The Frequency of a Norwalk-Like Pattern Of Illness in Outbreaks of Acute Gastroenteritis

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Abstract: Records of 642 outbreaks of acute gastroenteritis were reviewed to determine the proportion of outbreaks that were clinically and epidemiologically consistent with Norwalk-like virus infection. Using as our criteria stool cultures negative for bacterial pathogens, mean (or median) duration of illness 12–60 hours, vomiting in ≥50 per cent of cases, and, if known, mean (or median) incubation period of 24–48 hours, we found that 23 per cent of waterborne outbreaks, 4 per cent of foodborne outbreaks, and 67 per cent, 60 per cent, and 28 per cent of outbreaks in nursing homes, in summer camps, and on cruise ships, respectively, satisfied the criteria for Norwalk-like pattern. Of 54 outbreaks that satisfied the criteria for Norwalk-like pattern, 14 were investigated for virus etiology. Ten of these (71 per cent) yielded serologic evidence of Norwalk-like virus infection. Norwalk-like viruses are probably an important cause of outbreaks of acute gastroenteritis. Investigation for Norwalk virus antibody in outbreaks that are clinically and epidemiologically consistent with Norwalk-like virus infection is likely to yield diagnostically useful results. (*Am J Public Health* 1982; 72:1329–1332.)

Introduction

"Acute nonbacterial gastroenteritis" and "viral gastroenteritis" are terms applied to cases of acute gastroenteritis in which stool specimens are negative for bacterial pathogens. In an earlier paper, we attributed 31 (42 per cent) of 74 outbreaks of acute nonbacterial gastroenteritis investigated through the Centers for Disease Control (CDC) to the Norwalk virus on the basis of serologic testing of acute- and convalescent-phase serum specimens.[1] An additional 23 per cent of these outbreaks were attributed to Norwalk, or to antigenically related 27-nm (Norwalk-like) viruses. The remaining outbreaks in the series were clinically and epidemiologically indistinguishable from those in the first two categories and were believed to be caused by Norwalk-like viruses that were antigenically distinct from the Norwalk virus.

Although our previous paper demonstrated that outbreaks of acute nonbacterial gastroenteritis are commonly associated with Norwalk or Norwalk-like viruses, no information is available concerning the number of outbreaks associated with Norwalk-like viruses that occur each year, or the proportion of all outbreaks of acute gastroenteritis that are caused by these agents. This dearth of knowledge is due, in part, to the fact that laboratory investigation of outbreaks of acute nonbacterial gastroenteritis for virus etiology is not commonly performed. This paper has been compiled for clinicians, epidemiologists, and public health officials who encounter outbreaks of acute gastroenteritis. In the absence of laboratory confirmation, we use clinical and epidemiologic criteria to identify outbreaks of acute gastroenteritis that might be associated with Norwalk-like viruses, and we estimate the proportion of outbreaks of acute gastroenteritis that are caused by these agents.

Sources of Data

Waterborne Outbreaks

One hundred forty-two waterborne outbreaks were reported to CDC from 1976 through 1979.[2–5] These reports are actively solicited from state health departments each year; they include outbreaks in 39 states involving municipal, semipublic, and private water systems. Records of all 142 outbreaks were reviewed.

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Foodborne Outbreaks

Four hundred sixty foodborne disease outbreaks were reported to CDC in 1979, the most recent year for which this information was available.[6] These reports, actively solicited from state health departments each year by CDC, include outbreaks in 37 states. Records of all 460 outbreaks were reviewed.

Cruise Ship Outbreaks

Since 1975, CDC has been involved in surveillance of outbreaks of gastroenteritis occurring on cruise ships at sea based on a threshold of 3 per cent of passengers reporting illness to the ship's physician during a given cruise. Thirty-five instances of gastrointestinal disease rates over the threshold were reported during the period 1975 through 1980, and 18 were investigated by CDC. Records of all 18 of these outbreaks were reviewed.

Summer Camp Outbreaks

Since 1979, the New York State Department of Health has conducted surveillance on outbreaks of illness occurring in summer camps in New York State. These outbreaks are reported voluntarily by camp personnel; however, camp infirmary records are also reviewed periodically by public health officials to ascertain unusual rates of illness. Sixteen outbreaks were reported through 1980; eight were outbreaks of gastroenteritis. The records of each of these eight outbreaks were reviewed.

Nursing Home Outbreaks

Since 1975, the Pinellas County Health Department, St. Petersburg, Florida, has conducted active surveillance on outbreaks of illness occurring in nursing homes located in Pinellas County. Outbreaks are reported voluntarily by nursing home personnel but are actively solicited by the health department. Thirty-six outbreaks were reported through January 1981; 14 were outbreaks of gastroenteritis. Records of each of these 14 outbreaks were reviewed.

Methods

Records of each outbreak of acute gastroenteritis were reviewed for the following information: results of stool examination for bacterial pathogens and ova and parasites, results of virologic studies when performed, percentage of cases with vomiting, mean (or median) duration of illness, and mean (or median) incubation period. The incubation period was usually the interval between exposure to a common source of infection and onset of illness; in some instances it was estimated by measuring the interval between onsets of illness in primary and secondary (household contact) cases.

An outbreak was considered to have the clinical and epidemiologic characteristics of a Norwalk outbreak (Norwalk-like pattern) if it satisfied the following criteria: 1) stools negative for bacterial and (if performed) parasitic pathogens; 2) percentage of cases with vomiting ≥50 per cent; 3) mean (or median) duration of illness 12–60 hours; and 4) if available, mean (or median) incubation period of 24–48 hours. These criteria were chosen because of the 38 Norwalk outbreaks described in our earlier paper, 100 per cent, 89 per cent, 93 per cent, and 91 per cent of the outbreaks for which sufficient information was available satisfied these criteria, respectively.[1]

As in our previous work, an outbreak investigated serologically for virus etiology was attributed to a Norwalk-like virus if at least one patient demonstrated a fourfold rise in antibody titer to the Norwalk virus by radioimmunoassay[7] between acute- and convalescent-phase serum specimens. If 50 per cent or more of the patients tested demonstrated a seroresponse, the outbreak was attributed specifically to the Norwalk virus.[1]

Results

The results of the analyses of the outbreaks are shown in Table 1. Twenty-two (23 per cent) of the waterborne outbreaks and 18 (4 per cent) of the foodborne outbreaks met the criteria for Norwalk-like pattern. Of the outbreaks in nursing homes, in summer camps, and on cruise ships, 6 (67 per cent), 3 (60 per cent), and 5 (28 per cent), respectively, similarly satisfied the criteria.

Of the 54 outbreaks that met the criteria for Norwalk-like pattern, 14 were investigated serologically for Norwalk etiology (Table 1). Of these 14 outbreaks, ten were attributed to Norwalk-like virus infection, and seven were attributed specifically to the Norwalk virus. Thirteen of the 14 outbreaks investigated for virus etiology were investigated through CDC and were included in our previous publication.[1]

Discussion

The methodology in our study is unorthodox to the extent that we have attempted to identify outbreaks of gastroenteritis associated with Norwalk-like viruses without the laboratory confirmation required in our previous work.[1] This approach was necessary because outbreaks of acute nonbacterial gastroenteritis are not usually investigated for virus etiology; we have therefore resorted to clinical and epidemiological criteria to estimate the proportion of outbreaks of gastroenteritis associated with these agents. We emphasize that the finding of a Norwalk-like pattern in our study does not constitute proof of Norwalk-like virus etiology. This finding simply denotes a clinical and epidemiologic entity, the significance of which is discussed below.

The sensitivity of the criteria for Norwalk-like pattern for detecting outbreaks associated with Norwalk-like viruses can be determined with some accuracy. Of the 38 Norwalk outbreaks described in our earlier publication,[1] sufficient information was available for analysis in 26 outbreaks, and 20 (77 per cent) satisfied the criteria for Norwalk-like pattern.

The specificity of the Norwalk-like pattern for Norwalk-like virus etiology, unfortunately, cannot be determined with

TABLE 1—The Frequency of a Norwalk-like Pattern* of Illness in Outbreaks of Acute Gastroenteritis

Outbreak Group Studied	Number of Outbreaks Reviewed	Number of Outbreaks with Sufficient Data	Number of Outbreaks with Norwalk-like Pattern (%)	Number of Outbreaks with Norwalk-like Pattern Studied with Paired Serum Specimens	Number with Serologic Evidence of Norwalk-like Virus Infection†	Number Attributed Specifically to Norwalk Virus‡
Waterborne	142	96	22 (23%)	6	4	4
Foodborne	460	430	18 (4%)	2	1	1
Nursing Homes	14	9	6 (67%)	2	2	1
Summer Camps	8	5	3 (60%)	2	2	0
Cruise Ships	18	18	5 (28%)	2	1	1

*Norwalk-like pattern was defined by: 1) stools negative for bacterial pathogens; 2) percentage of cases with vomiting ≥50 per cent; 3) mean or median duration of illness 12–60 hours; and 4) if available, mean or median incubation period of 24–48 hours.

†Fourfold rise in antibody titer to the Norwalk virus by radioimmunoassay in at least one serum pair tested.

‡Fourfold rise in antibody titer to the Norwalk virus by radioimmunoassay in ≥50 per cent of serum pairs tested.

accuracy. Several 27-nm (Norwalk-like) viruses have been implicated in the etiology of acute nonbacterial gastroenteritis,[8] but a serologic test is available only for the Norwalk virus. In our earlier paper, Norwalk virus specifically accounted for only 42 per cent of such outbreaks, but at least one seroconversion to the Norwalk virus was documented in 65 per cent of the outbreaks, and the remaining 35 per cent of the outbreaks were also believed to be associated with Norwalk-like viruses.[1] Therefore, the fact that only seven of the 14 outbreaks in this study that satisfied the criteria for Norwalk-like pattern and were investigated serologically could be attributed specifically to the Norwalk virus (ten outbreaks showed at least one seroresponse) is not inconsistent with the possibility that all these outbreaks were caused by Norwalk-like viruses. Rotavirus, a larger (70-nm) RNA virus that commonly causes gastroenteritis in children less than two years of age,[9] might have been involved in some outbreaks with Norwalk-like pattern. Like the Norwalk virus, rotavirus may cause a brief illness in which vomiting is prominent. Rotavirus, however, has not been shown to be an important cause of outbreaks of gastroenteritis among adults. Despite considerable interest on the part of several investigators in recent years, only five outbreaks of rotavirus gastroenteritis involving primarily adults have been described in the English literature[10–14]; two occurred in isolated populations, and none occurred in the United States. We doubt that rotaviruses play an important role in the outbreaks that met our criteria for Norwalk-like pattern. Similarly, commonly recognized bacteria that cause outbreaks of acute gastroenteritis are probably not involved in the outbreaks with Norwalk-like pattern. *Salmonella* and *Shigella* would be excluded by the requirement that stool cultures from cases be negative for bacterial pathogens. *Campylobacter* and toxigenic *Escherichia coli* might not be excluded by a routine processing of stool specimens, but illness with each of these agents is usually prolonged (≥5 days) and vomiting is usually not reported in a majority of cases.[15–17]

On the basis of these considerations, we suspect that the specificity of Norwalk-like pattern for Norwalk-like virus infection is high. Depending on whether this specificity is higher or lower than the estimated sensitivity of 77 per cent, the percentages of outbreaks of acute gastroenteritis with Norwalk-like pattern in this study may underestimate or overestimate the percentages of outbreaks actually associated with Norwalk-like viruses.

Our data suggest that outbreaks of acute gastroenteritis associated with Norwalk-like viruses are common. Twenty-three per cent of the waterborne outbreaks and 4 per cent of the foodborne outbreaks met our criteria for Norwalk-like pattern. When analyzed by location, 67 per cent of outbreaks in nursing homes, 60 per cent of outbreaks in summer camps, and 28 per cent of outbreaks on cruise ships similarly met the criteria. As discussed above, these percentages serve as a rough indicator of the percentage of outbreaks actually associated with Norwalk-like virus infection.

A virus etiology was not sought frequently in the outbreaks of gastroenteritis that we reviewed. Of the 54 outbreaks that satisfied our criteria for Norwalk-like pattern, only 14 (26 per cent) were investigated for virus etiology. Since at least one serum pair from 10 of these 14 outbreaks demonstrated seroconversion to the Norwalk virus, testing of acute- and convalescent-phase serum specimens from outbreaks of suspected viral etiology appears to offer an excellent chance of yielding diagnostically useful results. Such testing is not widely available, but it may be arranged through the Viral Enteritis and Hepatitis Division, Center for Infectious Diseases, CDC, Phoenix, AZ.

The frequency with which Norwalk-like viruses appear to cause outbreaks of acute gastroenteritis suggests that these agents constitute an important public health problem. Investigation of additional outbreaks of gastroenteritis associated with these agents, and research aimed at easier and more rapid detection of Norwalk-like viruses may help us understand the true role of these agents in outbreaks of acute gastroenteritis.

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