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# INVESTIGATION OF AN EPIDEMIC OF HEPATITIS IN AHMEDABAD CITY

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## ABSTRACT

This study explores geographic distribution, clinical profile of Hepatitis cases and confirms the strain serologically. The investigation was conducted by the rapid response team of the Smt. NHL Municipal Medical College in the Hirawadi area of North Zone of Ahmedabad following reporting increased numbers and clustering of jaundice cases during routine survey by the link and health workers of Ahmedabad Municipal Corporation. Re-survey of the affected area was carried out and occurrence of new cases in the areas was noted along with collection of blood samples. Assessment of water distribution system and correction of faults was carried out simultaneously by the engineering department of AMC. A total of 377 houses were surveyed and it had total population of 2039. Total jaundice cases reported were 94. Age profile was assessed among the population of 1245 and the age cut-off was taken as 12 years so as to make epidemiological distinction between two types of water borne Hepatitis based on the survey data before the reports of laboratory are available. Sex wise distribution of population and cases showed male preponderance. Overall ratio of jaundice cases among <12 years versus >12 years age category was 1:15.25. Households having turbid water supply had significantly more number of cases. Overall attack rate was 5.22% with significantly higher attack rate in population over 12 years. Total 44 blood samples were taken and 33 (75%) of samples were positive for Hepatitis E whereas 5 (11%) samples were positive for both hepatitis A and E. HEV was confirmed as the major etiological agent in this outbreak and contaminated drinking water was identified as the source of infection.

**Key words:** Epidemic investigation, faeco-oral route, hepatitis E, serological examination, water borne transmission.

## INTRODUCTION

Acute viral hepatitis is caused by six distinct types of viruses A,B,C,D,E and G. Hepatitis E, Hepatitis E virus, consists of small, 32- to 34-nm diameter, icosahedral, nonenveloped particles with a single-stranded, positive-sense, 7.5-kb RNA. Hepatitis E virus (HEV) is the agent largely responsible for epidemic as well as sporadic hepatitis in the developing countries. The virus is transmitted by the feco-oral route, often through contaminated water. Primarily a self-limiting disease, it produces chronic sequelae. The epidemic investigation was carried out to explore area wise distribution and epidemiological parameters of the affected persons and area; to serologically confirm the strain of the Hepatitis virus; and, to make hypothesis about the agent, probable source, route of transmission, susceptible hosts and suggest actions and preventive measures

## MATERIALS AND METHOD

The city of Ahmedabad is divided into six zones by Ahmedabad Municipal Corporation (AMC) for the purpose of provision of heath and other services. The health department of AMC reported increase in number and clustering of cases of jaundice during their routine survey by the link and health workers in the Hirawadi area of North Zone.

Rapid Response Team was formed from Smt. NHL Municipal Medical College for investigating the epidemic. The team comprised of the faculty and residents from the Department of Community Medicine, Microbiology and Medicine Departments along with lab. technicians and other support staff. Information about the affected areas was obtained from the Health Staff of AMC in the north zone. A rapid house to house survey of the areas was carried out by survey teams for detection of cases of jaundice and collecting basic information about the cases and important epidemiological parameters. During the survey investigation reports of the jaundice cases were also seen and those having high SGPT levels and/ or yellowish discoloration of sclera were examined serologically for confirmation of strain of the Hepatitis virus. Re-survey of the affected area was carried out and occurrence of new cases in the areas was noted along with collection of blood samples. During the survey other things observed were like physical quality of drinking water as perceived by the respondents, food history of the affected persons, and history of contact with the case of jaundice at home or at work place, symptoms of the cases etc. Other activities which were carried out were treatment of the affected persons, distribution of chlorine tablets, health education of the respondents etc. Simultaneously teams from engineering department of AMC were detecting the source of contamination of water supply and correcting the same. AMC authorities also went for super-chlorination of water in the affected area.

## OBSERVATIONS AND RESULTS

Total 377 houses were surveyed from the affected

areas in the first four days. On the fifth day 179 houses were re-surveyed from the same areas. The area had a total Population of 2039. The average family size was 5.4. The total jaundice cases reported were 94 as in Table 1.

**Table 1: Population/ houses covered**

| Date | Houses covered | Population Covered | Jaundice cases reported |
|------|----------------|-------------------|------------------------|
| 12-4-09 | 152 | 794 | 29 |
| 13-4-09 | 108 | 660 | 20 |
| 14-4-09 | 48 | 200 | 30 |
| 15-4-09 | 69 | 385 | 0 |
| 16-4-09 | 179 | Re-survey | 15 |
| Total | 377 | 2039 | 94 |

Age and sex profile was assessed among the population of 1245 which was surveyed from 13-4-09 onwards. It was observed that out of total, 303 (24.34%) were below 12 years of age and 942 (75.66%) were above 12 years of age. The age cut-off was taken as 12 years so as to make epidemiological distinction between two types of water borne Hepatitis namely A and E, based on the survey data before the reports of laboratory are available. Sex wise distribution of population showed that males were 670(53.8%) and females were 575 (46.2%), with M:F ratio of 1.17:1.

**Table 2: Age and sex profile**

| Age profile | Male | | | Female | | |
|-------------|----------|---------------|-------|----------|---------------|-------|
| | Affected | Not affected | Total | Affected | Not affected | Total |
| <12 years | 4 | 170 | 174 | 0 | 129 | 129 |
| > 12 years | 31 | 465 | 496 | 30 | 416 | 446 |
| Total | 35 | 635 | 670 | 30 | 545 | 575 |

As far as age and sex profile of cases is concerned 65 cases of jaundice were reported from the foresaid 1245 population. Out of that, 35 (53.84%) cases occurred in males and 30 (46.16%) in females hence the M: F ratio of cases was 1.17:1. The age wise distribution of cases amongst males showed a ratio of 7.75:1 between those who are more than 12 years versus less than 12 years whereas in females all cases occurred in the age group more than 12 years. Overall ratio among >12 years versus < 12 years age category was 15.25:1. This indicated that in current epidemic majority of those affected were adolescents and adults. (Table2)

Age and Sex specific attack rates were calculated for the affected area. Overall attack rate was 5.22%. Attack rate among males and females was 5.22% and 5.21% respectively. There was no significant difference in the attack rates between males and females indicating the equal exposure and risk for both the sexes. Attack rate among males of less than

12 years of age was 2.3% and same in more than 12 year age group males was 6.25%. Attack rate among females of more than 12 years of age was 6.72% and there were no cases among females less than 12 years of age hence attack rate was 0%. When the attack rate in the age group less than 12 years was compared with that of more than 12 the difference was statistically highly significant (z=5, p<0.01). This showed that adolescents and adults had significantly more number of cases as compared to children indicating the nature of epidemic in favour of Hepatitis E. (Table3)

**Table3: Age and Sex-wise Attack Rate (%)**

| Age (years) | Male | Female | Total | p value |
|-------------|------|--------|-------|---------|
| <12 | 2.3 | 0 | 1.32 | <0.01 |
| >12 | 6.25 | 6.72 | 6.47 | Highly |
| Total | 5.22 | 5.21 | 5.22 | Significant |

Out of the total 377 houses which were surveyed, 80 (21.22%) had cases of jaundice. There were more than one cases of jaundice in 10 households with average number of jaundice cases per affected household as 1.175. 213 (56.5%) households gave the history of supply of turbid water which they call "Dolu Pani" in their local language. It was observed by the investigating team that many of the affected households had installed the electric motor system directly in the municipal water supply system as the pressure of the water was low during the supply hours. Out of 213 houses where the history of turbid water supply was positive, cases of jaundice were present in 35.7% whereas out of 164 houses where there was no history of turbid water supply the cases of jaundice were present in 2.4% of houses. When the rate of presence of hepatitis is compared between houses having turbid water supply versus clear water supply, the difference was statistically highly significant (z=9.5, p<.001). Hence clear association was observed between turbid water supply and occurrence of cases of hepatitis; with households having turbid water supply having significantly more number of cases. However odds ration was 22.2 indicating very high strength of association between dirty water supply and hepatitis. (Table 4)

Team from microbiology department collected blood samples for confirmation of strain of Hepatitis virus and samples were transported to the laboratory of VS General Hospital under cold chain system. Total 44 blood samples were taken from the cases of jaundice (high SGPT levels and/or yellowish discolouration of sclera). All the blood samples were subjected to testing for HEV IgM, HAV IgM and H Bs Ag and Hepatitis C.

**Table 4: Water quality and hepatitis cases**

| Water quality | Number of houses with Case/Cases of hepatitis | | Total |
|---|---|---|---|
| | Present | Absent | |
| Turbid | 76 (35.7) | 137 (64.3) | 213 (56.5) |
| Clear | 4 (2.4) | 160 (97.6) | 164 (43.5) |
| Total | 80 (21.22) | 297 (88.78) | 377 (100) |

Out of total 44 blood samples, 33 (75%) samples tested positive for Hepatitis E and 5 (11%) tested positive for both hepatitis A and E indicating thereby mixed infection with both the types of water borne hepatitis viruses. None of the samples were positive for Hepatitis B, C and Hepatitis A alone. Six samples tested negative for all the tests. (Table5)

**Table5: Collection and analysis of blood samples**

| Type of Hepatitis | Number (%) |
|---|---|
| Hepatitis E | 33 (75) |
| Hepatitis E and A | 5 (11) |
| Hepatitis A | Nil |
| Non reactive to A, B,C and E | 6 (14) |
| Hepatitis B | Nil |
| Hepatitis C | Nil |
| Total | 44 (100) |

## DISCUSSION

Total population of 2039 was covered in house to house survey and 94 cases of jaundice were detected giving the overall attack rate of 4.61%. Male: Female ratio was 1.17:1 in the present investigation survey with males outnumbering females. This finding is similar to finding by P. Sarguna etal[1] during epidemic investigation in Hyderabad. Male: female ratio was 2.8:1 in another study by A. Bhagyalaxmi etal.[2] Majority of cases occurred in the age group more than 12 years both amongst males and females with few cases amongst younger age group indicating there by clear cut epidemiological evidence in favour of hepatitis E which is further supported by statistically significantly higher attack rate among the age group more than 12 years. This finding is also similar to finding of several other studies [1,2,3,4]. In the present study households having contaminated water supply had statistically significantly higher number of jaundice cases than the households having clean water supply indicating a clear association of cases with dirty water supply. 44 blood samples were tested from the cases of Hepatitis and 75% samples were tested positive for Hepatitis E and 11% for both hepatitis A and E. None of the samples were positive for Hepatitis B,C and Hepatitis A alone. Hepatitis E virus (HEV) was the causative agent in 47.4% of the cases of viral hepatitis in a study by M. Beniwal etal.[5] In study by Sarguna etal hepatitis E was the major cause of the outbreak (78.57%). And mixed infection of HEV-HAV (5.31%).[1]

## CONCLUSIONS

Based on the above observations, it was concluded that the present epidemic had water borne mode of transmission and the strain of virus responsible was identified as hepatitis E as majority of cases occurred in adolescents and adults which goes in favour of epidemiological age pattern of Hepatitis E. Serological examination also proved Hepatitis E as the cause of current epidemic. The cause of the outbreak was contamination of water during distribution because of repair works on the roads and suction from the motors installed by the households.

In endemic areas, infection with HEV may be seen in association with other hepatotropic viruses (HAV) as observed in the present study. The actions suggested were superchlorination of drinking water, distribution of chlorine tablets, constant monitoring of free residual chlorine levels, health education and correction of the faults in water supply system.

**LIMITATIONS:** The present study was carried out at the beginning of the epidemic so the progress and termination of epidemic could not be studied. Estimation of free residual chlorine levels in water was carried out by the workers of AMC in the morning and same could not be repeated during the rapid survey by the investigating team.

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