

Investigation of a Hepatitis A outbreak in Panachkkad PHC area of Kottayam district Kerala by case control design

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Abstract

Background: Viral Hepatitis (HAV) continues to be a major public health problem in India and is hyper-endemic for HAV infection. Early investigation of an epidemic of Hepatitis A will go a long way in containing the epidemic and preventing further transmission of the disease. **Objectives:** The objectives of the investigation were to describe the epidemiological features of the Hepatitis A outbreak which occurred in PHC Panachikkad in November to December 2013, to find out the source of infection and suggest measures to control spread of the epidemic. **Setting and Design:** The setting was wards 5,7,18 and 19 of Panachikkad PHC, Kottayam District, Kerala State, India and the study was done using a case control design. **Methods:** The areas for investigation were identified in consultation with the PHC officials. For each case at least four to five household or neighbourhood controls were taken after matching for age. A total of 121 individuals were interviewed. All the cases and controls were interviewed at their home using a structured interview schedule which included information regarding the demographic characteristics, source of water, personal hygiene, and treatment of water before consumption, habit of consuming food from outside home and past history of Hepatitis. **Statistical Analysis:** Data was entered in Microsoft excel and was analysed using SPSS version 16.0. **Results and Conclusions:** A total of 121 individuals were interviewed as part of the study. Total number of probable Hepatitis A patients identified in the study was 22. Ten of them had laboratory confirmed Acute Hepatitis A (IgM Positive). Among the cases 20 (90.9%) belonged to the 15-30 age group category and only 2 (9.1%) to the 31-45 age group category. The major risk factors of the Hepatitis outbreak which were found to be statistically significant were male sex; OR 4.979(1.572-15.771), Jaundice in the family; OR 7.6 (4.742-12.179), Thattukada eating; OR 18.28(4.33-77.218), Alcohol consumption; OR 13.32(4.116-43.1). The protective factors were Eating from home; OR 0.33(0.108-0.98) and Boiled water at home for drinking; OR 0.162 (0.056-0.474).

Keywords: Case control design, Hepatitis A, Investigation of epidemic, Kottayam, Kerala.

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INTRODUCTION

Hepatitis A is an acute, self-limiting disease of the liver caused by the Hepatitis A Virus (HAV) that can cause

mild to severe illness. Globally, there are an estimated 1.4 million cases of Hepatitis A every year¹. History of Hepatitis dates back to 5th century BC as attributed to Hippocrates (epidemic jaundice)². Still now it remains one of the most commonly reported vaccine-preventable diseases. HAV is a 27-nm single-stranded, icosahedral, non-enveloped RNA virus that belongs to the Heparnavirus genus of the Picornaviridae family. Four distinct genotypes of HAV have been identified in humans, although they do not appear to have important biological differences. HAV is transmitted by the faeco-oral route and is more prevalent in developing countries or poor socioeconomic areas, where poor hygiene and sanitation facilitate the spread of the infection³. The anti-Hepatitis A virus (HAV) sero prevalence rate is presently

decreasing in many parts of the world, but in less developed regions and in several developing countries, HAV infection is still very common in the first years of life and sero prevalence rates approach 100%. In areas of intermediate endemicity, the delay in the exposure to the virus has generated a huge number of susceptible adolescents and adults and has significantly increased the average age of infection. As a result, fewer children are infected, leading to a larger population of adults, who lack protective antibodies against HAV. The immunity gap hence created can cause large outbreaks when there is a breach in the herd immunity. It is also documented that the severity of disease increases with age⁴. Viral Hepatitis continues to be a major public health problem in India and is hyper-endemic for HAV infection. Ever since the first epidemics of Hepatitis that had occurred in 1955 at Delhi, several epidemic outbreaks of Hepatitis have continued to occur in different parts of India^{5,6}. Studies conducted in the 2000s observed that nearly 90% of adolescents, adults, and most children acquired immunity to HAV infection in their preschool years⁷. However, recent studies have indicated a shift in epidemiology of HAV infection over the past decade. The Indian population also is showing a recent upward shift in the average age at first HAV infection, among the socio-economically developed population resulting in pockets of susceptible populations^{8,9}. Kerala even though known as “Gods Own Country” has a fair share of waterborne diseases. Several epidemics of Hepatitis A have been reported from several parts of Kerala including the district of Kottayam¹⁰. Identification of warning signs of a Hepatitis A epidemic by surveillance and a quick epidemic investigation of cases reported and the risk factors would go a long way in containing the epidemic. Epidemic investigations can be done by descriptive cross sectional method or case control method or cohort¹¹. But as per CDC (Centres for Disease Control Atlanta) a better design when population is not well defined would be a case control design¹¹. The current study attempts to investigate an epidemic of Hepatitis A in Panchikkad PHC area of Kottayam district by case control design

MATERIAL AND METHODS

Study Design

A case control design was adopted to investigate the outbreak as the population at risk could not be defined adequately. The case definitions are as follows

Case

Probable case of Hepatitis A—Any person with fever and jaundice within the last 3 months who is a resident of Panachikkad PHC area. Cases were selected based on the line list prepared by the PHC. Confirmed case of Hepatitis A – A person who has a blood report positive for IgM antibody for Hepatitis A.

Control

A household member or immediate neighbour of a probable/confirmed case as mentioned above who did not have fever and jaundice or a history of hepatitis in the last three months. They were group matched for age. Individuals who had a known history of Hepato-biliary or haematological disorders were excluded from both the cases as well as controls.

Setting

The setting is the geographical and administrative area of PHC Panachikkad in Kottayam district, Kerala State. A district level disease outbreak investigation team was constituted following the reporting of 22 cases of probable Hepatitis A from Panachikkad PHC area in Kottayam District. The objectives of the investigation were to describe the epidemiological features of the Hepatitis A outbreak of November to December 2013 in PHC Panachikkad and to find out the source of infection and suggest measures to control the spread of the epidemic. The investigation was carried out in Panachikkad PHC area which is located 12 kms to the south east of Kottayam town. The PHC has 23 wards with 7 sub-centres and a population of 47704. The terrain of the area is hilly with acute shortage of drinking water especially in the summer months. The population of the area mainly belonged to middle and low Socio Economic Status (SES). A retrospective design was used for the epidemic investigation. The areas for investigation were identified in consultation with the PHC officials and the line list given by the Medical officer of the PHC. After reaching the area the team was divided into 4 and the members visited houses in wards 5, 17, 18 and 19 where the clustering of cases were observed. For each case at least four to five household or neighbourhood controls were taken after matching for age. A total of 121 individuals were interviewed out of which 21, 42, 26 and 32 were from wards 5, 17, 18 and 19 respectively. All the cases and controls were interviewed at their home using a structured interview schedule which included information regarding the demographic characteristics, source of water, personal hygiene, and treatment of water before consumption, habit of consuming food from outside home and past history of Hepatitis. Blood samples were collected from 2 individuals fitting the case definition of fever with jaundice within the last 2 months and 2 more were collected from asymptomatic household or neighbourhood contacts (cases). Two environmental water samples were also collected, one stored water from water tanker supply where clustering of Hepatitis A cases were seen and another from a soda factory's well. The 22 cases (Hepatitis A Patients) found in the investigation were compared with 99 neighbourhood/family controls.

OBSERVATION AND RESULT

A total of 121 individuals were interviewed as part of the study and the details are as follows:

Total number of probable Hepatitis A patients (cases) identified in the study was 22. Ten among them were laboratory confirmed cases (IgM positive). Among the cases 20 (90.9%) belonged to the 15-30 age group category and only 2 (9.1%) to the 31-45 age group category. None in the age group of above 45 had Hepatitis A in our investigation. The number of males in the patient group were 18(81.8%) and females 4 (18.2%).

The other characteristic of the patients were:

1. Religion: Hindu religion 68.2% and Christian 31.8%;
2. Socio Economic Status: Below poverty line (BPL) as per the ration card 59.1%, APL 40.9%;
3. Education: 8th -12th standard were 95.5% and above +2 class 4.5%.
4. Occupation: skilled 40.9% manual labourer 27.3%, others 31.8%

Table 1: The clinical features of the cases

Sr. No.	Complaints	Number	Percentage
1	Fever	18	81.8
2	Yellow sclera/urine	17	77.3
3	Vomiting	13	59.1
4	Body ache	12	54.5
5	Headache	11	50.0
6	Loss of appetite	11	50.0
7	Nausea	7	31.8
8	Itching	6	27.3
9	Others (abd.pain, diarrhoea, lassitude etc)	10	45.5

On detailed clinical examination of the patients the major clinical findings were Icterus 45.5%, right upper quadrant abdominal tenderness 18.2% and pallor 9.1%.

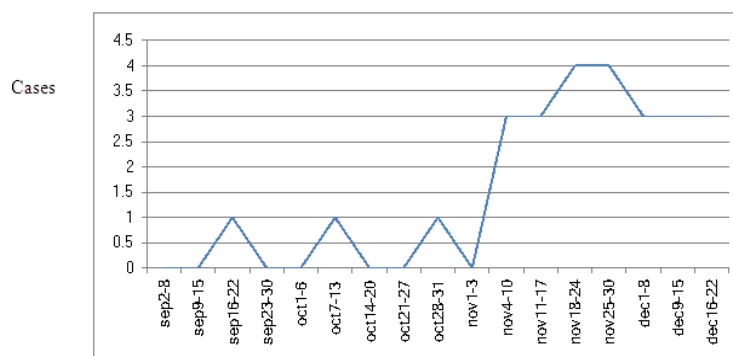


Figure 1: Epidemic curve of Hepatitis a outbreak: Nov-Dec 2013 In PHC Panachikkad Kottayam

As per the line listing prepared by the investigating team the index case of the epidemic was on 17.9.2013.

Table 2: The factors found to be associated with Hepatitis A:

Variable	Cases n (%)	Controls	Chi Square value	p Value	Odds Ratio (95%CI)	Interpretation
1 Male Sex	18 (81.8)	47(47.5)	8.539	0.003	4.979(1.572-15.771)	Significant risk factor
2 Jaundice in the family	7(31.8)	0 (0)	33.43	0.001	7.6 (4.742-12.179)	Significant risk factor
3 Eating from home	16(72.7)	88 (88.9)	3.893	0.049	0.33(0.108-0.98)	Significant protective factor
4 Frequent eating of outside food	10(45.5)	24(24.2)	4.009	0.044	2.604(1.12-6.78)	Significant risk factor
5 "Thattukada"(Road side eatery) eater	8(36.4)	3(3)	24.0	0.001	18.28(4.33-77.218)	Significant risk factor
6 Consumption of liquid refreshments from outside	16(72.7)	41(41.4)	7.083	0.007	3.772(1.360-10.461)	Significant risk factor
7 Alcohol consumption	18(81.8)	25(25.3)	25.14	0.001	13.32(4.116-43.1)	Significant risk factor
8 Boiled water at home for drinking	13(59.1)	89(89.9)	12.90	0.001	0.162(0.056-0.474)	Significant protective factor

Other observations

1. Anti HAV IgM: Out of the total 22 patients 8 were already tested positive for anti HAV IgM. The team took the blood samples from 2 probable Hepatitis A patients and two controls. The two tested blood samples of the probable cases were found to be positive for anti HAV IgM, making the total no of Laboratory positive cases to ten and the two from the controls were found to be negative.
2. Hospitalization: Out of the 22 Hepatitis patients 11(50%) were hospitalized with an average duration of stay was 5 days per person. The number of work days lost was 26 days +/- 13 days per person.
3. Insanitary wells: Out of the 46 wells the team visited 13(28.2%) were found to be insanitary either by not having a proper cover /drainage or the adequate distance from the septic tank. In wards 18 and 19 some were found to be very close to the septic tank.
4. Chlorination frequency of house hold wells: frequency of chlorination in the last six months before the onset of epidemic

Table 3: Frequency of chlorination of wells

Frequency of chlorination of household wells	No. of wells	Percentage (%)
Once in a week	2	4.3
Fortnightly	3	6.6
Monthly	5	10.9
1-3 monthly	15	32.6
More than 3 monthly	21	45.6
Total	46	100%

45.6% of the wells were chlorinated only once in three months or greater.

5. Method of chlorination of wells: On in-depth interview of the households it was observed that the technique of chlorination done in at least some of the wells in wards 5 and 18 were completely wrong. Both the bleaching powder packet was given to the household or the full solution and not the supernatant liquid was mixed into the well.
6. Soda factory: On visiting the soda factory in the area it was seen that the premises were unhygienic as was the well which was used to draw water for manufacturing soda. The water sample from this well was found to be unsuitable for drinking purpose as per the report given by the Department of Microbiology, Medical College Kottayam. It must be noted that alcohol consumption was found to be positively

associated with Hepatitis A in this outbreak, (refer table 2).

7. The water sample which was collected from the household of a suspected Hepatitis A case where the water supplied through a tanker lorry was stored for drinking purpose was found to be unsuitable for drinking when examined microbiologically.
8. Sanitary latrines: It was observed that all the latrines inspected were sanitary.

DISCUSSION

The outbreak investigated is a propagated Hepatitis A outbreak. Out of the total 22 probable cases 10 cases had a laboratory confirmed Hepatitis A infection (IgM positive). Hence the other cases can be epidemiologically linked to these laboratory confirmed case and we can classify the outbreak as Hepatitis A. Fig 1. Shows the epidemic curve of the Hepatitis A Outbreak and has the features of a propagated epidemic with secondary waves as usually seen in Hepatitis A outbreak. The outbreak seems to be growing. This is a warning sign that unless preventive measures are taken it could infect many more people. Out of the 22 infected with Hepatitis A, all of them were below the age of 45 years with 90% between 15-30 years. Most of the cases were males and seems to have a higher risk of contracting Hepatitis A (Odds ratio-4.979(C.I-1.572-15.771). It is clear that young males have been affected more and this could be due to the fact they go out regularly and probability of them eating out are higher than females. Similar results have been seen in the study conducted by Naresh chauhan *et al* in Ahmedabad where most commonly affected group was 25-30 years.¹²

The percentage of Below poverty line (BPL) cases as per the ration card was 59.1%, and those with educational qualification 8th 12th standard were 95.5% which are factors commonly associated with many infectious diseases 68.2% of the cases were either skilled or manual labourers which predisposes them to various sources of faeco-orally transmitted diseases. The nature of their work requires frequent travelling, exposure to unhygienic environment and eating from outside home which increases their chance of acquiring infections. Most common symptoms for the patients were fever, jaundice and vomiting as described by the standard textbooks but 27% complained of itching which is not usually seen in Hepatitis A. Thattukadas are road side eateries found in most parts of Kerala where food is prepared on the road side and served there itself. This leads to unhygienic practices of cooking and serving. The water used there also has a high -probability of being unhygienic. Those who consume food from thattukada regularly seems to have 18 times risk of contracting Hepatitis A compared to

controls (18.28(C.I-4.33-77.218)).The unhygienic practices of thattukada have also been cited in the study conducted by coreya *et al* in the study in three corporation of kerala.¹³ Another important risk factor for contracting Hepatitis A infection was consumption of alcohol. They have 13 times risk of Hepatitis A compared to controls. Probable reason for this could be either the soda used to mix with alcohol which was unhygienic or water used for diluting toddy (Country liquor) being unhygienic. It should be noted that the water sample collected from the soda factory in the present study was extremely unsuitable for drinking purpose as per microbiological reports. Two protective factors for Hepatitis A were eating from home and drinking boiled water. This clearly shows the importance of boiling water. Boiled water should be used at home and also should be carried to the workplace to prevent water borne diseases especially Hepatitis A. Other important observations that could have caused the epidemic were large number of insanitary wells in the area and the low frequency of chlorination. The proportion of insanitary wells in the area was 28.3% and 45% of wells were chlorinated at frequency of more than 3 months which could have helped the transmission of waterborne pathogens including Hepatitis A.

CONCLUSION

1. The outbreak investigated by the team is a propagated Hepatitis A outbreak.
2. The Outbreak seems to be growing and has the potential to become widespread unless proper control measures are initiated at the earliest.
3. The source of the epidemic appears to be multiple, Major risk factors were eating from "thattukada", drinking cool beverages from local shops, consuming alcohol and drinking water from tanker lorries without boiling.
4. The protective factors were drinking boiled water and eating from home.
5. Large number of insanitary wells and inadequacy of chlorination.

RECOMMENDATIONS

1. Disinfection of water: The best way to break the chain of transmission of this outbreak is to ensure that every family consumes water after proper boiling at all times. It was observed that many are taking water for drinking without boiling which should be discouraged by proper health education to families. Regular disease control measures that can be undertaken include proper hand washing with soap and water before and after food and toilet.

2. Frequency of chlorination of drinking water sources: The current status of frequency of chlorination is far from ideal. Every effort should be taken at the earliest to properly super chlorinate the drinking water sources on a regular basis. JHIs, JPHNs and ASHAs should take an active effort to properly super chlorinate the same at this period of outbreak.
3. Water quality monitoring: Quality of drinking water sources is to be continuously monitored bacteriologically as well as for residual chlorine. For this purpose testing kits must be made available to the field staff for quick assessment of water quality. This also should be intensively done at cool bars, restaurants, tanker lorries that carry drinking water and "thattukadas"
4. Inspection of food and hygiene should be actively intensified in "thattukadas" and hotels in Panachikad Panchayath as well as in the neighboring Panchayaths.
5. Health Education to owners as well as workers of eateries like thattukada and hotels as well as manufacturers of soda and local soft drinks.
6. Surveillance and monitoring should be intensified in Panchayaths bordering Panachikad so that early detection of new outbreaks or spread can easily be contained.

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