Original Research Article

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Investigation of Hepatitis A outbreak in Palakkad district

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ABSTRACT

Background: A study was carried out to investigate an outbreak of viral hepatitis reported by district health authorities from a self-administrative unit, Koppam of Palakkad district in Kerala in the month of November 2016.

Methods: An epidemiological investigation was carried out to investigate the outbreak, describe epidemiological features and recommend measures for control. An epidemiological case sheet was prepared, case definition formulated and blood samples were collected to confirm the diagnosis of hepatitis. Environmental samples were collected from wells, soil and tested for hepatitis A virus.

Results: 15 blood samples taken from cases of jaundice tested positive for hepatitis A, IgM antibody by ELISA test. More than three fourths 39 (79.6%) of the cases gave a history of having attended the same wedding function prior to the occurrence of symptoms. Attack rate (6.14%) was highest among 15-25 year age group. The water analysis from 3 of the wells in the area showed presence of coliform bacteria. Hepatitis A virus IIIA genotype was isolated from the soil sample of the house of the index case. Consumption of welcome drink was found to be associated significantly with cases than controls (OR 2.77; 95% CI: 1.02-7.52, p<0.05).

Conclusions: The hepatitis A (type IIIA) outbreak in Koppam was associated with poor sanitation practices among the people. During a socio-cultural-demographic event like marriage this led to an explosive outbreak. Involving community organizations to generate awareness regarding food sanitation, supported by a system of registration of such events, certification of food handlers can help to prevent future outbreaks.

Keywords: Outbreak, Hepatitis A, Sanitation

INTRODUCTION

Hepatitis A is an acute infectious disease caused by the hepatitis A virus. The virus is primarily spread when an uninfected (and unvaccinated) person ingests food or water that is contaminated with the feces of an infected person. The disease is closely associated with unsafe water or food, inadequate sanitation and poor personal hygiene. The virus is shed in the feces of persons with both asymptomatic and symptomatic infection. Under favorable conditions HAV may survive in the environment for months. ^{2,3}

Hepatitis A occurs sporadically and in epidemics worldwide, with a tendency for cyclic recurrences. The hepatitis A virus is one of the most frequent causes of foodborne infection. Several outbreaks of hepatitis A in various parts of India have been recorded in the past decade with anti-HAV positivity varying from 26 to 85%. Outbreaks of hepatitis A have been reported from different parts of Kerala over the years. 5-7

In India, HAV infection is very common but usually occurs in early childhood. Infection at this age is most often asymptomatic and leads to life-long immunity

against reinfection.8 Symptomatic hepatitis occurs in approximately 30% of children aged <6 years, some of whom become jaundiced. In contrast, older children and adults with HAV infection are usually symptomatic for several weeks. Following exposure, there is an incubation period of 15-50 days, after which the patient develops prodromal symptoms. Jaundice and hepatomegaly occur in 70% and 80% of symptomatic patients respectively.⁹

Approximately 85% of HAV-infected individuals recover within 3 months and nearly all have a complete recovery by 6 months. The case fatality of acute HAV infection is low but increases with age and in those co-infected with HCV infection.9

The first report of national viral hepatitis surveillance and outbreak data from India during the period 2011-2013 showed that two-thirds of outbreaks were reported from rural areas. For more than half (56%) of these outbreaks, etiology was known of which- 78 (48%) were caused by hepatitis E, 54 (33%) by hepatitis A, 19 (12%) by both hepatitis A and E, and 12 (7%) by hepatitis B or hepatitis C. Contaminated drinking water was the source of most outbreaks.10

An epidemiological shift in the age group affected has also been observed from the 1st decade of life to the 2nd and 3rd decades. This has been attributed to an improvement in socio-economic conditions as a result of which early childhood exposure to the virus has decreased.11

An outbreak of jaundice was reported to the district health authorities from Koppam self-administrative unit of Palakkad district in the month of November 2016. An epidemiological investigation was carried out to ascertain the etiological agent, describe epidemiological features and recommend control measures.

METHODS

A house to house visit was undertaken in two wards of the Koppam village, Palakkad district where jaundice was reported over a period of three days by a team from the Medical College, Palakkad.

The incidence rate of hepatitis in the recent months was compared with the previous years' reports from integrated disease surveillance project for the area.

There was a definite increase in number of cases in the current year as compared to the previous year. There was no report of mass population movement or increased surveillance from the district health authorities. 12 The report showed a seasonal trend in the occurrence of hepatitis cases with a peak in June and July and the second peak in November and December coinciding with the onset of monsoon and the wedding season respectively.

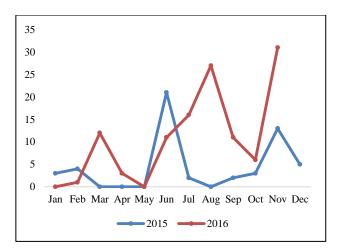


Figure 1: Graph showing number of cases of hepatitis reported during 2015 and 2016 in Koppam area.

A case definition was formulated after discussions with the health services team and a probable case of hepatitis was defined as an acute onset of illness with fever or tiredness followed by jaundice or increased liver enzymes after October 23rd 2016 in Koppam. An epidemiological case sheet was prepared and 49 cases were interviewed. Information regarding source of water supply, treatment of water before consumption, personal hygiene, toilet facilities, distance of water source from toilet, mass gatherings and exposure to mass food consumption was collected. ¹³ An environmental assessment was also carried out to assess the environmental factors that could have contributed to the outbreak.

Blood samples were taken from a representative set of 18 people to confirm the diagnosis of hepatitis and tested for hepatitis A and hepatitis E. The samples collected included 15 blood samples from the cases, 2 samples from the contacts of cases of jaundice and one sample from the food handler.

The well water from houses of 3 cases (index case and 2 others) was tested for bacterial contamination. Environmental sampling for the virus was also done by sending these water samples as well as soil samples from the house of the index case to National Institute of Virology, Pune.

A case control design was used to test the hypothesis. Controls were selected from the same neighbourhood. Controls were matched for age and had no past history of jaundice. They were also interviewed with the same questionnaire as the cases.

Data was entered into Microsoft Excel and analyzed using SPSS version 20. Data is described in proportions. Chi-square test was used to test for associations between hepatitis A infection and risk factors. Odds ratios were used to estimate the risk factors associated with hepatitis A infection.

RESULTS

The symptoms reported by the index case were initially tiredness followed by vomiting, fever and jaundice. The symptoms appeared 20 days after attending the wedding function. The patient had been tested for hepatitis at a private hospital and had taken ayurvedic treatment.

The wedding function was conducted at the house of the index case and was attended by 1500 guests. The primary case was the relative of the index case who had also attended the wedding function. The food was prepared by cooks at the site of the wedding. The water used for drinking purpose was drawn from the well of the house of the index case on the day of the wedding function.

A spot map was drawn showing the distribution of cases in Koppam. There was clustering of cases in two wards of Koppam. A differential diagnosis of hepatitis A and hepatitis E were thought of. All the 15 blood samples taken from cases of jaundice tested positive for hepatitis A IgM antibody by ELISA test and negative for hepatitis E. The food handler tested negative for hepatitis A and hepatitis E.

Table 1: Incidence of hepatitis A cases by age.

Age group in years	No. of cases	Total population	Attack rate (%)
<5	6	190	3.16
5-15	23	515	4.47
15-25	18	293	6.14
25-30	2	142	1.41

Attack rate was highest among 15-25 years age group (6.14%), followed by 5-15 years age group (4.47%) and less than 5 years age group (3.16%). 29 (59.2%) of cases were males while 20 (40.8%) of cases were females. No deaths or complications were reported.

Based on the onset of jaundice, the epidemic curve was drawn pointing to a common source outbreak.

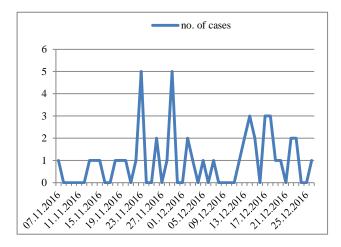


Figure 2: Epidemic curve.

Of the 49 cases interviewed, 39 (79.6%) of the cases gave a history of having attended the same wedding function prior to the occurrence of symptoms. The drinking water provided at the wedding was not boiled water. Considering the maximum incubation period as 50 days⁹ there were 22 secondary cases. Three cases that occurred in the primary incubation period had not attended the wedding but gave a history of frequent food intake from the nearby street vendors.

The number of cases started declining during the first week of December 2017. Peaks in the epidemic curve during the 2nd and 3rd weeks of December 2017 indicated that secondary person-to-person transmission was responsible. The last case was reported on 10th January 2017.

Majority of the cases (90%) did not have the habit of consuming boiled water before the outbreak. One fifth (20%) of the cases did not have the habit of washing hands with soap after defecation. Some of the children below 5 years of age had the habit of open defecation.

An environmental assessment was carried out to assess the environmental factors that could have contributed to the outbreak. All the wells in the area were insanitary wells, without a proper platform and pump. The wells were also not properly covered. It was also observed that majority of the wells had not been chlorinated in the area. The reasons for resistance in chlorination were that it altered the taste of water and chlorine was harmful to fishes that were bred in some of the wells.

The well from the house of the index case was found to be insanitary. It was situated at a distance of about 3m from the septic tank. The well was not covered and it had not been chlorinated before the outbreak. The parapet wall was broken at places and not in good condition with the probability of seepage from the septic tank situated nearby.

The water analysis from the wells showed presence of coliform bacteria indicating fecal contamination.

Hepatitis A virus was isolated from the soil sample (taken from near the well) of the house of the index case. One of the well water samples also tested positive for hepatitis A RNA. This sample was collected from the well which was the source of drinking water for three houses located within the same compound. There were 7 people affected with jaundice out of a total of 30 members from the three houses. The genotype of hepatitis A virus isolated from the soil and water samples was the IIIA genotype.

Of the cases studied, the attack rate was 67.5% among those who attended the wedding and consumed the welcome drink served at the wedding in contrast to 42.9% who had not consumed welcome drink. The attack rate for those who consumed salad was 58.7%, while

those who did not consume salad had an attack rate of 40%. The common ingredient in the welcome drink and

salad is the addition of water without boiling from the well.

Table 2: Factors associated with hepatitis A virus infection.

Item	Cases (N=49)	Controls (N=49)	Chi square p value	Odds ratio	95% CI
Attended wedding	39	29	0.03*	2.69	(1.095-6.605)
Taken welcome drink	27 (n=39)	13 (n=29)	0.04*	2.77	(1.020-7.520)
Eaten salad	37 (n=39)	26 (n=29)	0.42	2.14	(0.333-13.687)

^{*}Significant p<0.5.

The results of the case control study are given in Table 2. More than three fourths 39 (79.6%) of the cases had attended the wedding compared to 29 (59.2%) of the controls. Those who had attended the wedding were significantly more likely to be cases of hepatitis A (OR 2.69; 95% CI: 1.095-6.605, p<0.05). History of the affected and non-affected patients seemed to point to two food substances eaten during the wedding which was the probable cause. Therefore odds ratio was calculated only for welcome drink and salad. Consumption of welcome drink was found to be associated significantly with cases than controls; 27 (69.2%) of the cases compared to 13(44.8%) among controls (OR 2.77; 95% CI: 1.02-7.52, p<0.05). However, the consumption of salad was not found to be significantly different among cases and controls.

DISCUSSION

The probable source of infection is the well located within the compound of the house of the index case where the marriage took place. A large number of relatives had congregated at the wedding house and they could have infected the well due to the close proximity of the well and septic tank of toilet. This water was used without boiling for the salad, drinking water and in the welcome drink leading to onset of symptoms of hepatitis A. This is supported by the fact that Hepatitis A virus was isolated from the soil adjacent to the well. Coliforms were also identified from the well water indicating fecal contamination.

A significant association was found between cases of HAV infection and consumption of welcome drink at the wedding. Outbreaks of HAV among those using wells and contamination by adjacent septic system have been reported in other studies. ^{14,15} The failure to identify the hepatitis A virus from the well of the index case was probably due to frequent superchlorination from the onset of the outbreak.

In relation to water and sanitation, the Sustainable Development Goals aim to achieve universal and equitable access to safe and affordable drinking water for all by the year 2030. According to UNDP, at least 1.8 billion people globally use a source of drinking water that is fecally contaminated. The specific SDG goals of Kerala aim to provide 100% safe drinking water to all areas. The NSS data shows that over 85% of households

in Kerala depend on well water for their domestic needs which pattern is similar in our study too where almost all families use well water.¹⁷

Attack rate was highest among the 15-25 years age group (6.14%) followed by the 5-15 years age group (4.47%). Mathew et al in their study reported that the seroprevalence of HAV is highest among the 11-15 years age group (48.6%) followed by 8.6% in the 6-10 years age group. ¹⁸ Evidence from several other studies in Kerala and other areas of India supports the fact that the age of acquiring hepatitis A virus (HAV) infection is shifting from early childhood to adolescence and young adulthood with improvement in economic and living conditions of the communities. ^{7,11}

The strain isolated in the present outbreak was hepatitis A III A genotype. A similar genotype was also reported in an outbreak of viral hepatitis at Kottayam, Kerala during January 2005.⁶ An outbreak of hepatitis A in the neighbouring district of Ernakulam also reported the same genotype (personal communication). The HAV isolated in the hepatitis A outbreak in Shimla also belonged to genotype III A.¹⁹ Genotypes I-III are most commonly associated with human infections and have a variable geographical distribution. Majority of human strains (80%) belong to genotype I. The predominantly circulating genotype in India is genotype III A.^{6,19-21}

Personal and environmental sanitation was poor. Most i.e., 90% of the cases did not have the habit of consuming boiled water before the outbreak. Drinking unboiled water was found to be source of a hepatitis A outbreak.²² Anti-HAV positivity has also been found to be higher among unsafe (unboiled, filter and ponds) water users than that of safe (boiled and tube well) water users.²³ Anti-HAV positivity has also been found to be higher among unsafe (unboiled, filter and ponds) water users than that of safe (boiled and tube well) water users, though hand-washing has been found to be protective against hepatitis A infection.^{23,24} Though hand-washing has been found to be protective against hepatitis A infection.²⁴ One fifth (20%) of the cases did not have the habit of washing hands with soap after defecation. Resistance among the people regarding chlorination was another area of concern as they claimed that it changed the taste of water and was also harmful for breeding of fishes in the wells water. Resistance to change in taste or odor of water has also been reported in a study from Vellore. ²⁵

Secondary cases continued to occur by person-to-person transmission indicating poor sanitation practices. Improving personal and environmental sanitation would help to decrease the transmission of the virus. Behaviour change communication campaigns targeting personal hygiene measures like washing hands before eating food and after defecation, boiling water before drinking were conducted. Importance of periodic chlorination of wells was also emphasized.

Control measures were implemented soon after the outbreak was reported. Superchlorination of wells was done on alternate days for the first week, followed by twice weekly for a month and then weekly thereafter till twice the incubation period of the disease.

As the outbreak had occurred after attending a wedding function and with similar outbreaks reported in other areas of Palakkad district, a recommendation given to the health authorities was that all weddings and other public gatherings should be notified to the concerned Health Inspector through local self- governing body. The Health Inspector should mandatorily undertake visits to the household prior to the function and provide health education to the members of the household. The food and safety inspection team should also check that the food handlers are certified by Food Safety and Standards Authority.

Multipronged strategies including involving community organizations to create awareness regarding food sanitation should be promoted. Schools in the area should also be involved so that students become ambassadors of safe food practices.

Geographic regions with known HAV outbreaks should be kept under close surveillance. The disease surveillance activities in such areas should be strengthened. Available data indicate that there are pockets of susceptible population within different regions of India among older children and adults. Heterogeneous pockets of susceptible and exposed individuals may co-exist in rapidly developing societies. ¹¹

Vaccination against hepatitis A should be part of a comprehensive plan for the prevention and control of viral hepatitis. The countries with intermediate endemicity will benefit the most from universal immunization of children. Universalizing HAV vaccination could prevent the disease incidence in community, but the cost of vaccine would be a limiting factor. Hepatitis A vaccine can be recommended to susceptible populations in countries with intermediate endemicity.

The limitations of this outbreak investigation were that it did not include subclinical or asymptomatic cases. There

were logistic difficulties in confirming the presence of hepatitis A IgM antibody among all the cases. The welcome drink served at the mass gathering contained ice which was procured from a nearby district. This could not be analyzed separately for the presence of hepatitis A virus.

CONCLUSION

The hepatitis A (type IIIA) outbreak in Koppam was associated with poor sanitation practices among the people. During a socio-cultural-demographic event like marriage this led to an explosive outbreak. Involving community organizations to generate awareness regarding food sanitation, supported by a system of registration of such events, certification of food handlers can help to prevent future outbreaks.

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