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Investigating an outbreak of Hepatitis-A in village Sharair in Himachal Pradesh

KEYWORDS

Outbreak ,Bauri, Hepatitis

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ABSTRACT Consumption of contaminated water from a local water source - "a Bawri" leads to An Outbreak of Hepatitis A in a scarcely populated hilly Village, Sharair near Shimla, Himachal Pradesh, 2007.

Background: Since January 2007 several outbreaks of Hepatitis A were reported in and around Shimla town. On 13/8/2007 a paediatrician of Deen Dyal Upadhyaya Hospital, Shimla reported two hospitalised cases of jaundice from village Sharair, Shimla. Their attendants reported more cases in the village. An outbreak was suspected and investigated to confirm diagnosis, control current and prevent future outbreaks.

Methods: Information on similar cases during the previous year was collected from local PHC and villagers. Changes in surveillance and population movements were considered. We defined as case as any person with history of acute Jaundice in the village. Sharair from 18/6/2007 to 30/10/2007. Active house to house case search, line listing of cases, and descriptive epidemiology was carried out. 13 serum samples were tested for Hepatitis-A, E, B and C antigens. Water samples were tested for coliform count. Through a retrospective cohort study, we collected information on exposures using an interview schedule consisting of semi-structured questions.

Results: All 13 serum samples were found to be positive for IgM antibodies for Hepatitis-A, and negative for hepatitis E, B and C. Water samples from different Bauries tested positive for high coliform bacteria while tap water proved uncontaminated. Epicurve showed continuous transmission, Spot map indicated clustering of cases around the "peepal bali bauri". Attack rates were more among 5-9 years and 5-44 years old. Both sexes were equally affected. Water drinking from the Peepal bali Bauri was significantly associated (CI 1.2-65.49 p=0.0077).

Conclusions: An outbreak of Hepatitis A was confirmed and caused due to consumption of contaminated water from local Bauries. Villagers were advised to cover the Bauri to decrease contamination by feet, drink water from the taps, given and taught to use chlorine tablets. Local health authorities were advised to enforce routine chlorination of all water sources in the village and monitor water quality as per national surveillance guidelines.

INTRODUCTION:

Global incidence of hepatitis-A is 1.4 million cases per year. India is among the high endemic states of the world for hepatitis-A. In India, reported incidence of all type of hepatitis in the year 2006 was 0.015%. The trend of cases of Hepatitis-A is increasing in different age groups in the country. From the year July 1999- July 2003, the proportion of patients with acute Hepatitis due to HAV age group of 13- 20 years have increased from 27.2% to 61.5% ($p=0.008$).

Recent studies from Delhi on sero-prevalence of HAV show that almost 100% children are sero-converted by the age of 10 years. Amongst the many types of hepatitis virus, hepatitis A and E virus infection is very common during rains in India, mostly due to lack of sanitation facilities. Hepatitis, which leads to liver damage, manifests through jaundice. Yellow eyes are the main sign accompanied by dark yellow urine as the main symptom of jaundice.

In 2004, an explosive hepatitis A outbreak occurred in adults from the southern state of Kerala (1170 cases), in 2007, Himachal Pradesh, a north Indian state experienced epidemic of Hepatitis A (450 cases) at Shimla which was found to be due to genotype IIIA like the one seen in Kerala. The Shimla outbreak was investigated by a FETP scholar.

Pina et al, demonstrated that there was a 90-100% identity between environmental and clinical samples and studies

from NIV, Pune show that some of the Hepatitis viruses are present in effluent and are not treated well in our current water treatment methods, therefore we need to have a fresh look at our water treatment, which has been neglected area. A study by Mackiewicz et al,(2004) reported presence of HAV in saliva samples, that indicates the human to human transmission potential of the disease.

Background:

Shimla is the capital of Himachal Pradesh, a northern hilly state of the country. In the month of January 2007 there was a major outbreak of Hepatitis-A in Shimla town and hundreds of people suffered. The cause of the outbreak was mixing of the sewerage with the leaking water supply lines. The Hepatitis A virus was isolated from the contaminated water samples.

After this outbreak many small outbreaks were reported around the peripheral areas of Shimla town and when this scholar returned from the first contact session already sporadic cases were being reported from various parts of the town.

Outbreak of Hepatitis in village Sharair:

On 13/8/2007 a paediatrician of Deen Dyal Upadhyaya Hospital, Shimla informed the scholar that there are two cases of jaundice admitted in hospital from village Sharair near Shimla, and the attendants reported more cases in the village. FETP Scholar was asked to investigate the situation. A rapid response team (RRT) was constituted that in-

cluded a technician, peon and a driver to visit the village next day accompanied by the scholar.

Sharair village is a small village with a population of 219 situated below a hill and have four natural sources of water apart from tap water supply that comes from the river below the hill base. The literacy rate of the village is 95% and people are well versed with the concept of hygiene as 65% of them had toilet facility.

Methods:

We followed the ten steps recommended by WHO/CDC for the investigation of outbreaks. The steps of an outbreak investigation include (1) determining the existence of the outbreak, (2) confirming the diagnosis, (3) defining a case, (4) searching for cases, (5) using descriptive epidemiological data to generate hypotheses, (6) testing hypotheses using an analytical epidemiological study, (7) drawing conclusions, (8) comparing the findings with established facts, (9) communicating the findings and (10) executing prevention measures.

1. Determining the existence of the outbreak:

In order to determine the existence of an outbreak we collected data related to jaundice cases from nearby Primary Health Centre (PHC) for previous years. We also collected information related to similar episodes in the past from the villagers.

2. Confirming the diagnosis:

We confirmed the diagnosis by case history and clinical sign and symptoms and We collected blood and water samples for serology and coliform count respectively. Serum samples were sent to NIV, Pune for Hepatitis-A and Hepatitis-E antibody testing. All the samples taken were sent to DDU Hospital Shimla for Hepatitis-B and Hepatitis-C antibodies testing.

Water sample from different available water sources used for drinking were sent to laboratory for testing its quality, potability as well as to find out any recent contamination, if any.

3. Defining a case :

We defined a case as any person with history of acute Jaundice in the vill. Sharair from 18/6/2007 to 30/10/2007. We examined the suspected cases in the community to clinically diagnose the cases (i) by history taking (ii) recording the clinical signs and symptoms.

4. Searching for cases:

We searched for cases house to house and searched wards of D.D.U.hospital, Shimla for any admitted cases. We discussed with local health authorities to ascertain any change in surveillance and population movements reported, which was not there. Hence a outbreak was suspected and therefore we initiated further investigations.

5. Using descriptive epidemiological data to generate hypotheses:

We described the outbreak in terms of Time, Place and Person characteristics to generate the hypothesis. We hypothesised that the outbreak could be due to contaminated water supply.

6. Testing hypotheses using an analytical epidemiological study:

We did a retrospective cohort study and collected information on possible exposures from all the residents in the vil-

lage. We administered a trawling questionnaire to cases to identify possible exposures.

We collected information about the water sources used, history of having a case in the school or visit to an area of recent outbreak, eating vegetables and fruits raw, sanitary latrine present or not and any other social gathering or event preceding 4 weeks of this event, in the village like marriage etc.

We calculated age and sex specific attack rate to describe the person characteristics. We constructed an epi-curve and a spot map. We carried out a literature survey and consulted experts from Deen Dyal Upadhyae Hospital, Shimla, to determine the biological plausibility of our finding.

7. Drawing conclusions:

We derived conclusions based on the findings of descriptive epidemiology, analytical study and results of the laboratory examination of water samples and blood samples.

8. Making recommendations:

We made recommendations, based on the conclusions arrived, to implement control measures and prevent future outbreaks.

9. Communicating findings:

We communicated these findings to the district and state health authorities along with the recommendations.

10. Executing preventive measures:

A model to cover the suspected water source was suggested and agreed upon by the villagers to prevent contamination.

Results:

1. Determining the existence of the outbreak:

Hospital records of nearby Primary Health Center of last three years did not show occurrence of jaundice in the affected village. The villagers reported one case each during 2005 and 2006.

2. Confirmation of the diagnosis:

Clinically all cases (17) show had yellow discoloration of eyes and 90% were having symptoms of pain abdomen, 76% had clay colored stools and dark colored urine and 65% were having itching and 40% were having vomiting, which was consistent with syndrome of jaundice.

The diagnosis was confirmed by serology, all 11 samples were found to be positive for IgM antibodies for Hepatitis-A. All the samples were found to be negative for other types of hepatitis like Hepatitis-B, Hepatitis-C and Hepatitis-E.

Serum Bilirubin of 2 cases was found to be 2.3% and 2.9 mg%.

3. Searching for cases:

On house to house active case search, we found 6 more cases yielding a total of 17 cases in a population of 219 and an attack rate of 7.8%.

4. Generating hypothesis:

We used descriptive epidemiology to generate hypothesis, the different distributions were as follows:

Time distribution:

The epi-curve shows (Fig II) continuous transmission and

no clustering of cases. The outbreak was prolonged over the three months period show that it had slow transmission. Index case had occurred on July 9, 2007 and outbreak peaked during the week 6-12 August, therefore indicating an incubation period of 3-4 weeks

Place distribution

of cases show scattered pattern and some clustering of the cases near the water bourses.

Person distribution

of cases show the attack rate is 47% in children with age 5-9 years and was less, 4% in elder age group 15-44 years old and in the higher age group it was 0%. Male and females are equally affected.

Interviews of patients using trawling questionnaire did not reveal any common meal, food ice cream vendor in the area.

Environmental investigation:

Though all the four water sources were found to be contaminated by the coliform bacteria, the two heavily contaminated Bauries were having highest attack rates in the respective hamlets drinking water from them, with Peepal Bali Bauri having attack rate of 11.34% and the Jabbal 2 bauri having attack rate of 4%.

The results of water samples reported contamination with coliform bacteria in water sources of different Bauries but excellent water quality of tap water. The most frequently used source, Peepal bali Bauri, was found to be most contaminated. The peepal bali bauri, (Fig III Bouri 1) had E.Coli count as 160 MPN /100 and Jabli No. 2 Bauri had the count as 90 MPN/100 (Annex III).

Using the above information we hypothesized that this outbreak was a water borne outbreak with the Peepal bali bauri (No. 1 out of four bauries) being the source of infection.

5. Testing hypothesis:

Retrospective cohort study done to identify the different exposure factors demonstrated that there was no common event between the cases like marriage or fair and only common event is drinking water from these natural water sources, Bauri and this peepal bali bauri was found to be significantly associated with the cases and thus a reason for this outbreak. (RR for Peepal bali bauri = 8.85, CI= 1.2-65.49). Other exposures like eating raw salad, visit to an area of recent outbreak and having toilet in household, were not found to be significantly associated.

6. Comparing the findings with existing facts about Hepatitis A:

1. Symptoms:

All the patients had jaundice like in other water born Hepatitis .

2.Age:

Age distribution of cases show the attack rate is more in children with age 5-9 years which is also comparable with other studies⁸, and was less in elder children of 15-44 years old and nil in the higher age group. In Kerala many adults were non-immune and developed infection with HAV⁷.

3.Sex:

Like many other studies our study show that both males

and females were equally affected, however the earlier Shimla outbreak had more females than males affected.

4.Lab results:

We found IgM antibodies in the serum of cases, show that the outbreak was of recent origin.

5. Exposures:

Water borne transmission was reported in other outbreaks of Hepatitis A in India, Shimla outbreak was due to mixing of sewerage with water supply system^{5,7}.

Like many outbreaks in India referred to here, our outbreak was also found to be associated with the drinking water source and no food item was associated.

Limitation of the study:

We could not confirm the presence of HAV in the water source due to logistic constraints of testing in a hilly and remote terrain, as facility is not available in local labs. We could not identify the exact cause of contamination of the water source, Bauri.

Discussion:

The occurrence of 17 cases of jaundice in the village was an unusual event and thus confirmed to the definition of an outbreak. We came to know about the outbreak which indicated a surveillance failure. The IDSP was implemented in the state since 2005, but no weekly reports were sent by local health worker. Recently there was an outbreak of Hepatitis-A in Shimla town. The Shrair village is near to Shimla and many people come to Shimla regularly and therefore there may have been some link to the recent outbreak in Shimla but was not proven in our study.

.The epicurve is consistent with persistent common source.

Spatial analysis of the outbreak show that though there were four natural drinking water sources in the village, 95% of the cases had drunk water from Peepal bali Bauri, no.1. (Fig III)

Conclusions:

The outbreak of Jaundice in Sharair village can be attributed to the contaminated Peepal bali Bari in the village which is not covered and also because of its proximity to the road making it prone to contamination by outsiders as well. Also the Bauri is situated at low height and during floods of monsoons the water from the road enters the bauri making it further prone to contamination.

Recommendations:

The people were advised to boil the water and put chlorine tablets in all the Bauries. It was suggested to clean all the Bauries and then keep putting Chlorine tablets in them and get regular lab reports for the quality of water after cleaning the bauries.

The residents were advised to cover the Bauri to decrease contamination by feet and a model for this has been suggested (See Fig II and III). People were advised to not to eat vegetables and fruits raw and wash them before eating.

The outbreak was detected late, pointing to a surveillance failure; feedback was given to the district surveillance officer to strengthen case detection under IDSP.

Fig I: Frequency of symptoms among cases, outbreak of Hepatitis A, Sharair, Shimla HP 2007

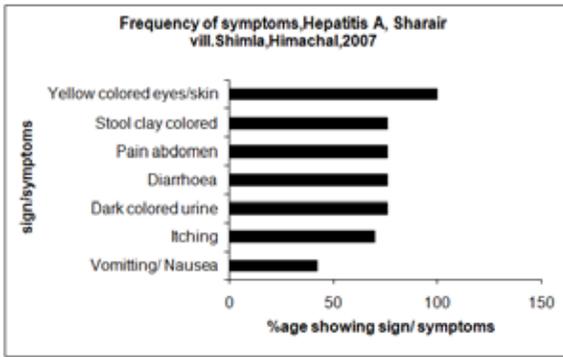


Fig II: Time distribution among cases, outbreak of Hepatitis A, Sharair, Shimla HP 2007
Epi-curve:

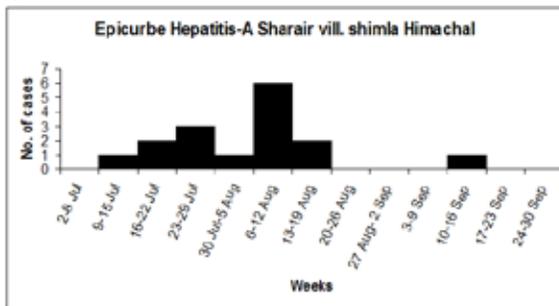


Fig III: Distribution of Hepatitis A cases by place, Village Sharair, near Shimla, HP, India, 2007

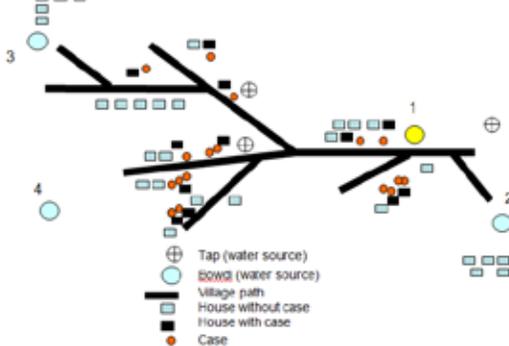


Table I : Age sex wise attack rates

| Characteristic | | Cases | Population | Attack rate /100 |
|----------------|--------|-------|------------|------------------|
| Age | 0-4 | 3 | 23 | 13 |
| | 5-9 | 7 | 15 | 47 |
| | 10-14 | 3 | 8 | 37.5 |
| | 15-44 | 4 | 97 | 4.1 |
| | >45 | 0 | 76 | 0 |
| Sex | Male | 8 | 107 | 7.5 |
| | Female | 9 | 112 | 8 |
| Total | | 17 | 219 | 7.75 |

Table II: Outbreak of Hepatitis A, attack rate by water sources, vill sharair, Shimla HP 2007

| Water source | Cases | Population at risk | Attack Rate |
|-------------------|-------|--------------------|-------------|
| Peepal Bali Bauri | 16 | 141 (Hamlet-1) | 11.34 |
| Jhabbal-11 | 1 | 25 (Hamlet-11) | 4 |
| Jhabbal-1 | 0 | 28 (Hamlet-111) | 0 |
| Dori Bauri | 0 | 25 (Hamlet-1V) | 0 |

Table III: Risk of Hepatitis-b according to exposures, Shrair vill., Shimla, Himachal, India, 2007

2x2 tables for exposure to Peepal bali bauri:

| Peepal Bali Bauri | Cases | Not-ill | # exposed | RR | CI |
|-------------------|-------|---------|-----------|------|-----------|
| Exposed | 16 | 125 | 141 | 8.85 | 1.2-65.49 |
| Not-exposed | 1 | 77 | 78 | | |
| Total | 17 | 202 | 219 | | |

Table IV: Risk of Hepatitis-b according to exposures, Shrair vill., Shimla, Himachal, India, 2007

2x2 tables for exposure to raw salad/fruits:-

| Raw Salad/ Fruits | Disease | Not-Disease | Total | RR | CI |
|-------------------|---------|-------------|-------|-----|----------|
| Exposed | 5 | 38 | 43 | 1.7 | 0.63-4.6 |
| Not-exposed | 12 | 164 | 176 | | |
| Total | 17 | 202 | 219 | | |

Table V: Risk of Hepatitis-b according to exposures, Shrair vill., Shimla, Himachal, India, 2007

2x2 tables for exposure to the area of recent outbreak:-

| Visit to area of recent outbreak | Disease | Not-Disease | Total | RR | CI |
|----------------------------------|---------|-------------|-------|------|------------|
| Exposed | 7 | 92 | 99 | 0.85 | 0.34- 2.15 |
| Not-exposed | 10 | 110 | 120 | | |
| Total | 17 | 202 | 219 | | |

Table VI: Having a sanitary toilet and risk of Hepatitis, vill Sharair, Shimla.

| Having a sanitary toilet | Disease | Not-Disease | Total | RR | CI |
|--------------------------|---------|-------------|-------|------|-----------|
| Having toilet | 11 | 115 | 126 | 1.35 | 0.52-3.53 |
| Not-having toilet | 6 | 87 | 93 | | |
| Total | 17 | 202 | 219 | | |

Table VII: Risk of Hepatitis according to exposure, vill. Sharair, Shimla 2007.

| | Risk among exposed | | | Risk among unexposed | | | Association | |
|---------------------------------|--------------------|---------|-----|----------------------|---------|-----|-------------|----------|
| | Ill | Not ill | % | Ill | Not ill | % | RR | 95% CI |
| Peepal bali bauri (n= 219) | 16 | 125 | 13 | 1 | 77 | 1.3 | 8.9 | 1.2-65.5 |
| Raw salad/ fruits (n= 219) | 5 | 38 | 13 | 12 | 164 | 7.3 | 1.7 | 0.6-4.6 |
| Visit to epidemic area (n= 219) | 7 | 92 | 7 | 10 | 113 | 8.9 | 0.9 | 0.3-2.2 |
| Having toilet (n= 219) | 11 | 115 | 9.5 | 6 | 87 | 7 | 1.4 | 0.5-3.5 |

ANNEXURE I : Semi-structured questionnaire for outbreak investigation:

An outbreak of hepatitis in Sharair village near Shimla, Himachal Pradesh, 2007.

ID No. patient _____ HOUSE NO. ____

Village name _____

Name of the head of the family _____

Date of Interview (DD/MM/YY) _____

Details of the family members

| | | | |
|------|-----|-----|---------------|
| Name | Age | Sex | Ill / not ill |
|------|-----|-----|---------------|

Exposure Details:-

Drinking water exposure:-

| | |
|---------------------|------|
| From the BAUDI No.1 | No.2 |
| No.3 | No.4 |

From tap supply. 1. Yes 2. No

From any other source _____

Is water is chlorinated or boiled or treated with any other method

2. History of attending any social gathering since 18-6-2007 (a month before the first case was detected)

- a) Marriage
- b) Attending school having a schoolmate infected with jaundice.
- c) Having a household contact with jaundice.

3. Habit of eating vegetables and fruits raw in the family 1. yes 2. no

4. History of travel to an area of recent Jaundice outbreak 1. yes 2. no

5. Sanitary Latrine 1. Present 1. Yes 2. No
If yes then 1. used 2. not used

6. History of any contact with a person with jaundice outside the village-----

IF ILL WITH JAUNDICE ONLY THEN TO BE FILLED

Symptoms:-

DATE OF ONSET

- 1. Yellow eyes/ skin
- 2. Pain abdomen
- 3. Diarrhea
- 4. Vomiting / nausea

- 5. Dark colored urine
- 6. Stool- clay colored / any other color
- 7. itching

TREATMENT HISTORY

Treatment taken:

1. Yes 2 no If yes, then from

1. Government hospital 2. private

3. Faith healer

4. any other

2. OPD/IPD

3. Date of symptoms-----

4. Date of seeking the treatment-----

Duration of treatment-----

Medicines given 1. Oral 2. Intravenous 5. Tests results if any----- diagnosis if any-----

Annex II: The water testing report for different water sources Shrair vill. Shimla, Himachal.

Lab results of water testing, Sharair, Himachal Pradesh, India, 2007

| Water source | REPORT | |
|-------------------|---------|----------------|
| | MPN/100 | Result |
| PIPAL WALI Bauri | 160 | Unsatisfactory |
| Jabli Bauri no. 1 | 17 | Unsatisfactory |
| Jabli Bauri no. 2 | 90 | Unsatisfactory |
| Dori wali Bauri | 35 | Unsatisfactory |
| Household sample | 180 | Unsatisfactory |
| TAP WATER | 0 | Excellent |

Fig I: Bauri that is existing:-



Fig II: Source of contamination by shoes as there is no protection boundary:-



Fig III: Suggested pattern of taking water from the bauries:



Fig IV: Hose to house survey being carried out in Sharair village, Shimla, Himachal Pradesh.



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