



Burden of norovirus in healthcare facilities and strategies for outbreak control

A. Kambhampati^a, M. Koopmans^{b,c}, B.A. Lopman^{a,*}

^aCenters for Disease Control and Prevention, Atlanta, GA, USA

^bNational Institute for Public Health and the Environment, Bilthoven, The Netherlands

^cDepartment of Virology, Erasmus Medical Center, Rotterdam, The Netherlands

ARTICLE INFO

Article history:

Received 4 December 2014

Accepted 6 January 2015

Available online 4 February 2015

Keywords:

Antiviral agents

Gastroenteritis

Genogroup II type 4

Infection control

Norovirus



CrossMark

SUMMARY

Norovirus is the most frequently occurring cause of community-acquired acute gastroenteritis in people of all ages. It is also one of the most frequent causes of outbreaks in healthcare settings, affecting both long-term care facilities and acute care hospitals. Whereas norovirus gastroenteritis is typically mild and resolves without medical attention, healthcare-associated infections often affect vulnerable populations, resulting in severe infections and disruption of healthcare services. Globally, most norovirus outbreaks in hospitals and residential care institutions are associated with genogroup II type 4 (GII.4) strains. Recent data demonstrate that excess mortality occurs during outbreak periods in healthcare facilities. Nosocomial outbreaks can result in large economic and societal costs. Current control measures for norovirus are largely based on general infection control principles, and treatment is mainly supportive and non-specific. While neither vaccines nor antiviral agents are currently available, both are being developed with encouraging results.

Published by Elsevier Ltd on behalf of the Healthcare Infection Society.

Introduction

Norovirus is the leading cause of community-acquired gastroenteritis in all age groups, being associated with 18% of all acute gastroenteritis cases globally.¹ An estimated 19–21 million cases of norovirus and nearly 800 resulting deaths occur in the USA each year.² The high prevalence of norovirus in the community makes it difficult to prevent introduction into healthcare settings, including long-term care facilities and acute care hospitals, where infection can spread and result in severe illness. Surveillance data from high-income countries

around the world consistently indicate that most norovirus outbreaks occur in healthcare facilities.³ Both acute care hospitals and long-term care facilities are affected. From 1992 to 2000, ~40% of 1877 reported norovirus outbreaks in England and Wales occurred in hospitals, with another 39% in residential care facilities.⁴ Similar findings have been reported elsewhere in Europe and in other high-income countries, where outbreaks in acute care and long-term care facilities are roughly equal in frequency.^{5–7} Reports of acute care outbreaks in the USA, however, are relatively infrequent, and >60% of all reported norovirus outbreaks in the USA occur in long-term care facilities such as nursing homes.⁸ Though this discrepancy in rates of acute care norovirus outbreaks between the USA and other high-income countries may be the result of a lower incidence of acute care outbreaks in the USA, it may also signify substantial

* Corresponding author. Address: 1600 Clifton Road, MS A34, Atlanta, GA 30333, USA. Tel.: +1 404 639 4832.

E-mail address: blopman@cdc.gov (B.A. Lopman).

underreporting of such outbreaks. A recent survey of infection prevention personnel in US hospitals provides evidence for underreporting; norovirus was reported as the most frequent cause of outbreaks of hospital-acquired infection, accounting for 18% of outbreaks and >65% of hospital unit closures.⁹ Studies in Europe also have found evidence for significant underreporting of norovirus illness, including nosocomial infection.^{10,11}

Biology and transmission characteristics

Noroviruses are positive-sense single-stranded RNA viruses that are both genetically and antigenically diverse.¹² Human illness is predominantly caused by two genogroups (G) of norovirus, GI and GII, which consist of nine and 22 genotypes, respectively.¹³ Noroviruses have evolved several characteristics that facilitate transmission through human populations. The virus is transmitted primarily through the fecal–oral pathway; ingestion of as little as 18–1000 viral particles can lead to infection.^{14,15} Recent analysis of volunteer studies suggests a higher ID₅₀, but still supports the notion of a low infectious dose. In addition to direct person-to-person transmission, people may come into contact with norovirus through contaminated food, water, or aerosolized particles.^{16–18} Aerosolization of norovirus following vomiting can be particularly problematic, as norovirus particles can settle on surfaces and fomites and survive for long periods of time, and have been shown to withstand low levels of chlorine disinfection and temperatures ranging from freezing to 60°C.^{16,19–22} A study of environmental samples from outbreak-affected hospital wards found GII norovirus on almost half of the swabs, including in dust and on surfaces.²³ Once the virus is ingested, there is an incubation period of between 12 and 48 h, after which infected persons generally experience acute onset of symptoms of gastroenteritis, such as vomiting, diarrhoea, abdominal cramps, as well as systemic symptoms, including fever. However, 20–30% of infected individuals may remain asymptomatic.²⁴ The dynamics of viral shedding can also facilitate norovirus transmission. Shedding can precede symptom onset in up to 30% of those exposed to the virus, peaks around four days after exposure, and can continue for up to eight weeks.^{14,25} Viral particles are shed profusely in faeces, with between 10⁵ and 10¹⁰ viral copies per gram of stool, but can also be found in vomitus.²⁵ Asymptomatic individuals may also shed norovirus, though the infectivity of shed particles is unknown.^{14,25,26} Together, the long shedding period and large amount of virus shed per infected person contribute to environmental persistence of the virus and secondary attack rates of ≥30% among contacts of infected individuals.²⁰

Transmission and control in healthcare settings

Many of the same characteristics that promote community transmission are magnified in the healthcare setting. Whereas most community cases of norovirus resolve within 12–60 h and without medical attention, nosocomial outbreaks of norovirus largely affect vulnerable populations, including the institutionalized elderly and the immunocompromised.²⁷ In such populations, typically mild infections may progress to more severe or prolonged illness.^{27–31} Among vulnerable populations, symptoms of norovirus may last for between four and

six days.³² However, chronic norovirus symptoms and shedding lasting for 15 months were described in an HIV-affected patient.³¹ In addition to longer symptomatic periods, individuals in healthcare settings may shed for extended periods of time, acting as reservoirs for spread of the virus to other susceptible persons.^{32–34} Reports have detailed shedding periods ranging from 22 to 433 days in paediatric cancer patients.³⁵

Nosocomial outbreaks of norovirus may result in severe patient outcomes. Whereas deaths caused by norovirus are rare in the community, individuals in healthcare facilities, particularly the elderly, are more likely to be hospitalized or die.^{36–40} Estimates from England, Wales, The Netherlands, and the USA suggest that norovirus constitutes a leading cause of gastroenteritis-associated deaths in those aged >65 years of age.^{36,37,41,42} Increases in the annual numbers of deaths have been observed in years in which novel GII.4 viruses emerged, and were recognized to cause global increases in cases. The widely circulating GII.4 noroviruses undergo antigenic changes to escape from population immunity, resulting in emergence of a new strain every two to four years.^{43–47} These novel strains have been associated with pandemics as well as with increased morbidity and mortality.^{40,45,46,48,49} GII.4 noroviruses are particularly predominant in healthcare settings.^{5,7,21} Some of the strongest evidence that norovirus plays a causal role in deaths comes from a study of >400 US nursing home outbreaks, where an 11% (95% CI: 5–18%) increase in all-cause mortality was observed during periods in which these institutions were experiencing outbreaks.⁵⁰ A detailed outbreak investigation suggested that some excess mortality may be associated with drugs used frequently in the elderly.⁵¹

In addition to causing severe illness in hospitalized individuals, norovirus may also spread rapidly throughout facilities, leading to high attack rates. A recent study demonstrated that the average interval of time from the infection of one patient to another (i.e. the serial interval) was 1.86 days.⁵² This study also provided evidence that proximity (i.e. occupying a bed in the same bay as an infected patient) was a risk factor for infection in patients. Since nurses and other healthcare staff also work in close proximity to patients, the virus commonly affects staff working in outbreak wards. In one outbreak in a US tertiary care hospital, 105 healthcare workers in two separate units became ill, of whom 13 visited the emergency department or were hospitalized for their condition.⁵³ Given the high levels of contact in healthcare settings, defining the relative role of staff and patients, both symptomatic and asymptomatic, is a critical question for norovirus transmission. A modelling study of a series of outbreaks in Dutch hospitals suggests that symptomatic patients, rather than asymptomatic healthcare workers, are the main drivers of transmission.⁵⁴

Current prevention and control measures for norovirus aim to minimize the risk of introduction and transmission of the virus in healthcare settings.^{55,56} The recommendations for prevention and control are summarized in Box 1.⁵⁷ One particularly controversial control measure is the closure of hospital wards or units to new admissions. This is a costly measure from an economic perspective and disruptive to the provision of healthcare services. The efficacy and cost-effectiveness of ward closure remain a subject of debate, although there is some evidence suggesting that rapid implementation of control measures reduces the overall duration and final outbreak size.⁵⁸

Download English Version:

<https://daneshyari.com/en/article/6122105>

Download Persian Version:

<https://daneshyari.com/article/6122105>

[Daneshyari.com](https://daneshyari.com)