DEPARTMENT OF VETERANS AFFAIRS
Veterans Health Administration
Washington DC 20420

IL 10-2007-010
In Reply Refer To: 111

July 26, 2007

UNDER SECRETARY FOR HEALTH'S INFORMATION LETTER

THE ROLE OF NOROVIRUS IN OUTBREAKS OF GASTROENTERITIS

1. Background. Noroviruses (Norwalk-like viruses) are frequent causes of gastroenteritis outbreaks. The viruses are transmitted by multiple modes: ingestion of contaminated food or water, swimming in contaminated water, person-to-person by the fecal-oral route, and by aerosolization of viral particles from vomitus. These outbreaks of disease occur any place where persons congregate, including military settings, cruise ships, group homes, schools, and nursing home care units. The latter is of particular interest to the Veterans Health Administration (VHA) with its past and future emphasis on nursing home care. Since acute gastroenteritis can be a serious disease in the elderly or those with co-morbid illness, it is reasonable to provide information on the virus, diagnosis, treatment, and most important, prevention strategies to mitigate the possible effects of a norovirus cluster of cases in VHA nursing home care units and other VHA sites of care.

2. The Virus. Noroviruses are members of the family *Caliciviridae* and are well-recognized etiologies of non-bacterial acute gastroenteritis. Noroviruses cause approximately 23 million cases of acute gastroenteritis each year and are likely the leading cause of outbreaks of gastroenteritis in the United States. Since such outbreaks are not uncommon, prompt detection of cases is necessary so that a prevention program can be implemented to prevent spread of infection in a congregate setting.

3. Diagnosis. The key to diagnosis of norovirus disease is suspecting acute viral gastroenteritis when a patient becomes ill, or when an outbreak of acute gastroenteritis becomes apparent. Symptoms include: acute-onset vomiting, non-bloody diarrhea, abdominal cramps, and nausea. Molecular techniques are used for the specific diagnosis of norovirus disease. The usual test is reverse transcription polymerase chain reaction (RT-PCR) on stool. Norovirus RT-PCR testing is usually initiated after it has been determined that an outbreak evaluation is necessary. Actual testing is usually done in specialized laboratories at the municipality, State or Centers for Disease Control and Prevention (CDC) level. Specimen collection must be coordinated with the receiving laboratory to ensure proper collection and transport. Ideally, the stool sample needs to be collected within the first day of onset of symptoms since the viral yield is greatest at this point. Rectal swabs are of less value compared to stool (diarrhea) specimens. Vomitus can also be collected. Paired sera for acute and convalescent testing are also useful; the convalescent specimen must be collected 3 to 6 weeks after resolution of symptoms. Therefore, this is primarily a retrospective diagnosis. Environmental specimens may be of use and must be collected after it has been determined that evaluation is necessary and that such specimens will be of benefit to outbreak mitigation.

4. Treatment. There is no specific antiviral treatment for norovirus. Therefore, goals of treatment are supportive with particular emphasis on hydration and electrolyte balance. This may be particularly difficult in the elderly and chronically ill. Dosage adjustments of regular medications may be required if renal dysfunction occurs. In general, the disease is self-limited after approximately 36 to 72 hours and is of minimal risk to a younger, healthier population.

5. Prevention. Prevention of spread of norovirus infection and disease is particularly difficult because of certain characteristics of the organism. The virus requires a very low infectious dose of 10 to 100 viral particles for spread of infection. The low infectious dose facilitates person-to-person transmission by the fecal-oral route (usually contaminated hands to mouth) and perhaps by droplet formation or aerosolization of viral particles in vomitus. There may be asymptomatic shedding in the stool for 2 days before illness and for 2 to 3 weeks after acute illness. This obviously increases the risk of secondary spread and increases the chance of transmission when a food handler is infected. The virus is particularly environmentally stable and can survive up to 10 parts per million (ppm) chlorine, freezing, and heating to 60° Centigrade. This makes it difficult to eliminate the virus from contaminated water and on environmental surfaces. In addition, the usual cleaning solutions used in hospitals are not particularly effective against norovirus. There is substantial strain diversity with multiple genetic and antigenic types. This requires complex diagnostics, and allows for repeated infections by multiple strains. Lastly, the lack of long-lasting immunity (probably only a few months) allows infections to occur more than once in the same patient.

a. **Specific Prevention Strategies.** Specific prevention strategies include:

(1) Early Identification. Early identification of patients with possible infectious diarrhea.

(a) When a patient with potential infectious diarrhea is identified, appropriate precautions need to be taken. Standard precautions alone are unlikely to be sufficient. Increased rigor may be necessary if norovirus is suspected, confirmed, or during an outbreak situation. Droplet precautions may be warranted in the event of vomiting as evidence exists for transmission due to aerosolization of vomitus; presumably, this results in infectious vomitus droplets that can contaminate surfaces or enter the oral mucosa and be swallowed. Considering norovirus is an enteric infection with a low infectious dose and environmental implications for transmission, contact precautions should be instituted. ***NOTE:*** *Further information on isolation precautions can be found in the current CDC Guideline for Isolation Precautions in Hospitals at the Web site: www.cdc.gov/ncidod/dhqp/gl_isolation.html.*

(b) During an outbreak, patients with suspected norovirus infection may need to be placed in private rooms or cohorted to prevent spread of the infection to other patients.

(c) In addition to other personal protective equipment necessary for contact precautions, persons who clean areas substantially contaminated by feces or vomitus should consider wearing masks (not respirators) to prevent unintended ingestion of viral particles.

(2) Patient Hygiene

(a) All patients should wash their hands before eating. Patients with suspected infectious diarrhea need to avoid congregate settings as much as possible. If congregate activities are necessary, patients need to wash their hands first. Soap and water is preferred for washing hands.

(b) Patients with norovirus acute gastroenteritis should be left in contact precautions at least 48 hours after symptoms abate.

(3) Staff Hygiene

(a) Staff need to wash their hands with soap and water for at least 15 seconds after using the bathroom, before food handling, between patients and before and after any other duties where soiling may spread virus from patient-to-staff, staff-to-staff or staff-to-patient. ***NOTE:*** *The use of only alcohol-based hand-hygiene products without prior hand washing with soap and water is not recommended as an abatement strategy for norovirus. For specifics on appropriate hand hygiene protocols before patient contact, see VHA Directive 2005-00,2 Required Hand Hygiene Practices.*

(b) Employees who have norovirus acute gastroenteritis need to be off duty during acute illness and for approximately 48 hours after symptoms abate.

(4) Food Discipline. Because of the residential quality of nursing home care units, food discipline needs to be maintained at all times. This includes issues regarding the sharing of food among patients, the sharing of food from patients-to-staff, the sharing of food from staff-to-patients, and other potential mechanisms for spread of infection among the nursing home care community.

(5) Training and Education. Patients and staff should receive specific training and education on acute gastroenteritis (epidemic diarrheal disease) to include causes, risks, and prevention techniques with emphasis on the hygienic issues in the prevention of the spread of the disease. ***NOTE:*** *If there is acute gastroenteritis in the community, it is prudent to educate visitors regarding issues of food discipline and handwashing.*

b. **Environment of Care.** In the nursing home setting, cleanliness is not a luxury, but rather a necessity. Because of the proximity of groups of elderly and/or chronically ill patients, some of whom may be incontinent, attention to the details of rigorous cleaning of the environment is critical. In the best of circumstances, however, norovirus presents a particular challenge. The violent nature of norovirus-associated vomiting can spread infectious vomitus droplets to environmental surfaces. When there is evidence of norovirus activity in the nursing home setting and at other VHA sites of care, the usual cleaning routine may not suffice because of the stability of the virus in the environment and the low infectious dose. Therefore, the following cleaning recommendations are provided:

(1) More frequent cleaning, using an Environmental Protection Agency (EPA)-registered hospital detergent and/or disinfectant designed for general housekeeping purposes, in patient-care areas is appropriate.

(2) Considering environmental surfaces have been implicated in health care-associated transmission of norovirus, additional disinfection of environmental surfaces in patient care areas may be prudent. Suitable disinfectants for this purpose include freshly-prepared chlorine solutions at concentrations equal to or greater than 1000 ppm, phenol-based compounds (although the CDC suggests that concentrations 2 to 4 times higher than normal may be necessary), or accelerated hydrogen peroxide products. ***NOTE:*** *Quaternary ammonium compounds are not active against noroviruses and should not be used to disinfect areas with evidence of norovirus activity.* The most practical disinfectant is a 1 to 50 (ratio) solution of domestic bleach (an EPA-registered sodium hypochlorite product is preferred). A fresh 1 to 50 bleach solution must be prepared daily since the effectiveness of diluted bleach tends to break down quickly. If bleach or other oxidizing agents are used as disinfectants, they must be part of a two-step process in which they follow the use of an EPA-registered hospital detergent to remove any soil on the surface being cleaned. However, phenol-based compounds have both cleaning and disinfecting properties and can be used in a one-step process. Disinfectants must be used with care.

(3) If possible, new persons should not be moved into the setting until the outbreak has abated and the area has been appropriately cleaned and disinfected.

(4) Contaminated linens need to be handled as little as possible with the minimum of agitation, laundered with detergent at the maximum available cycle length, and machine dried.

6. <u>Conclusion.</u> While norovirus disease can be a major inconvenience in such places as cruise ships, in nursing home care units the consequences of this disease are considerable and can be fatal. It is prudent to maintain vigilance in routine infection control practices and prepare for the contingency of a patient becoming ill with acute viral gastroenteritis. If prepared, the facility should be able to address the first such case and prevent spread to other residents and staff. The keys for successful prevention of cases and the prevention of spread of infection with viral gastroenteritis agents are:

a. A clean environment of care;

b. Early detection of patients who may have viral gastroenteritis;

c. Rapid intervention with appropriate precautions;

d. Meticulous attention to handwashing, food discipline, and specialized cleaning, as needed; and

e. Limiting patient admissions and staff movement among wards if an outbreak situation is determined.

7. References

a. CDC. "Norovirus Activity – United States, 2002," Morbidity and Mortality Weekly Report (MMWR) 52(03):41-45; 2003. *Erratum* published February 14, 2003 MMWR 52(06):113. On page 43 under "CDC Laboratory Surveillance," the parenthetical list on the 22nd line should read (*Alaska*, Georgia, Kentucky, North Carolina, and Utah).

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c. CDC. "Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force," MMWR 51(No. RR-16); 2002.

d. CDC. Noroviruses. CDC Technical Fact Sheet. Last reviewed August 3, 2006. http://www.cdc.gov/ncidod/dvrd/revb/gastro/norovirus-factsheet.htm .

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f. Mattner F., Sohr D., Heim A., Gastmeier P, Vennema H., Koopmans M. "Risk Groups for Clinical Complications of Norovirus Infections: An outbreak Investigation," Clinical Microbiology and Infection. 12:69-74; 2006.

g. Treanor J.J., Dolin R. "Noroviruses and Other Caliciviruses," published in Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases, 6th ed. Vol. 2, Chapter 172, pgs. 2194-2201. Elsevier Churchill Livingstone, Philadelphia, PA; 2005.

h. VHA Directive 2005-002. Required Hand Hygiene Practices. http://vaww1.va.gov/vhapublications/ViewPublication.asp?pub_ID=1214 .

8. Inquiries

a. For questions related to clinical issues of the norovirus illness, contact the Office of the Program Director for Infectious Diseases at (513) 475-6398.

b. For questions regarding sanitation and linen, contact the Environmental Programs Office at (202) 565-8525.

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