

Norovirus Infections

Public Health Importance and Outbreak Management

Introduction

Outbreaks of viral gastroenteritis reported to local health departments are usually community-based, involving adults or older children. These outbreaks are typically caused by an organism called norovirus (previously called Norwalk-like Virus). Outbreaks involving preschool children in institutional settings such as childcare centers or pediatric wards are more likely to be caused by other viruses that cause diarrhea in early childhood (e.g. rotavirus, adenovirus, calicivirus, or astrovirus).

In outbreaks of gastroenteritis, health care facilities often face the problem of having to take action before an etiologic agent can be identified. This problem particularly applies to outbreaks caused by viruses, since laboratory diagnosis can be delayed for days or weeks. Distinguishing viral from bacterial or protozoal etiologies is sometimes difficult because of overlapping clinical syndromes, but prior testing to rule out bacterial causes is recommended.

The following information will focus on the norovirus that often causes gastroenteritis outbreaks in settings where older children and adults are living in crowded circumstances.

Clinical Syndrome of Norovirus

Signs and Symptoms

The incubation period for clusters of disease caused by the norovirus is 12 to 48 hours, and the average duration of illness is 12 to 60 hours. The symptoms are characterized by the acute onset of:

- Nausea
- Vomiting
- Abdominal cramps
- Watery, non-bloody diarrhea

These symptoms are experienced by all age groups, but diarrhea is more common among adults, whereas children more frequently experience vomiting. However, individuals in all age groups can experience vomiting alone. Constitutional symptoms such as headache, fever, chills and myalgia are frequently reported. Severe dehydration caused by norovirus gastroenteritis can be potentially fatal, especially in the elderly. No long-term sequelae of norovirus infection have been reported, but the elderly often report persistence of constitutional symptoms for several weeks.

Mode of Transmission

Noroviruses have a very low infectious dose and therefore can be easily transmitted through droplets, fomites, person-to-person transmission, and environmental contamination. Documented routes of transmission include contaminated water, contaminated food (especially raw shellfish and salads), ice which has been handled, and aerosolized vomitus.

Length of Infectiousness

Norovirus is shed for at least 48 to 72 hours after resolution of all symptoms. Recent studies, however, have demonstrated the presence of virus in the stool for several months after infection. Additional research is needed to accurately determine the length of infectiousness.

Treatment

For most people, viral gastroenteritis is a self-limited illness of a few days duration, with virus replication restricted to the mucosa of the gut. The main risk is of dehydration and electrolyte imbalance. Maintenance of good hydration is important, particularly among the elderly and those receiving diuretic medication. Hospitalization and treatment with intravenous fluids are required only for cases in which dehydration is severe, or in which the caretaker cannot provide adequate oral rehydration.

Immunity

Most persons' antibody levels against norovirus rise after infection; these titers normally peak by the third week and persist until approximately the sixth week, after which they decline. The nature of resistance and susceptibility to the norovirus is poorly understood, but it is likely that previous exposure to a strain of norovirus provides some immunity against severe disease if reinfected with the same strain.

Outbreak Characteristics of Norovirus

Numerous reports have described the course of outbreaks caused by norovirus, usually involving older children and adults. The settings are diverse and include banquets, cruise ships, nursing homes, health-care facilities, cafeterias, recreational lakes, swimming pools, campgrounds, hotels, schools, fast food restaurants, and others. Norovirus probably circulates at a low background level of infection in a community until an infected individual contaminates a common source, and an outbreak occurs. Although secondary cases can multiply the number of persons affected, outbreaks are generally limited to 1-2 weeks unless transmission is facilitated by a closed environment such as a cruise ship or prolonged by renewal of the susceptible population, such as new admissions to a hospital ward.

Specific Outbreak Situations

Nursing Homes and other Residential Institutions

Large and protracted outbreaks of viral gastroenteritis have occurred in nursing homes and institutional residences. Risk factors in such settings include the density of living quarters and decreased personal hygiene among some residents because of incontinence, immobility or reduced alertness. Diuretic medications and disabilities among this population can increase the risk of an adverse outcome in what otherwise might be a mild diarrheal episode.

Cruise Ships and Camps

The close living quarters of ships and camp dormitories amplify opportunities for person-to-person transmission of viral agents. Gastroenteritis outbreaks normally end after all susceptible persons have been infected; however, in cruise ship and camp settings, new and uninfected individuals sometimes arrive every 1 or 2 weeks, thereby replenishing the number of susceptible persons and prolonging the outbreak. Norovirus outbreaks extending over five successive cruises have been documented.

Pediatric Wards and Daycare Facilities

Continuous close contact among unrelated children, some of whom may be ill, can accelerate the progression of endemic diarrhea through a small population into an outbreak. Nosocomial and day-care transmission of rotavirus during its peak season is particularly efficient and difficult to control. Calicivirus, adenovirus, astrovirus and norovirus particles are found more frequently in stool specimens from children in these settings than from children in other settings.

Restaurants / Catered Events

Investigations of foodborne norovirus outbreaks have implicated various food items, drinking water and ice. Food items such as lettuce and herbs can be contaminated by sewage before entering the kitchen, or ill food handlers can contaminate food items during preparation. The risk for contamination through foodhandlers is increased when the food item is consumed without further cooking (e.g., ready-to-eat foods) and when a semi-liquid food (e.g. cake frosting or salad dressing) is contaminated in such a way that a small inoculum is mixed and spread to multiple persons.

Outbreak Control and Management

Clinical and epidemiologic signs that suggest the presence of norovirus in outbreaks of acute gastroenteritis include:

1. Stool specimens that are negative for bacterial and parasitic pathogens
2. Greater than 50 percent of cases with vomiting
3. Average duration of illness of 12-60 hours; and
4. Average incubation period of 24-48 hours

Testing of stools for norovirus is available on a case-by-case basis through the Washington State Public Health Laboratory only in consultation with Public Health-Seattle & King County, and typically only to confirm suspected food borne outbreaks. Testing is also available through some clinical laboratories.

Norovirus Outbreak Control Goals and Actions

For each goal there are one or more recommended actions. Each outbreak and setting is unique, therefore, not all of these recommendations will be feasible in every outbreak; there may be additional interventions not listed here that could interrupt transmission as well.

Goal: Rule out the possibility of a bacterial infection

- Test several stool samples for possible bacterial causes of gastroenteritis, such as *Salmonella*, *E. coli* O157:H7 and *Shigella*, especially if diarrhea is bloody or if diarrhea persists for 2 or more days.

Goal: Monitor the outbreak

- Prepare a list of all persons who have been affected by the illness (including staff) together with their ward/room/work location, and date and time of onset of symptoms. Attached is a form that can be used for this purpose. Analyze this information to determine the spread of the outbreak and whether it is being controlled.
- Report suspected outbreaks of a communicable disease to Public Health immediately by calling 206-296-4774.

Goal: Identify and eliminate common sources of transmission

- Discard leftover food from any meals implicated in a point-source outbreak (an outbreak where several people who shared the same meal become ill in a short period of time).
- Empty, clean and disinfect ice machines.
- Consider discontinuing family-style or self-serve buffet meal service and instead designate food service employees to serve residents until the outbreak is under control.

Goal: Prevent personnel from becoming infected

- Review proper handwashing technique with employees.
- Ensure that handwashing stations are supplied with soap, paper towels, and hands-free trash bins.
- Provide alcohol based handrubs with at least 60% alcohol. Educate staff to use them only when hands are not grossly contaminated and when no soap and water are available.
- Provide disposable gloves, gowns and masks to staff.
- Direct personnel who come into direct contact with ill persons to wear disposable gloves and to remove and properly dispose of them upon completion of the interaction.
- Direct personnel to wear gowns when contamination of clothing with fecal material or vomitus is possible.
- Direct personnel to wear masks when cleaning areas that are grossly contaminated by feces or vomitus because spattering or aerosols of infectious material may contain infectious virus particles.

Goal: Prevent employee transmission of the illness:

- Restrict staff members who develop symptoms of gastroenteritis from working until at least 48 hours after resolution of symptoms.

- Decrease the number of staff that work among different wards, and dedicate staff to each ward to prevent the introduction of the illness to other parts of the facility.

Goal: Prevent visitors from spreading the illness to residents

- Restrict the number of visitors to the facility, especially to units with affected patients.
- Educate visitors about the fact that the facility is having an increase in gastrointestinal illness with signs, letters, etc.
- Ensure that persons visiting ill patients wear clean gowns and wash their hands before and after visiting patients with symptoms.
- Ensure that visitors of ill patients do not visit other patients.
- Restrict all persons with recent symptoms of gastroenteritis (especially children) from visiting the facility.

Goal: Minimize transmission between residents:

- Isolate ill residents from well residents until at least 48 hours after resolution of symptoms.
- Feed ill residents in their rooms with disposable cutlery and dinnerware. If convalescing patients resist dining in their rooms, consider cohorting convalescing residents at tables together.
- Conduct health assessments of patients with complaints of gastroenteritis in their living quarters or in a separate area of the clinic to prevent the clinic from becoming the focus of transmission.
- Restrict new admissions until the outbreak has ended.
- Consider cancelling group activities within the facility, especially those activities where fomite transmission may facilitate transmission (such as card or dice games), or where food is shared (i.e., cooking classes, birthday parties).
- Consider feeding all people in their rooms using disposable cutlery and dinnerware.
- Temporarily suspend self-serve snacks, such as a common fruit bowl, popcorn machine, etc.

Goal: Prevent transmission to other facilities

- Suspend transfer of patients between wards or to other institutions until patients have been symptom-free for at least 48 hours.
- Inform staff who are employees of other facilities that they should not report to work at other facilities until at least 48 hours after resolution of symptoms.
- If a patient must be transferred during an outbreak, advise the staff of the receiving institution of the outbreak so that they can take appropriate precautions to prevent the transmission of infection in their facility. Do this for both symptomatic and asymptomatic patients.

Goal: Handle laundry safely

- Ensure that staff who handle soiled linens and clothes wear disposable gloves and gowns and handle the soiled linens and clothes as little as possible, with minimum agitation to prevent microbial contamination of the air.
- Transport laundry in an enclosed and sanitary manner (e.g. in a plastic bag if the laundry is wet or moist).
- Promptly machine-wash soiled linens and clothes with a detergent in water at the maximum cycle length, and machine dry.

Goal: Clean and sanitize soiled surfaces

- Use an antimicrobial product approved by the EPA as being effective against norovirus (see attached list or http://epa.gov/oppad001/list_g_norovirus.pdf). A one-third cup of standard chlorine bleach in one gallon of water is considered effective to sanitize surfaces contaminated with vomitus or fecal matter.
- Ensure that healthcare facility staff use appropriate personal protective equipment (e.g. gloves and goggles) and follow directions strictly when using disinfectants.
- Clean carpets and other porous surfaces with steam cleaning or an EPA approved cleaner.
- Clean bathrooms and rooms (including toilets, shower, walls, floors, benches, taps, door handles, etc) occupied by ill persons on a routine basis.
- Promptly dispose of feces and vomitus collected during the cleaning procedure in a manner that prevents transfer of this material to other surfaces or persons. Persons performing these tasks should wear appropriate protective barriers (e.g., latex gloves—and if splashing is possible, a mask or face shield and garments such as a uniform, jumpsuit or gown to protect street clothing).

Goal: Educate staff and residents about the importance of following outbreak control activities

- Provide periodic briefings to staff and residents outlining the status of the outbreak and the outbreak control activities that are being implemented.
- Provide information about the transmission of viral gastroenteritis and infection control procedures.
- Provide clear guidelines on how to report new ill patients, new ill staff, public vomiting/fecal accidents, handwashing sinks that need to be stocked, etc.

References

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