Investigation of an Outbreak of Acute Gastroenteritis in Kollam, Kerala, India

P. S. Rakesh[1], Vishnu Narayanan[2], Swapna S. Pillai[2], Rahul Retheesh[2], and Soumya Dev[3]

Abstract

An outbreak investigation was initiated following a report of unusual occurrence of acute gastroenteritis in Ashramam area, Kollam district, Kerala, India. House to house survey was conducted to identify cases. Person, place, and time analysis was done. Hypothesis was generated based on findings from cross sectional study, anecdotal evidences, laboratory investigation, and environmental observations. Univariate analysis was done generating odds ratios and confidence intervals to identify factors associated with the disease. A total of 57 cases were reported. Attack rate was highest among children younger than 14 years (22%). Among them, 91.2% (52/57) of the cases and 45.8% (169/369) of the people who had not developed the disease were dependent on pipe water (OR 12.31; 95% CI 4.81-31.52) for drinking purpose. The time frame of the disease occurrence, environmental observations, anecdotal evidences, and the results of analytical study indicated the possibility of the acute gastroenteritis outbreak as a result of pipeline contamination. The study warrants establishment of a good water quality surveillance system.

Keywords

acute gastroenteritis, outbreak investigation, water quality, pipeline contamination, water contamination

Introduction

On January 2, 2016, primary health care field workers reported an unusual occurrence of acute gastroenteritis in Ashramam, Kollam, Kerala, southern India. Cases were reported from 3 residential colonies in the area. An outbreak investigation was initiated with the objective of describing the possible source of the outbreak and to describe the epidemiological features of the same.

Ashramam is located near the bank of Lake Ashtamudi in Kollam district. There were 103 households residing in the 3 colonies. Residents of the village mainly depend on public taps and well for water supply. A preliminary investigation was done by visiting the area and interviewing 8 cases.

A probable case of acute gastroenteritis was defined as an acute onset of illness with any of the symptoms of abdominal pain, vomiting, diarrhea with/without fever, from December 15, 2015 in a resident of that area. Case definition was framed based on group consensus, and it has been made simple to pick up the cases from the community by the field level health workers. A line list of cases was developed based on house to house visit over the entire area. Information regarding the date of onset, age, sex, treatment, and laboratory investigation were collected. The catchment area hospitals were visited to finalize the line list.

Attack rates by age and gender were calculated. An epidemic curve was drawn and a spot map was generated with cases marked along with the water sources. Key informant interview was conducted with eight people who acquired the disease, leaders in that area, health workers in that area and the local pump operator. Information regarding the source of drinking water, drainage system, important events before the onset of illness, public gatherings, exposure to outside food and local food vendors were collected. Sanitary inspection was done by visiting the water lines and household wells.

Based on the preliminary investigations, a questionnaire was framed and interview was conducted with all the households in that area. The questionnaire included information regarding demographic data and source of water in each house. Three water samples from public water sources at different levels were sent for microbiological analysis in state public health laboratory, Trivandrum. Residual chlorine level was tested in water sample from tap water.

[1]Centre for Public Health Protection, Kollam, Kerala, India
[2]Travancore Medical College, Kollam, Kerala, India
[3]Integrated Disease Surveillance Project, Kollam, Kerala, India

Corresponding Author:
P. S. Rakesh, 27 Netaji Nagar, Kizhakkekara, Kottarakara, Kerala 691506, India.
Email: rakeshrenjini@gmail.com

Table 1. Attack Rates and Factors Associated With Acute Gastroenteritis.

Characteristics	Categories	Affected	Total No. of People	Attack Rate (%)
Age group (years)	<5	6	27	22.22
	5-14	12	53	22.64
	15-24	9	54	16.66
	25-34	2	61	3.27
	35-44	4	58	6.89
	45-59	10	99	10.11
	≥60	14	74	18.91
Gender	Male	21	197	10.65
	Female	36	229	15.72

Characteristics	Categories	Affected	Not Affected	Odds Ratio (95% CI)
Using water from pipeline for drinking purpose	Yes	52	169	12.31 (4.81-31.51)
	No	5	200	
Well at house	Present	26	240	0.45 (0.25-0.79)
	Absent	31	129	

Three stool samples of cases were sent for culture to public health laboratory, Kollam.

Data were analyzed using SPSS 16.0, for Microsoft Windows. Chi-square test for any associations and odds ratios with confidence intervals were estimated to identify the risk factors associated with the disease.

The comparison with background data confirmed the existence of an outbreak of acute gastroenteritis at Ashramam, Kollam district. The line list generated consisted of 57 cases (attack rate = 57/426 = 13.38%). A total of 103 houses were visited of which 32 houses had at least 1 case. Attack rate was highest among children younger than 14 years, 22.64% among 5- to 14-year-olds, and 22.22% among children younger than than 5 years. Attack rate was 16.66%, 3.27%, 6.89%, 10.1%, and 18.9% among the age groups 15 to 25, 26 to 35, 36 to 45, 46 to 60, and ≥60 years. Attack rate was higher among females (15.72%) as compared with males (10.65%). The details of attack rates and factors associated with acute gastroenteritis are given in Table 1. Epidemic curve drawn based on the onset of the first symptom depicted a sharp increase in the number of cases on December 31, 2015 (31 cases) followed by a sharp fall suggesting a point source outbreak. The epidemic curve is shown as Figure 1. Symptoms were generally mild abdominal pain followed by vomiting with or without loose stools. It was self-limiting in most of the cases within 48 hours. A few (9/57) had hospital admissions, but neither deaths nor fatal complications were reported.

Improper drainage system running parallel to the pipeline and unsanitary disposal of excreta in houses near to the lake, where sewage is directly passed into the lake without any septic tanks were noticed. Water was pumped from an overhead tank, which received its supply directly from a bore well. A pipeline break was seen in an area approximately within a distance of 3 m to the lake. On testing the water sample, residual chlorine was absent. Another pipeline break was described in a nearby area by the water authority laborers, which had not been repaired since 1 year. A valve block was described by the local people, which was previously used for draining the washed water from the pipeline that had been nonfunctional for past 2 years. It was also noticed that no cases were reported from households without pipe water connection.

None of the other hypothesis generating interview led to suspicion any other event or factors that could explain the outbreak. We specifically looked for factors related to celebrations during New Year or Christmas, but could not relate it to this outbreak. The water samples sent had shown growth of *Escherichia coli*. Stool samples had not shown any growth. On analyzing the data from questionnaire, it was seen that 91.2% (52/57) of the cases and 45.8% (169/369) of the people who had not developed the disease were dependent on pipe water (OR 12.31; 95% CI 4.81-31.52), suggestive of pipeline contamination as the source of the outbreak. Of them, 45.6% (26/57) of cases and 65% (240/369) of unaffected people had a well in their house (OR 0.45, 95% CI 0.28-0.79).

The outbreak affected more at extremes of age. Females are more affected, which could be because of the fact that they are mostly at home and the probability of consuming household water at a particular time is more as compared with male members. Though one of the pipelines was broken for more than a year, the pathogen would have been brought to this area recently by some case, which would have entered the pipeline. In the outbreak, 45.8% of people not affected but had access to the polluted water did not end up getting sick. This could be due to the host-related immunity factors. The investigation helped in eliminating the common source of outbreak, convincing the water authority regarding their role in preventing outbreaks and the local self-government regarding the importance of sanitary regulations. Attempts for testing virus or other organism from
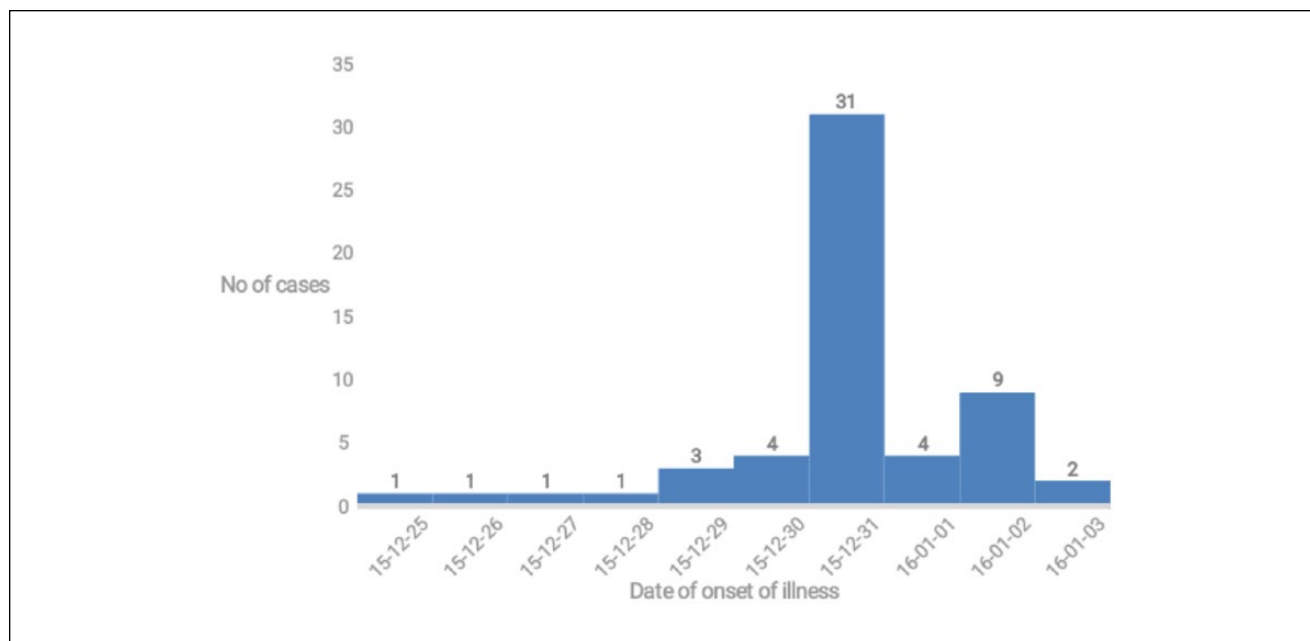
Figure 1. Epidemic curve showing date of occurrence of acute gastroenteritis in Kollam.

stool samples were not done for want of laboratory infrastructure. Testing for pathogens in the lake, storage tank, as well in a few wells would have been valuable. The second peak in the epidemic curve could be due to person to person transmission or a repeat exposure.

The seventh goal of Millennium Development Goals is to reduce the proportion of population without sustainable access to safe drinking water. For providing safe drinking water, we need to understand various ways by which water gets contaminated and take steps to avoid the same. There have been previous outbreaks of waterborne diseases in the district due to pipeline contaminations.[1]

To summarize, there was an outbreak of acute gastroenteritis in Ashramam, Kollam district, affecting mainly children up to 15 years old. The time frame of the disease occurrence, environmental observations, anecdotal evidences, and the results of analytical study indicated the possibility of the acute gastroenteritis outbreak as a result of pipeline contamination. The study warrants establishment of a good water quality surveillance system and efficient planning and execution of water supply, drainage system, and sewage disposal. Behavior change communication to address the practice of dumping sewage into water sources is the need of the hour.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Author Biographies

P. S. Rakesh is an epidemiologist attached to Centre for Public Health Protection, Kollam, Kerala. He possessed his MD in Community Medicine from Christian Medical College, Vellore, India. He served previously as the District epidemiologist, Integrated Disease Surveillance Project, Kollam and later as technical consultant, TB Control, Kerala State and consultant, Practical Approach to Lung-health pilot project in India.

Vishnu Narayanan is a junior doctor at Travancore Medical College, Kollam.

Swapna S. Pillai is a junior doctor at Travancore Medical College, Kollam.

Rahul Retheesh is a junior doctor at Travancore Medical College, Kollam.

Soumya Dev is currently the district epidemiologist, Integrated Disease Surveillance Project, Kollam. She had her MPH from SRM University, Chennai.