

## Review

# Norovirus

Brett Mitchell

Senior Nurse Manager Infection Control, North Glamorgan NHS Trust, Prince Charles Hospital, Merthyr Tydfil, Wales

*Int J Infect Control* 2006, 2:1

Available from: <http://www.ijic.info>

### Introduction

Highly infectious agents in a hospital setting can have a significant impact on the functioning of clinical areas, patient delivery and care. *Norovirus* is one such organism and is now one of the most common causes of gastroenteritis.<sup>8</sup> The transmission and identification of this virus will be reviewed with a focus on a hospital setting. Symptoms and management of patients suffering from this virus will also be discussed. During outbreaks of *Norovirus*, staff are often reservoirs for transmission and often become infected themselves. Therefore it is important that the management of staff, including infection control issues and public health issues, are also analysed. Communication with all members of staff, patients and relatives are paramount in controlling and managing outbreaks.

### Background Information

The introduction of electron microscopy for examining faecal samples led to the discovery of a number of viruses that cause diarrhoeal illness. Within the genera of Caliciviridae, a distinct virus called Norwalk like virus (NLV) or *Norovirus* was uncovered.<sup>13</sup> *Norovirus* have a characteristic surface morphology formed by 32 cups or "calices" with the tips of the virus bent and have a ragged outline. A complete virion is around 35-40nm in diameter. *Noroviruses* also have different antigenic properties as identified by the use of immune electron microscopy demonstrating numerous different strains.<sup>13</sup> Other characteristics of *noroviruses* include a single stranded positive RNA genome tail and a single capsid polypeptide molecular mass.<sup>12</sup>

Caliciviruses have a large variety of diseases/syndromes such as respiratory disease in cats and haemorrhagic disease in rabbits. Within humans however, *Norovirus* is a major cause of nonbacterial epidemic gastroenteritis.<sup>9</sup>

### Laboratory Identification

Due to the nature of the *noroviruses* causing gastroenteritis, diarrhoea is a common symptom. Examination of faecal specimens can be used to identify NLV, however these need to be collected as soon as possible after symptoms start to increase the chances of diagnosis, as viral shedding in stool is highest in the first 24-48 hours after illness. It is important to send faecal specimens for both virological and microbiological analysis to exclude bacterial or other causes of diarrhoea or gastroenteritis. To identify NLV, several laboratory tests can be undertaken.<sup>13</sup> Electron microscopy is a widely available test used for the diagnosis of caliciviruses, however this procedure requires skilled operators, expensive capital equipment and, as the viruses are small and difficult to recognise, the sensitivity may be affected. More recently, solid phase immune electron microscopy has been used to increase the sensitivity of electron microscopy. Apart from microscopy, enzyme immuno-assays can also be used for the detection of calicivirus antigens and antibody responses to them. Finally, nucleic acid detection techniques, such as polymerase chain reaction (PCR), have also been used for the detection of NLV. However the success of PCR depends on the removal of inhibitors of reverse transcription from the samples and the choice of primers used.<sup>15-17</sup>

Other laboratory tests, such as full blood count, liver function and electrolytes, would usually be within normal limits (assuming no co-infection or other morbidity).<sup>17</sup>

### Symptoms

Diarrhoea and vomiting are common symptoms associated with *Norovirus* infection. Other symptoms can include stomach cramps or pain and fever. The illness lasts for approximately 48 hours and is preceded by an incubation period of up to 72 hours (mean 33-36 hours). Symptoms



can present within 12 hours of exposure. Dehydration is a common complication of *Norovirus* infection, especially among the elderly or young.<sup>3, 20, 22</sup>

### Transmission

There have been numerous studies and retrospective analyses of outbreaks relating to the transmission of *Norovirus*. Conclusive evidence of this highly infectious agent has suggested that the faecal-oral route is a common way in which *Norovirus* is transmitted. Other mechanisms of transmission include direct person-to-person spread such as vomiting or by consumption of faecally contaminated food or water.<sup>3, 6, 11, 18</sup>

Respiratory transmission of *Norovirus* has been implicated; however studies involving experimentally induced *Norovirus* via nasopharyngeal washings on human volunteers have not resulted in infection.<sup>17</sup> There is some evidence that caliciviruses are stable in the environment and that this may pose another source of inadvertent exposure.<sup>10</sup> Within the hospital environment, transmission via the faecal oral route or by vomiting are most important, given the close proximity of patients and regular patient contact by staff. Once a person has recovered from infection, (usually 48 hours) they may be immune to the virus for a period of up to 14 weeks.<sup>23</sup>

### Outbreak Management

There is no specific treatment for people infected with *Norovirus*. Dehydration is common due to diarrhoea and vomiting. In the elderly and young patients, dehydration may need to be treated with intravenous fluids. When a patient is infected with *Norovirus*, particularly in the hospital, it is vital that the transmission of the virus is stopped. If a case or cases of *Norovirus* are identified in the hospital environment there are a number of measures used to manage the outbreak.

Wherever possible, infected patients should be isolated and nursed using personal protective equipment (PPE) including gloves and aprons. When a patient is vomiting or has recently vomited, visors and mask should be worn. Masks should conform to European Standard 14683. It is vital that all staff are immediately informed of a potential outbreak and that appropriate PPE is used where appropriate. Single isolation may not always be possible due to limited single rooms, so during larger outbreaks, patients displaying symptoms can be put together in larger areas.

Infection prevention and control nurses (IPCN) must visit the affected area regularly and increase the awareness and importance of handwashing, particularly after contact with infected patients and before handling food and drink. Handwashing should last for more than 10 seconds. Alcohol gels (70-90% methanol or ethanol) have been shown to be effective against *Norovirus*. Access to and the number of alcohol gel dispensers should be increased during an outbreak.<sup>4, 13</sup>

Other measures that need to be taken to reduce transmission and minimise an outbreak include regular cleaning and inspection of "dirty" areas including commodes, toilets, bed pan washers and closure of the ward to new admissions. Non-urgent tests for patients with *Norovirus* infection should be postponed and transfers to other wards/areas should be avoided. Similarly, the incubation period of *Norovirus* should also be considered before moving non-symptomatic patients in an affected area. Furthermore, nonessential staff should be excluded from affected clinical areas. In areas where a patient has vomited, removal of exposed food and rapid disinfection of the area must be performed. Thorough cleaning must be performed in the area 48 hours after the last patient displays symptoms.<sup>2, 5, 13</sup> The Health Protection Agency<sup>14</sup> in the United Kingdom advises that closing wards to new admissions during an outbreak reduces the length of the outbreak.

Cleaning of the ward during an outbreak must be enhanced and particular attention paid to sinks, emptying bins and toilet areas. *Norovirus* can survive well in the environment. A solution of hypochlorite 1000 ppm is recommended for the cleaning of floors, tables and patient areas. Vacuum cleaning after an outbreak has the potential to re-circulate *Norovirus* and therefore is not recommended.<sup>7</sup> Studies have supported the use of a detergent and hypochlorite in one solution during an outbreak of *Norovirus*. This is exactly the practice in Medical Admissions Ward at the University Hospital of Wales. This solution is used during outbreaks of noroviruses.<sup>1, 19</sup> More recently, this solution has been used for everyday cleaning in order to prevent and minimise the effects of an outbreak.

### Staff Management

Staff who become infected with *Norovirus* should be excluded from work for 48 hours after resolution of their symptoms. If they return to work before this period, there is a risk of transmitting the virus to another person and hence lengthen and increase the outbreak. Although the virus can persist for longer than 48 hours (after resolution of symptoms), exclusion of staff for more than this period is difficult to manage and of unproven benefit.<sup>21</sup> Staff should report to their manager their symptoms when they fall sick so that a pattern of the outbreak and possible further transmission can be investigated by the IPCN.

Due to short term immunity, staff who return to work after being excluded due to *Norovirus* can care for patients who are currently displaying symptoms of the virus. Managers of the department should try and ensure the same nurses are caring for a cohort of patients to minimise the risk of infection, especially during the asymptomatic stage. During outbreaks of *Norovirus* in the University Hospital of Wales, nursing staff and patients were classified as "clean" and "dirty" and allocation of patients' care distributed accordingly.



It may also be worthwhile for managers to obtain faecal specimens from staff who are off work due to a possible *Norovirus* infection. There are two benefits; firstly, to determine transmission routes and patterns on the ward and secondly to discourage staff taking time off work unnecessarily. During a large outbreak, all staff in an area can be given the universal stool containers, therefore making collection of specimens easier when they do display symptoms.

### Public Health Reporting

Within the United Kingdom there is no compulsory reporting to the Health Protection Agency (HPA) which is responsible for public health. Infection Prevention and Control teams however are encouraged to report outbreaks to the HPA. The HPA does publish details and trends of *Norovirus* outbreaks in England and Wales via its communicable disease report. The HPA also offers advice and alerts when outbreaks are occurring so that hospitals and General Practitioners are aware and can take any necessary precautions.

### Conclusion

*Norovirus* is a highly infectious virus which causes gastroenteritis in humans. The high infectivity rate causes rapid spread within the population and particularly in close environments such as hospitals. Transmission occurs readily via the oral route after coming into contact with a contaminated surface or matter. Although the symptoms are not usually life threatening, an outbreak in a hospital can cause significant costs due to staff sickness and increased length of stay of patients. It is vital that detection of an outbreak occurs quickly and infection control measures are implemented immediately.

Infection control measures include proper hand washing, patient isolation, non-movement of symptomatic patients, appropriate cleaning and disinfection of infected areas, use of PPE where appropriate, closure of wards to new admissions and the management of infected staff.

It is vital that the IPCN communicates efficiently and effectively with all departments directly or potentially (such as X-ray) involved in the care of *Norovirus* infected patients. Clear guidance must be issued to staff working in these areas in order to reduce the impact and shorten the length of the outbreak.

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