

Norovirus: small virus, minimal infectious dose but big impact

In recent years norovirus has become a well known cause of gastrointestinal upsets in man, especially with regards to dramatic outbreaks of vomiting and diarrhoea on cruise liners. In this article we will endeavour to update you on this interesting virus.

At the outset it should be noted that not all cases of norovirus infection in man are cases of food poisoning as spread can occur from person to person via the vomit or faeces of an infected person. If, however, an infected person is working with food he can very easily contaminate the food he is handling and then the person who consumes that food becomes infected (food poisoning).

This often involves people who wash and prepare salads and fruits because after having been prepared, these fruits and salads are not subjected to a process (cooking) that would render them safe for human consumption.

Obviously if a water supply becomes contaminated with norovirus many people can become infected in a short time.

Norovirus was first detected in a major 'food poisoning outbreak' at a school in Norwalk, Ohio, USA in 1968 and was originally called SRSV (small round structured virus) and is sometimes referred to as the Norwalk or Norwalk-like virus. Later, the term norovirus was internationally adopted as the name for this type of virus.

Simple structure

Norovirus is a single stranded RNA (sRNA) virus that has a simple structure.

Noroviruses belong to either the GI or GII groups and each of these contain some 15-20 or so genome types, meaning that currently over 30 norovirus genotypes exist.

In addition, noroviruses have a high mutation rate so new genotypes will be constantly evolving.

It would appear that noroviruses only multiply in man's digestive tract with large amounts of virus being shed in the faeces (probably $>10^8$ virus particles per g of faeces). Compare this to an infectious dose of just 10-100 virus particles and one can see why infection is so easily established and

how large numbers of people can be infected. Putting it another way, one gram of faeces has the potential to infect millions of people!

Like all viruses norovirus can not multiply in foods or in the environment. In addition, this virus can retain its infectivity for a relative long time in sea or river/pond/lake water and can survive at refrigerator temperatures.

Norovirus is thought to be partially resistant to chlorine compounds. Hypochlorite solution containing at least 1,000ppm of chlorine, and with a one minute contact time, is required to inactivate the virus in faeces.

This may partially explain a food poisoning outbreak in the UK in which a chef vomited in a sink and then washed out the sink and sanitised it using hypochlorite.

Most of the people in the restaurant who subsequently ate lettuce that was washed in this same sink then went down with viral food poisoning!

Routes of transmission

Norovirus can be transmitted in several ways. If the route of infection is by food or water the resulting disease in man is considered to be food poisoning whereas if it is direct contact with human faeces the resulting disease in man is considered to be an infectious disease.

The routes of spread of norovirus include:

- The virus is to be found in the vomit and faeces of infected people and can spread person to person via poorly washed/sanitised hands or via generated droplets of vomit or faeces. An infected person can excrete virus by their faeces for up to a month or so, even though that person shows no clinical signs of the infection.
- Norovirus can be transmitted by infected food handlers to the foods they handle.
- Norovirus can be transmitted by eating raw or uncooked bivalved molluscs as they accumulate the virus in their mid-gut from the water or sewage they are in. Such molluscs grown near sewage outflows are a real

risk as sewage treatment often does not totally rid the sewage of the virus.

- Norovirus infection can be acquired from drinking untreated water, such as that from a stream or well.

The detailed epidemiology of norovirus is poorly understood because of the low numbers of virus needed to cause infection in man, coupled to the lack of suitable detection systems, but this is now being resolved with the use of modern molecular systems such as PCR.

The symptoms of norovirus infection in man usually appear with 24-72 hours of virus ingestion. The main presenting symptoms are vomiting, diarrhoea and abdominal pain. These normally only last for a few days. In some instances, the symptoms are similar to those of a mild cold and include headache, fever, chills, muscular aches, sore throat and fatigue. The most serious symptoms tend to be confined to the very young and the very old.

Interestingly, since the immunity in man against norovirus is short (6-14 weeks) and since there are many norovirus genotypes people tend to suffer repeat infections with norovirus. This is a factor in the high number of reported cases of norovirus food poisoning.

As there are no effective antiviral drugs or vaccines treatment tends to be confined to fluid replacement and general supportive therapies.

Country variations

The amount of human food poisoning attributable to norovirus varies by country and year, for example, in Japan between 2001 and 2006 annual figures ranged from 15-35% and although almost 28,000 human cases were reported per year, no deaths were seen.

Interestingly, some 50% of cases were reported to be from infections acquired from composite foods such as sushi, sandwiches and the raw fish product sashimi, which people handled while cooking it.

Oysters are also notorious sources of norovirus infections! ■