organization. Hepatitis A. Fact sheet 328. Geneva: World Health Organization; 2016. Available at: <http://www.who.int/mediacentre/factsheets/fs328/en/>. Accessed on 16th June 2017.
2. Hollinger FB, Ticehurst JR. Hepatitis A virus. In: Fields BN, Knipe DM, Howley PM, editors. *Fields Virology*. 3rd ed. Philadelphia: Lippincott-Raven; 1996: 735–782.
3. Lemon SM. Hepatitis A virus. In: Webster RG, Granoff A, editors. *Encyclopedia of Virology*. London: Academic Press Ltd; 1994: 546–554.
4. Verma R, Khanna P. Hepatitis A vaccine should receive priority in National Immunization Schedule in India. *Human Vaccines Immunotherapeutics*. 2012;8(8):1132-1134.
5. Sebastian B, Mathai, S, Mathew G, Ouseph M, Balakrishnan P. An outbreak of hepatitis A in central Kerala—clinical profile. *Indian J Gastroenterol*. 1998;17:10–2.
6. Arankalle VA, Sarada Devi KL, Lole KS, Shenoy KT, Verma V, Haneephabi M. Molecular characterization of hepatitis A virus from a large outbreak from Kerala, India. *Indian J Med Res*. 2006;123(6):760-9.
7. Rakesh PS, Sherin D, Sankar H, Shaji M, Subhagan S, Salila S. Investigating a CommunityWide Outbreak of Hepatitis A in India. *J Glob Infect Dis*. 2014;6(2):59–64.
8. Zachariah SM, Sreedevi C, Aswathy S, Kokkayil P, Mathews AA. Investigation of Hepatitis A outbreak in Palakkad district. *Int J Community Med Public Health* 2017;4:4125-30.
9. Bergeisen GH, Hinds MW, Skaggs JW. A waterborne outbreak of hepatitis A in Meade County, Kentucky. *Am J Public Health*. 1985;75(2):161-4. 15.
10. Bloch AB, Stramer SL, Smith JD, Margolis HS, Fields HA, McKinley TW, et al. Recovery of hepatitis A virus from a water supply responsible for a common source outbreak of hepatitis A. *Am J Public Health*. 1990;80(4):428-30.