

Original Research Article

Clinical and epidemiological aspects of an outbreak of viral hepatitis E in a training centre

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ABSTRACT

Background: HEV infection is responsible for half of all outbreaks of acute liver disease in endemic areas. The present study deals with eighty eight cases of faeces orally transmitted Hepatitis E virus (HEV) in a regimental training center in South India in October 2016 to November 2016.

Methods: Methodology and case definitions which were used for confirmed case and presumptive case of viral hepatitis were same as those which were used by Singh et al in their study. Surveillance data for all the cases was reviewed. The outbreak was described in terms of person, place and time. A sanitary survey carried out to detect the likely sources of contamination of water and to study the methods of sewage disposal with regards to septic tanks/soak pits.

Results: Out of eighty-eight cases, two persons were HBsAg +ve, five were positive for both Hepatitis A and E, sixty-eight were positive for hepatitis E, five were positive for Hepatitis A, 8 persons were found negative for all the above hepatitis viruses. Overflow of sewage with foul smell and leaking water pipeline in 2 places were observed in the unit area. The overall attack rate was 27.69%.

Conclusions: The present outbreak was due to faecal contamination of drinking water supplied to the regimental centre, which occurred due to old and corroded leaking pipelines in close proximity to old sewage lines having leakage through their walls. Medical authorities should maintain surveillance for all water and food borne diseases.

Keywords: Outbreak, Viral hepatitis, Sewage contamination, Epidemiological investigation

INTRODUCTION

The first direct evidence for the existence of additional waterborne hepatitis agent was reported by Balayan et al in 1983. The workers also described successful fecal-oral transmission of hepatitis to a volunteer from patients with Hepatitis A like disease in Tashkent, Uzbekistan.¹ HEV infection is responsible for half of all outbreaks of acute liver disease in endemic areas.²⁻¹²

HEV is a single-stranded, positive-sense RNA virus classified in the family *Hepeviridae* comprising of four known genotypes (1-4), at least two new putative genotypes of mammalian HEV, and one floating genus of avian HEV. Genotypes 1 and 2 HEVs affect only humans, while genotypes 3 and 4 are zoonotic and are responsible worldwide for sporadic and autochthonous infections in both humans and several other animal species.¹²⁻¹⁴

Hepatitis E has a major global impact. One-third of the world population is estimated to have been exposed to the agent. It is estimated that 2.2 million cases of hepatitis E occur in India alone. Besides, 20 million cases of incident HEV infections were estimated to occur in nine endemic zones causing an estimated 3.4 million cases, 70 000 deaths and 3000 stillbirths in 2005.^{7,15,16}

The present study deals with an outbreak of faeco orally transmitted HEV in a regimental training center in South India. Present study comprises of 88 cases of viral hepatitis which occurred from second week of October 2016 to third week of November 2016. Methods of detailed epidemiological investigation of the outbreak and relevant findings are discussed in the study. The objective of the workers was to describe the clinic epidemiological aspects of an outbreak of Viral Hepatitis E in the training center.

METHODS

The study design used was a cross section descriptive study. The study was carried out from second week of October 2016 to third week of November 2016 in a large metropolitan city of India. The workers obtained detailed information from each reported case, viz date of reporting to the joining the training centre, date of onset of symptoms, date of admission, movement history during the incubation period, history of having worked as food handler in the cook house, personal hygiene and other relevant data. The workers also carried out active case finding by surveys during the period of the outbreak.

For confirmed case of viral hepatitis the case definition used was any individual presenting with fever, anorexia, pain abdomen, vomiting, yellowish discoloration of eyes, passage of high coloured urine, hepatomegaly and icterus on clinical examination with deranged liver functions on laboratory investigations. For presumptive case of viral hepatitis the case definition used was any individual presenting with fever, anorexia, pain abdomen, vomiting, yellowish discoloration of the eyes, passage of deep yellow coloured urine with clinical hepatomegaly and icterus.

All the cases were admitted to the local tertiary care service hospital. Serum samples in respect of all cases were tested for the IgM antibodies against hepatitis E virus by micro capture enzyme linked immunosorbent assay (ELISA) and for antibodies against hepatitis A virus (HAV) and hepatitis B virus (HBV). Biochemical parameters such as serum bilirubin, alanine aminotransferase (ALT) aspartate aminotransferase (AST), urine urobilinogen and bilirubin were also assessed.

Epidemiological investigation

The workers proceeded to describe the outbreak in terms of time, person and place. A sanitary survey to detect the

likely sources of water contamination and to assess the sewage disposal methods was carried out. The blue print of the water supply pipelines and the sewage system was obtained. Place distribution of the cases with relation to the water distribution line was mapped out and the attack rates in each of these subunits was calculated. The record of bacteriological examination of water for coliforms was also reviewed.

Standard statistical tools like calculating relative risk and Chi square were utilized for data analysis. The above study methodology has already been validated by Singh et al in their study.¹⁷

RESULTS

Clinical profile

Fever (69.31%), anorexia (71.59%), pain abdomen (45.45%), icterus (98.86%) and deep yellow discoloration of urine (97.72%) were the signs and symptoms of the cases. We also observed that thirty-one (35.22%) cases had poor personal hygiene i.e., their nails were not trimmed.

The disease followed an uneventful self-limiting course with average length of stay in hospital of about 2 weeks. All cases were mild to moderate in severity. There were no complications or fatalities.

Relevant laboratory findings

The serum bilirubin level ranged between 1.5 mg/dl to 16.3 mg/dl on admission. Out of eighty eight cases, two persons were HBsAg+ve, five were positive for both hepatitis A and E, sixty eight were positive for hepatitis E, five were positive for hepatitis A, 8 persons were found negative for all the above hepatitis viruses. Serum glutamic oxaloacetic transaminase (SGOT) and serum glutamic pyruvic transaminase (SGPT) was raised in all cases it was found to be raised in all of them. Total proteins, albumin, globulin and A:G ratio was carried out in 77 (87.50%) cases and it was found to be within normal limits in all of them.

Epidemiological findings

Within a short span of thirty eight days, 88 cases of viral hepatitis occurred among recruits and troops in the regimental training center. This works out to an incidence of 27.69 per 1000.

Overflow of sewage with foul smell and leaking water pipeline in 2 places were observed in the unit area. On 15th September 2016 while some work was being carried out by a JCB near recruit line the water pipeline was broken and sewage pipeline was also overflowing at that point of time. Photographs of the same are given as Figure 1 (a and b). Unit was provided with MES water supply. MES receives treated water from the Water

Supply and Sewerage Board at the pump house, where it was stored temporarily in two large sumps. Rechlorination was carried out by bleaching powder dosers at this end, before supplying to the user unit. The efficacy of water treatment by the Water Supply and Sewerage Board could not be ascertained as the same was located far away from the city. In a couple of places in the affected barracks, it was observed that water pipeline was passing through the septic tank. It was also reliably learnt from various sources, which recruits due to their hectic training schedule, often fill up their drinking water bottles from the bathroom itself, rather than walk up to the RO plant which was located about 100 meters away.

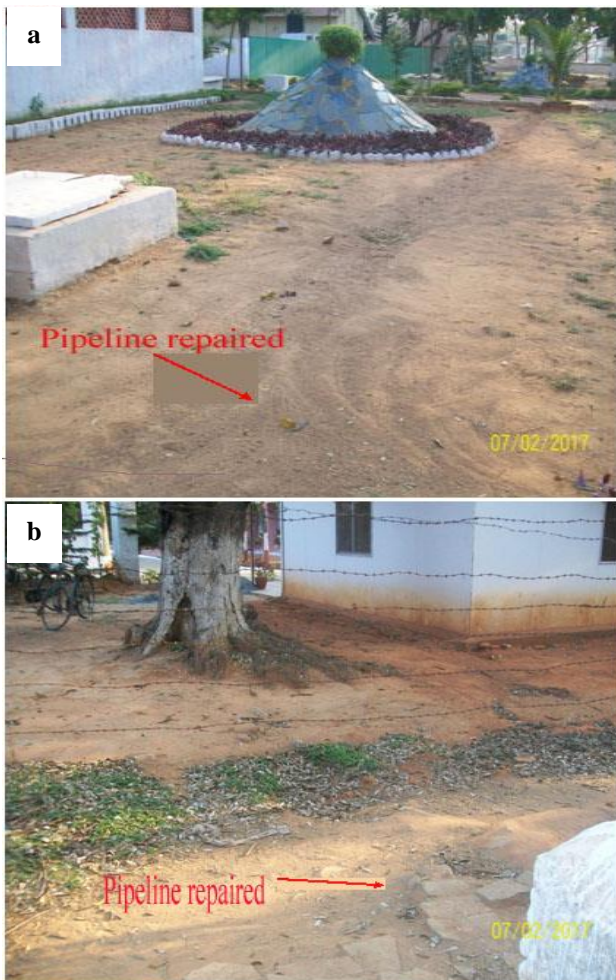


Figure 1 (a and b): Repaired sewage pipelines.

From records it was seen that only the number of cases of viral hepatitis in the station in the years 2013, 2014 and 2015 were 15, 9 and 11 respectively. Training battalion wise distribution of cases of viral hepatitis is given in Table 1. Table 2 shows attack rates in recruits/troops who were exposed to leaking pipelines compared to those not exposed. The relative risk for those exposed against those non-exposed was 16.6 (95% CI of RR 15.70, 17.49). The difference in attack rates between the two groups was statistically significant ($p < 0.0001$). All the 88 cases of viral hepatitis were recruits; and no serving soldiers were

affected. Age wise distribution of cases is given in Table 3. Spot map of the cases is given in Figure 2.

Table 1: Training battalion wise distribution of 88 cases of viral hepatitis.

Training Battalion	No. of cases	Strength	Attack rate (%)	Remarks
I and II	83	1600	5.1875	Exposed to leaking drinking water pipeline to leaking drinking water pipeline
III and IV	05	1600	0.3125	Not exposed to leaking drinking water pipeline
Total	88	3200	2.75	

Table 2: Attack rates in recruits/troops consuming water from the leaking water pipeline as compared to those not consuming water from the leaking water pipeline.

Source of water	No. affected (%)	No. not affected (%)	Total (%)
Leaking water pipeline	83 (5.1875)	1517 (94.8125)	1600 (100)
Normal pipeline	5 (0.3125)	1595 (99.6875)	1600 (100)
Total	88 (2.75)	3112 (97.25)	3200 (100)

RR=16.6 (95% CI of 15.7<RR<17.49), Chi square (Yates Corrected)=71.10, Df=1, $p < 0.0001$.

Table 3: Age distribution of cases of viral hepatitis.

Age (years)	N (%)
18-20	49 (55.68)
21-23	39 (44.31)
Total	88 (100)

The workers also observed that there was no unusual incidence of cases among the troops and families who were residing outside the regimental center. Besides, there were no reports of such increased incidence of viral hepatitis or any other water and food borne disease among the civil population of the city. This was checked from local newspaper reports, local TV and radio channels and liaison with the local Civil Hospital and private practitioners.

Twenty two out of thirty two serial water samples taken from points of suspected contamination 19 Oct 2016 to 9 Nov 2016 reported as unsatisfactory (presumptive coliform count of more than 180 per 100 ml of water). Bacteriological examination reports of water samples

collected from source and consumer end prior to this period were satisfactory. Results of water samples taken from other cook houses were satisfactory at all times.

Reports of water samples taken from suspected points of contamination after repair of the leaking water pipeline were satisfactory.

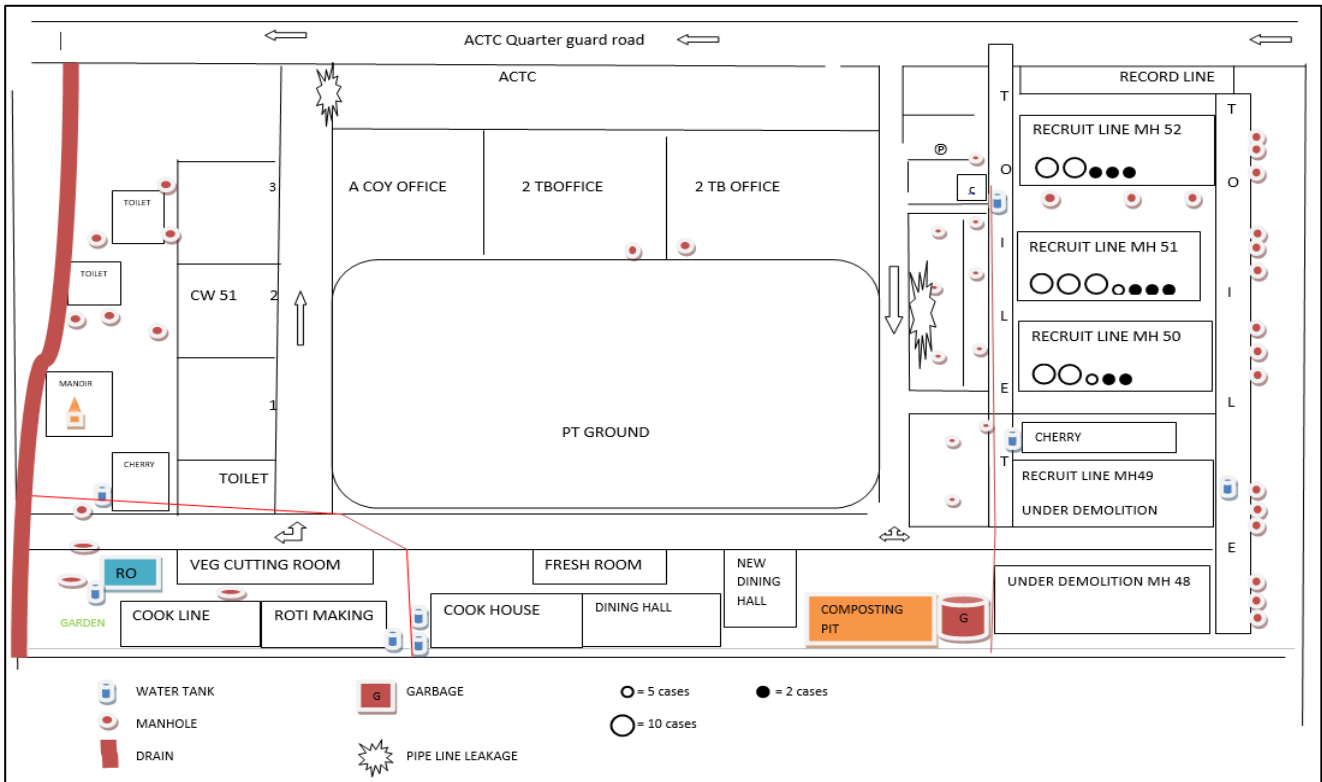


Figure 2: Spot map of the cases.

Time distribution

Hundred percent cases were admitted to the service hospital in that station between 13 October 2016 and 19 November 2016. Subsequent to this period, there were no cases. We continued our epidemiological investigation till 31 January 2017. During this follow up period also, no case of viral hepatitis occurred among the troops/recruits of the Regimental training centre. Epidemic curve of the cases of viral hepatitis is given in Figure 3.

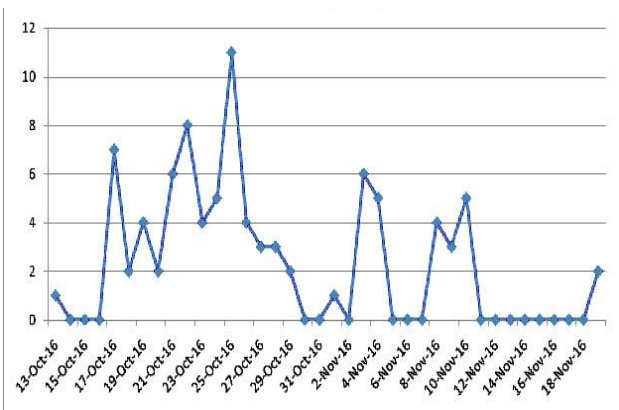


Figure 3: Epidemic curve of the cases of viral hepatitis distribution w.e.f. 13 October 2016 to 19 November 2016.

DISCUSSION

In present study, seventy three out of eighty eight serum samples (82.95%) examined showed the presence of IgM antibodies against HEV. Thus we established beyond any reasonable doubt that HEV was the cause of the outbreak.¹⁸

Much higher attack rates of viral hepatitis was found in those, consuming water supplied from the leaking water pipelines as compared to those who consumed water supplied from other pipelines indicating that the present outbreak was due to sewage contamination of drinking water supply. Our finding was further substantiated by the presence of high coliform counts in drinking water at the consumer end when the outbreak commenced.

Epidemics of viral hepatitis E are generally unimodal and short-lasting. Some epidemics are multimodal, but even in such epidemics, controlling water contamination was soon followed by cessation of appearance of new cases. Massive contamination of water supply systems is often the commonest cause of Hepatitis E outbreaks. Young adults in the age group of 15-40 years are commonly affected by Hepatitis E.¹⁸

Studies carried out by previous workers have revealed an attack rate of viral hepatitis E from 1.9-17%. In present

study the overall attack rate was 2.75% with the recruits exposed to sewage contaminated water showing a higher rate of 5.1875% as compared to 0.3125% in those not exposed to sewage contaminated water.^{1,18}

Twelve countries viz, Indonesia, Myanmar, Vietnam, Japan, China, Bangladesh, Pakistan, Nepal, Iraq, Uzbekistan, Turkmenistan, and India have reported HEV outbreaks.¹⁴

Since the discovery of HEV, many archived samples obtained during NANB hepatitis outbreaks were tested for the presence of HEV. A large jaundice outbreak in New Delhi, India, in 1955–1956 with more than 29,000 suspected cases was the first retrospectively identified HEV outbreak, with an attack rate of 2.05%. Subsequently, India has repeatedly reported large HEV epidemics, affecting hundreds to thousands of people. The largest HEV outbreak in India was reported in Kanpur, India during December 1990–April 1991. About 79 000 suspected cases (jaundice patients) were reported, with an attack rate of 3.76%. Another large HEV outbreak was reported from Nellore (South India) with 23 915 suspected cases. Twenty One HEV outbreaks, were reported in India from 1975 to 1994, 13 of them (62%) reported more than a thousand suspected cases. Approximately 240 suspected cases being reported from Lalkuan (Nainital District, Uttarakhand) is the most recent epidemic in India. The attack rate ranged from 0.34% to 8.61%. Saharanpur, 1992–1993 (14%); Nainital district, Uttarakhand, July 2005; and Baramulla district, Kashmir, 2007–2008 (21.6%) were the only three outbreaks that reported attack rate of more than 10%.¹⁴

Some HEV strains associated with sporadic attacks have been detected in North America and Europe in the last few years. In developed nations viral hepatitis E occurs sporadically. It is generally traced to travel to an endemic area. Less than half a dozen cases in the United States have been found which do not have an association with travel to endemic areas.¹⁸⁻²⁰

CONCLUSION

The study shows how despite several massive outbreaks having occurred in the past both in India and abroad as has been highlighted in the discussion complacency does set in regarding water quality monitoring and education of all concerned regarding water borne diseases. The above study thus highlights the necessity of strict water quality monitoring by all authorities concerned in the country to prevent morbidity and mortality due to water borne diseases.

Recommendations

We strongly recommend that medical authorities in the station should maintain a strict vigil on the state of environmental sanitation. In this regard, particular emphasis be paid to the state of water supply and sewage

disposal system. Good liaison must be maintained with MES and administrative authorities at all times. In old cantonments, most of the water and sewage pipelines are more than 50 years old. Besides, the blueprints are outdated. The blueprints do not correctly indicate the water supply and sewage system networks. This poses to be a major hurdle in identifying the source of contamination whenever such water borne outbreaks occur.

Replacement of all vintage water and sewage pipelines on a war footing should be advocated by senior medical authorities. The progress in improvement of water distribution and sewage disposal systems, should be periodically reviewed by the Station Health Committee in each station, during their quarterly meetings. This point should invariably get top priority among all the agenda points.

Maintaining surveillance for all water and food borne diseases such as, acute diarrhea, dysentery, typhoid fever, viral hepatitis and cholera etc. by the medical authorities is an absolute necessity. The water quality should be monitored on a daily basis. Daily check for free chlorine at source as well as at the consumer ends must form a part of surveillance. Any absence of free chlorine should be taken as indication of faecal contamination unless proved otherwise. The same should be investigated thoroughly and immediately. Bacteriological examination of water for coliform counts from source as well as from various consumer ends must also be carried out periodically.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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