Original Article

Study on Outbreak of Deadly Enteric Pathogens due to Sewage Contamination of Drinking Water Supply at Halisohor, Chattogram

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Abstract

Introduction: Access to safe drinking water is very important issue at all level of life for maintaining good health and development. Water contamination by sewage waste is one of the most important causes of water pollution world-wide.

Objectives: To detect the causative infectious agents from all hospitalized patients hailing from an area of simultaneous outbreak of jaundice and fever and also to highlight the importance of regular bacteriological tests of drinking water.

Materials and Methods: This observational study was carried out among 1298 patients reported to CMH Chattogram between April 2018 to May 2018. For diagnosis, all relevant investigations were done following standard laboratory proceducers in CMH Chattogram, Armed Forces Institute of Pathology Dhaka and in ICDDR,B.

Results: Out of 1298 admitted patients, 933(71.9%) patients had symptoms of acute viral hepatitis (AVH). IgM anti-HEV were found positive (100%) in 550 randomly selected hepatitis patients. From seropositive cases, 7 of the 10 random samples (70%) were found HEV-RNA positive by real time PCR. Co-infection of AVH with enteric fever was detected in 73(5.6%) patients. Only enteric fever was diagnosed in 150 (35.7%) high febrile cases. Water for bacteriological tests revealed thermos-tolerant E. coli immediately before and during the outbreak.

Conclusion: Providing safe drinking water in a developing country is always a big issue. Contaminated drinking water can transmit deadly enteric pathogen that often causes a catastrophe of mass population. Only ensuring safe water distribution systems following WHO guidelines can minimize these sufferings.

Key-words: Acute viral hepatitis, enteric pathogen, enteric fever, contaminated drinking water, bacteriological tests for water.

Introduction

Drinking water contamination by microbial agents remains a significant threat even in the most developed countries[1]. Hepatitis E is found worldwide, but the disease is most common in East and South Asia. The virus is transmitted via the fecal-oral route, principally via contaminated water[2]. The disease is ecologically dependent and is a major public health concern, especially in resource-poor countries[3]. HEV is a single stranded RNA virus having single serotype with four genotypes. In Asia, the Middle East, Africa and even in developed countries Hepatitis E virus is the most important cause of sporadic and epidemic hepatitis in adults[4]. To prevent water borne pathogens usually national standards or international guidelines are followed for judgment of drinking water safety. Between these, the important one is WHO Guidelines for Drinking-Water Quality[5]. This study was done to find out the causes of both hepatitis and fever from admitted patients of the outbreak area and also to detect the source of infections.

Material and Methods

This observational study was carried out among all 1298 patients reported to CMH Chattogram from Halisohor area of Chattogram with jaundice/fever/gastroenteritis/other symptoms between April 2018 to May 2018. No patient gave any history of staying outside of their residence in preceding 02 months of illness. Chronic sufferers from any hepatitis and ingestion of any systemic drugs/ alcohol prior to illness were excluded. In jaundiced patients liver function tests were done by analyser ABX Pentra-400. IgM anti hepatitis E virus (HEV) were carried out by ELISA using EIAgen HEV IgM kit. RNA was extracted and screened for the presence of HEV RNA by real time PCR using QIAamp Viral RNA Minikit. IgM anti Hepatitis A virus (HAV) were also done by ELISA. HBsAg and Anti HCV were done by immunochromatographic (ICT) devices and also by ELISA. Clinically suspected malarial cases were tested by qDetectTM Malaria Pf/Pv test kit, an antigen capture ICT assay. For diagnosis of enteric fever blood culture in Trypticase Soy Broth and biochemical tests in triple sugar iron agar were done. For Widal tests MICROPATH ®ANTIGENS/FEBRILE ANTIGEN KITS were used. In gastroenteritis cases stool routine examination were done to find out protozoa/helminths/inflammatory cells (pus cells, RBC). In few cases stool culture was also done. Complete blood picture was carried out specially to see platelet count by analyser ABX Pentra DF 120. In some of the jaundiced patient prothombin time were also done. Following WHO guidelines multiple tube/Most Probable Number (MPN) method was performed to detect

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thermotolerant (faecal) coliforms from water sources. Here faecal coliforms were grown by multiple fermentation tube technique. Double strength MacConkey's broth were inoculated and kept at 44°C for 24 hours. In next day, number of tubes showing turbidity of the media and gas in inverted Durham's tube were calculated by probability table.

Results

About 4000 inhabitants were present at the outbreak region of Halisohor area. Out of them 1298 (32.5%) patients admitted in the hospital. Among them 892 (68.7%) were male trainees, 321 (24.7%) were service men and rest 85 (6.6%) were women and children. Maximum number, 1012 (78%) of affected persons were between 18-30 years of age group. Total 933 (71.9%) patients admitted with features of acute viral hepatitis (AVH) along with or without fever. The number of patients suffered from only AVH were 820 (63.2%), enteric fever 77 (5.9%), non-specific febrile illness 230 (17.7%) and gastroenteritis 58 (4.5%). Co-infection of AVH with enteric fever were 73 (5.6%) and AVH with non-specific febrile illness 40 (3.1%) (Table-I). At the time of outbreak, a total of 1207 trainees were staying in the dormitories among them, 735 (82.4%) were suffered from AVH and 157 (17.6%) from other ailments.

Abnormal LFT (raised bilirubin and serum Alanine Transaminase) were found in all 933 hepatitis patient. Among them 550 randomly selected icteric and anicteric patients were tested for IgM anti-HEV and all were found positive (Table-II). For molecular diagnosis of the causative agent, RNA was extracted from randomly selected 10 seropositive samples and HEV RNA was found positive in 07 (70%) cases. A total of 420 patients were admitted with only fever or fever with clinical/ subclinical jaundice. Among them 122 (29.0%) patients had mild fever. Rest 298 (71%) patients with temperature of >100°F were tested to find out the etiological agents. By Blood culture Salmonella typhi were confirmed in 26 (6.2%) cases and in 124 (29.5%) cases widal test revealed significant titre against S. typhi (Table-III). From the rest 148 (49.7%) cases 50 suspected cases were tested for malarial antigens (Pf and Pv). But the results were found negative. Water for bacteriological tests to detect thermo-tolerant coliform (E. coli) were carried out monthly in the affected area and high count of the E. coli growth were reported in seven different water sources during and immediately before this outbreak (Table-IV).

Table-I: Spectrum of diseases among admitted patients (n=1298)

Diagnosis of the patients	Frequency	Percentage
AVH	820	63.2
AVH with enteric fever	73	5.6
AVH with nonspecific febrile illness	40	3.1
Enteric fever	77	5.9
Nonspecific febrile illness	230	17.7
Gastroenteritis	58	4.5

Table-II: Detection of IgM Anti HEV (n=550)

Patient's status	Bilirubin status	Test number	Opinion
Icteric	Hyperbilirubinemia	437	Positive
Anicteric	Hyperbilirubinemia	113	Positive

Table-III: Laboratory methods to detect febrile pathogens (n=298)

Tests	Positive results	Negative results	Percentage	Opinion
Blood culture	26	-	8.7	Enteric fever
Widal test	124	-	41.6	Enteric fever
Blood culture, Widal test and ICT for malaria	-	148	49.7	Non- specific febrile illness

Table-IV: Bacteriological tests of water by Most Probable Number (MPN) to detect thermotolerant coliforms *(E. coli)*.

Existence of water points / Reserviours	Number of affected water points	Test results
Dormatory: 09	05	Unsatisfactory (Score: 18+)
Water reserviour: 01	01	Unsatisfactory (Score: 18+)
Family residence: 03	01	Unsatisfactory (Score: 18+)

Discussion

In the present outbreak, IgM anti HEV antibody were found in all randomly selected hyperbilirubinemia patients which is a confirmed outbreak[6]. Hepatitis E epidemic in a military unit of Pakistan showed 95% of the patients are positive for IgM anti HEV[7]. During an outbreak in a regimental center, India 265 patients were infected with Hepatitis E virus within 3 months' period and 97.4% were seropositive for IgM anti HEV[6]. The higher attack rates of viral hepatitis is seen in trainees who used to take water from common water points, shared toilets and stayed in the dormitories in a relatively crowded condition. In the preceding 2-3 months of current outbreak, higher number of thermos-tolerant coliform (*E.coli*: MPN/100 ml were 18+) were found in water sources of 5 dormitories out of 9. Similar type of findings were found in a training center of India[8]. Usually more than 95% of the thermos-tolerant coliform isolated from water are the gut organism Escherichia coli, the presence of which is definitive proof of fecal contamination[9]. So it is proven that HEV is a fecal-oral transmitted virus[10,11]. In 1993 outbreak in India, 5% of the HEV affected patients were< 20 years and 17.5% were> 20 years of age; In 1998 outbreak 5.6% of patients were < 25 years and 35.3% were >25 years of age[12]. As current outbreak occurred in a young adults training institute, so we found maximum HEV affected patients were between 18-30 years of age group (78%).

The attack rates of viral hepatitis E have varied between 1.9% to 17% in previous outbreaks[10,13,14]. The outbreak in the police training center, Nepal was traced to faecal contamination of the well where out of 1000 trainees 150 (attack rate 15%) got acute hepatitis[13]. In the present outbreak the overall attack rate was found 23.3%, but the trainees exposed to sewage contaminated water had higher rate of 78.8%. In this study we found 70% cases were HEV RNA positive. In a study in Italy[14] HEV RNA was found in 23 out of 52 samples (44.2%).Different studies revealed co-infection of HEV with Salmonella species[15-19]. But here in this study surprisingly we have found 73 patients (5.6%) were co-infected with Salmonella typhi along with HEV. Another 77 patients were only suffered from typhoid fever. As both of these pathogens are water borne and faecal contamination of drinking water sources were confirmed, that's why percentage of co-infection of HEV and Salmonella typhi are quite high in current study. Not all patients developed co-infection, as the exact clinical outcome of Salmonella infection depends largely on the individual serovar involved, the infected host species and the immunological status of the individual. During HEV epidemic in Pakistan, water sources closer to the living/cooking quarters of the affected group had a significantly high coliform count almost like the current outbreak in Halisohor[7].

Conclusion

This study suggests that ensuring and providing safe drinking water in underdeveloped and developing countries are still a challenge. But meticulous monitoring of the water sources, treatment and distribution systems are the key issues for safeguard against water borne deadly pathogens.

References

1. Fawell J, Nieuwenhuijsen MJ. Contaminants in drinking water: Environmental pollution and health. British Medical Bulletin. 2003; 68:199–208.

2. Hepatitis E fact sheet. In: World Health Organization: media centre (http://www.who.int/mediacentre/ factsheets/fs328/en/, accessed 10 March 2017) July 2019 update.

3. Khuroo MS, Khuroo MS, Khuroo NS. Sanitation and sewage disposal in India. JK-Practitioner. 2015; 20:43–6.

4. Panda SK, Thakral D, Rehman S. Hepatitis E Virus. Reviews in Medical Virology. 2007; 17(3):151-80.

5. WHO Guidelines for drinking-water quality. Surveillance and control of community supplies. Geneva, World Health Organization.1997; (http://www.who.int/water_sanitation_health/publications/small-water-supplies-guidelines/en/).

6. Banerjee A, Sahni AK, Nagendra A et al. Outbreak of viral hepatitis E in a regimental training centre. Medical Journal Armed Forces India. 2005; 61(4):326–9.

7. Bryan JP, Iqbal M, Tsarev S et al. Epidemic of hepatitis E in a military unit in Abbottabad, Pakistan. American Journal of Tropical Medicine and Hygiene. 2002; 67(6):662-8

8. Naik SR, Agarwal R, Salunke PN et al. A large waterborne viral hepatitis E epidemic in Kanpur, India. Bulletin of the World Health Organization. 1992; 70(5):597–604.

9. Skidmore SJ, Yarborough PO, Gabor KA et al. Hepatitis E Virus: The cause of a waterborne hepatitis outbreak. Journal of Medical Virology. 1992; 37(1):58–60.

10. Amarapurkar D, Agal S, Rajiv Bajal R et al. Epidemiology of Hepatitis E Virus Infection in Western India. Hepatitis Monthly. 2008; 8(4):258-62.

11. Singh V, Singh V, Raje M et al. Routes of transmission in the hepatitis E epidemic of Saharanpur. Tropical Gastroenterology. 1998; 19:107–9.

12. Bandopadhyay S, Khera AK, Banerjee K et al. An investigation of an outbreak of viral hepatitis in a residential area of Delhi. Journal of Communicable Diseases. 1993; 25:67–70.

13. Shrestha SM. Hepatitis E in Nepal. Kathmandu University Medical Journal. 2006; 4:530-44.

14. Candido A, Taffon S, Chionne P et al. Diagnosis of HEV infection by serological and real-time PCR assays: A study on acute non-A-C hepatitis collected from 2004 to 2010 in Italy. Bio Med Central Research Notes. 2012; 5:297.

15. Deepak B, Singh DG, Singh BH. Co-infection of Hepatitis A and E with Salmonella Infection. Iranian Journal of Pediatrics. 2009; 19:79-81.

16. Yu-Ting Kuo, Chi-Yang Chang, Ming-Shiang Wu et al. Acute hepatitis with nontyphoidal Salmonella and hepatitis E virus co-infection. Advances in Digestive Medicine. 2014; 1:92-4.

17. Ohnishi S, Hatanaka K, Nakanishi M et al. Acute hepatitis with Salmonella paratyphi A and hepatitis E virus coinfection. Journal of Clinical Gastroenterology. 2003; 37:350-1.

18. Baker S, Dougan G. The genome of Salmonella enteric serovarTyphi. Clinical Infectious Diseases. 2007; 45:29–33.

19. Costa LF, Paixao TA, Tsolis RM et al. Salmonellosis in cattle: Advantages of being an experimental model. Research in Veterinary Science. 2012; 93:1–6.