

Norovirus: an established viral plague

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ABSTRACT Norovirus, or the winter vomiting virus as it has become more commonly referred to, is responsible for acute epidemics of gastroenteritis and diarrhoea throughout the year and has gained much public notoriety due to its impact on semi-closed communities such as schools, hospitals, offices and cruise liners. In this article Dr Stephanie Dancer provides an expert overview of norovirus and what can be done to stop it spreading.

KEYWORDS Community, gastroenteritis, hospitals, norovirus, outbreak, vomiting

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INTRODUCTION

Norovirus is an enterovirus responsible for epidemics of acute gastroenteritis and diarrhoea both in children and adults. The virus was previously known as Norwalk-like agent, or Small Round Structured Virus (SRSV), following the first documented outbreak in a primary school in Norwalk, Ohio, during the late 1960s. The disease was originally recognised as long ago as 1929, when it was called winter vomiting disease, due to the fact that it seemed to be more prevalent in the winter. Nowadays it can, and does, occur throughout the entire year, giving the impression of an almost continuous outbreak of viral gastroenteritis in certain parts of the UK.¹

EPIDEMIOLOGY

Human strains of norovirus are quite distinct from animal strains, and spread directly between people or indirectly via an environmental reservoir. Occasionally, specific items of food can be implicated in its transmission, for example oysters that have been exposed to water containing human sewage, or fruit that has been in contact with water contaminated by faeces.

The virus circulates freely in the population, but usually only manages to engage public health attention if it initiates outbreaks in semi-closed communities such as hospitals, care homes, schools, hotels, cruise liners and prisons. Since there are economic implications following such outbreaks, in addition to the unpleasant symptoms for individuals, infection control and public health personnel apply policy guidance on the management of norovirus outbreaks in order to minimise spread and stop an outbreak. Without such attention, hospitals can grind to a halt, schools have to close and holidays are brought to an abrupt end. Outbreaks on cruise liners have even precipitated international incidents between countries, resulting in an extensive review of the practices applied to managing outbreaks of gastroenteritis on such ships.²

CLINICAL MANIFESTATIONS

Only small numbers of the virus are needed to initiate infection, and the incubation period is usually just one or two days. The symptoms are generally vomiting, often described as projectile, with or without diarrhoea, and often abdominal cramps. Patients can have diarrhoea without any episodes of vomiting, which can cause confusion over the diagnosis. While unpleasant, the symptoms are generally mild and self-limiting, and the illness usually recedes as quickly as it appears, within 48–72 hours. Some patients may only experience one or two episodes of vomiting, but this is enough to transmit the virus to others, since even a small amount of vomit can contain large numbers of infectious virus particles.

The treatment of norovirus gastroenteritis is usually supportive only, although elderly and compromised individuals may require intravenous fluid replacement for a day or two. Once symptoms abate, the patient may continue to excrete infectious virus for up to 48 hours – sometimes for up to two weeks – an important point to remember for infection control management.

MANAGEMENT IN HOSPITALS

Is it an outbreak?

In hospitals, outbreaks are generally recognised quickly, due to the sudden onset and projectile nature of vomiting.³ Another indication that norovirus is involved is staff reporting in sick as well as patients experiencing symptoms. These signs alert the infection control team, who investigate each case with careful history-taking. If an outbreak is suspected, the ward is usually closed, staff restrictions are implemented and specimens sent to the regional virus laboratory for analysis. Occasionally, patients are found to have other reasons for vomiting or diarrhoea – for example, laxative prescribing, parenteral feeding and antibiotic therapy, including overgrowth of *Clostridium difficile*. Increasing numbers of stool samples received by laboratories identify more potential cases of *C. difficile*, since this organism can

be part of the normal faecal flora.⁴ Infection control teams have to decide whether there is a genuine outbreak and, if so, whether it is predominantly caused by norovirus or if there are alternative reasons for a cluster of patients experiencing diarrhoea. If a norovirus outbreak is identified, it is allowed to run its normal course within the ward, since all the patients and staff would almost certainly already have been exposed. Only when all persons have been symptom-free for at least 48 hours, with no new cases, will the decision be made to reopen the ward to new admissions.

Attention to hygiene

Throughout the course of the outbreak, the infection control team will remind everyone about the importance of hand hygiene. While every hospital ward is well equipped with strategically positioned bottles of alcohol gel, there are current concerns over the efficacy of these formulations against norovirus. It is possible that alcohol-based hand rubs may be inadequate for preventing the transmission of norovirus.⁵ Therefore, the infection control team will encourage staff to wash their hands with soap and water, as well as supervising patients' hand hygiene. This piece of advice is often forgotten, but it is just as important to remember, particularly before meals. Visitors, too, should be reminded about washing their hands, both at the beginning and end of their visit to the ward. Occasionally, it is necessary to limit the number of visitors (particularly children) to a ward during an outbreak.

Restrictions should also be placed on all staff working in, or visiting, the ward. Nurses should not work elsewhere during the course of the outbreak, and this includes agency work on other wards or even at other hospitals. Along with colleagues, they are encouraged to stay on the ward for the duration of their shift and not venture out to other parts of the hospital, including the canteen. Patients who require *urgent* investigations in other departments may be taken out by porters, accompanied by a nurse if necessary. Support staff such as occupational therapists, physiotherapists, phlebotomists and dieticians should restrict their time on a ward during an outbreak unless there are important reasons for visiting a patient. These staff will have access to the rest of the hospital and could spread the virus to another area, thus initiating yet another outbreak. Doctors' clinical responsibilities can also be assessed, and specific junior staff assigned to an affected ward for the duration of the outbreak.

Once the outbreak has run its course, the most important infection control intervention is to deep clean the ward.⁶ This includes clinical equipment, as well as floors, toilets and surfaces. Curtains should be removed and sent to the laundry, and other soft furnishings either washed down or, preferably, steam cleaned. All general cleaning, especially of toilets and bathroom areas, should be performed with a chlorine-containing disinfectant or bleach (sodium hypochlorite) at a specified concentration. If the bleach clean is not performed, the outbreak may start up again

as soon as new patients are admitted. This is because norovirus survives happily in the warm clinical environment while retaining its infectivity, readily transferring to patients from hands that have just touched a contaminated site.

MANAGEMENT IN THE COMMUNITY

Outside hospitals, norovirus outbreaks can be devastating in closed or semi-closed communities. Those that often attract public attention include sudden and extensive outbreaks in hotels or on cruise liners, but outbreaks also occur in nursing and residential homes, prisons and schools. An outbreak reported recently in a primary school involved 79 pupils and 24 members of staff.⁷ Subsequent investigation showed that person-to-person contact was a major factor in the transmission of the virus, but there was a suggestion that contaminated computer equipment (keyboards and mice) was also implicated. To deal with outbreaks in these communities, public health officials recommend good hand-washing practices, exclusion of symptomatic persons and thorough environmental disinfection with a diluted (1:50 concentration) household bleach solution, to include sites that are shared but not commonly cleaned. These include frequent hand-touch sites such as lift buttons, light switches and handles, among many others.

Nurseries and long-term care homes have also reported outbreaks that require similar public health interventions.^{8,9} Even business and factory workers are not exempt, following a report from Japan where 91 staff members from eight different companies contracted norovirus, thought to have been transmitted through contaminated packed lunches supplied by one catering firm.¹⁰ This particular outbreak highlights the importance of worker health management and hygiene programmes for catering staff.

Travellers and holidaymakers may also come into contact with norovirus, given the risk from crowded planes, trains and coaches, and the semi-closed communities found in hotels and on cruise liners. It only requires one symptomatic person to contaminate their surroundings or a communal toilet for an outbreak to be initiated. One report details how flight attendants vomited into an aeroplane toilet on a transatlantic flight, resulting in a further five cases among passengers who used the same toilet during the flight.¹¹ Interestingly, the toilet was reported as appearing clean.

Decontamination of an aircraft or coach with bleach or by steam cleaning is not, however, as difficult to organise as the decontamination of a cruise ship full of passengers. Given the serious economic implications for cruise ship companies and the difficulties of controlling norovirus outbreaks on a ship at sea, comprehensive guidelines are now available for companies, passengers and staff. Many companies issue basic hygiene guidance to passengers after they book, in order to warn of the risk and to advise caution in boarding a vessel if experiencing signs and symptoms of gastroenteritis.

THE FUTURE

There is no doubt that norovirus will continue to plague us, both in hospitals and the community, for the foreseeable future. High bed-occupancy rates in healthcare facilities are not easily ameliorated in today's National Health Service and will continue to put patients at risk of outbreaks. There are also signs that the virus is changing, with more prolonged outbreaks, more virulent manifestations and a greater degree of infectivity.¹² This has occurred in the UK and elsewhere, with reports of almost continuous norovirus outbreaks throughout the year, as well as during the winter months.

The different nature of these outbreak patterns has been attributed to the appearance of a new genetic variant related to genogroup II/4.¹³ Now that individual strain types can be characterised, such genetic changes can be documented and investigated. Hospital closures, lost bed days and staff absence focus the need for epidemiological analyses of specific strains and their routes of transmission.

It is of concern that norovirus could become more pathogenic, since the short duration of illness and the relatively benign nature of symptoms, unpleasant as they are, usually provide reassurance to those responsible for controlling outbreaks. Increasing virulence would be an unwelcome addition to the superlative transmission and survival properties of the virus. The management of a prolonged and serious outbreak of norovirus would challenge current healthcare facilities and have grave economic implications for healthcare providers.

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KEY POINTS

- Norovirus infection, causing self-limiting vomiting and diarrhoea, has been known about for nearly 80 years; its predilection for the winter months has, more recently, reduced, with infection occurring at all times of the year.
- Isolated cases may occur in the community, but it is the propensity of the virus to cause outbreaks in closed and semi-closed communities such as hospitals, schools and hotels that causes the greatest concern.
- If an outbreak occurs, the symptoms should be allowed to run their natural course in individual patients (with supportive care as required), but efforts should be made to avoid spread from the site of the initial outbreak producing further outbreaks.
- Hand-washing will reduce spread at the time of an outbreak, while deep cleaning and disinfection with bleach following an outbreak will help to remove surviving virus from the environment.
- The identification of different strains of the virus, each with its own symptom pattern, and an apparent tendency for newer strains of the virus to produce more severe or prolonged symptoms are concerns for infection control teams charged with managing outbreaks.

Community spread would further compromise the workforce and impact on institutions and businesses nationwide. With the virus's enormous capacity for genetic change, however, it is expected there will be more new variants emerging in the coming years, each with its own distinctive properties and disease-causing potential.

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