Prolonged norovirus shedding and the use of a rapid norovirus polymerase chain reaction to assess terminal room cleaning in immunocompromised patients

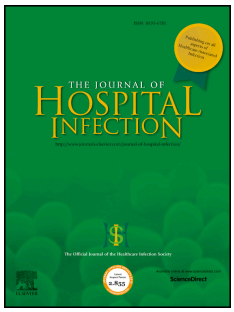
Smith, C.; Casey, A.; Round, S. L.; Malladi, R.; Holden, E.; Garvey, M. I.

DOI:
10.1016/j.jhin.2019.02.006

Document Version
Peer reviewed version

Citation for published version (Harvard):
Smith, C, Casey, A, Round, SL, Malladi, R, Holden, E & Garvey, MI 2019, 'Prolonged norovirus shedding and the use of a rapid norovirus polymerase chain reaction to assess terminal room cleaning in immunocompromised patients', *The Journal of hospital infection*, vol. 102, no. 3, pp. 354-355. https://doi.org/10.1016/j.jhin.2019.02.006

Accepted Manuscript



Prolonged norovirus shedding and the use of a rapid norovirus PCR to assess terminal room cleaning in immunocompromised patients

Caroline Smith, Anna Casey, Sarah L. Round, Ram Malladi, Elisabeth Holden, Mark I. Garvey

PII: S0195-6701(19)30089-1

DOI: https://doi.org/10.1016/j.jhin.2019.02.006

Reference: YJHIN 5666

To appear in: *Journal of Hospital Infection*

Received Date: 10 February 2019

Accepted Date: 12 February 2019

Please cite this article as: Smith C, Casey A, Round SL, Malladi R, Holden E, Garvey MI, Prolonged norovirus shedding and the use of a rapid norovirus PCR to assess terminal room cleaning in immunocompromised patients, *Journal of Hospital Infection*, https://doi.org/10.1016/j.jhin.2019.02.006.

Prolonged norovirus shedding and the use of a rapid norovirus PCR to assess terminal room cleaning in immunocompromised patients

Caroline Smith[1], Anna Casey[1], Sarah L. Round[1], Ram Malladi[1], Elisabeth Holden[1] and Mark I. Garvey[1,2*]

[1]University Hospitals Birmingham NHS Foundation Trust, Queen Elizabeth Hospital Birmingham, Edgbaston, Birmingham, B15 2WB

[2]Institute of Microbiology and Infection, The University of Birmingham, Edgbaston, Birmingham

Keywords: Norovirus, Cleaning, PCR, Environmental Sampling, Decontamination, immunocompromised, clinical haematology

Running title: Using PCR to detect environmental norovirus

Word count (body of text): 800

* Corresponding author

Email: mark.garvey@uhb.nhs.uk or m.i.garvey@bham.ac.uk

Tel: 0121 371 3787

Sir

Noroviruses have been recognised as an important cause of chronic gastroenteritis in immunocompromised patients.[1-4] Prolonged norovirus illness has been reported in persons who are immunosuppressed as a result of immunosuppressive therapy.[1] Norovirus shedding in stool has been detected by PCR up to 56 days in immunocompetent patients.[2] In immunocompromised patients this can be longer; Ludwig *et al.,* (2008) reported norovirus detection up to 433 days in paediatric cancer patients.[3] Roddie *et al.,* (2009) reported that 18% of patients who underwent allogeneic hematopoietic stem-cell transplantation contracted norovirus over a 1-year period.[4] Here we describe ongoing transmission of norovirus GII from a chronic carrier on a clinical haematology ward at Queen Elizabeth Hospitals, Birmingham (QEHB), UK. We also describe use of a norovirus PCR to assess for environmental clearance of the virus.

A patient with acute myeloid leukaemia was admitted to the clinical haematology unit at QEHB in January 2018 due to manifestations of graft versus host disease. During this admission, the patient acquired norovirus GII due to an outbreak on the ward, and was then isolated in a single room. The patient subsequently had multiple stays on the ward during these 10 months (5 inpatient stays in total), during which time he had persistent diarrhoea and continued to test positive for norovirus by PCR. On each admission the patient was isolated in a different side room (either balanced pressure or positive pressure) with en-suite toilet facilities, and on discharge an infectious clean of the room was routinely undertaken.

However, despite these measures a total of 14 patients acquired confirmed norovirus GII infection during the times that this patient was on the ward.

Additionally, 3 staff members developed norovirus-like illnesses, although these cases did not undergo norovirus PCR testing. Epidemiological data indicated that the chronic carrier was the only common factor on each occasion, suggesting this was the index patient for these transmissions. In two instances the patient immediately admitted into the room vacated by the index patient acquired norovirus infection. Molecular typing also suggested transmission of the same strain of norovirus (GII genotype 4 prototype strain Sydney/2012/Australia).

In response to the evidence of ongoing transmission from the chronic carrier, in October 2018 the positive pressure side room that had been occupied by the chronic carrier patient for 29 days was environmentally sampled post-discharge. Before sampling the room underwent enhanced cleaning, comprising detergent/ disinfectant (1,000ppm; Chlor-Clean, Guest Medical, Aylesford, UK), steam-cleaning, and double-strength hypochlorite solution (2,000ppm; Chlor Clean) followed by hydrogen peroxide misting (OxyPharm, Sandbach, UK) at 12% concentration. After cleaning was assessed as adequate by an infection control nurse multiple macroscopically clean touch-points throughout the side room were then sampled (Table 1), as described previously.[5] Swabs were tested using the Cepheid Xpert Norovirus PCR (Cepheid Inc, Sunnyvale, CA, USA).[6] Norovirus was detected by PCR from the environmental sampling after the enhanced clean. A second room clean was ordered, which included an additional step of UV irradiation (Hygiene Solutions, Kings Lynn, UK) (Table 1). This time no detectable norovirus was detected on environmental sampling and the bed space was reopened.

In immunocompromised adults, norovirus gastroenteritis can become chronic and persist for weeks to years,[1] as in the case described here at QEHB. Bok *et al* suggested that it is not clear whether noroviruses are transmissible to immunocompetent adults from patients with chronic viral shedding, questioning the virulence of noroviruses in this setting.[1] However, in our experience we saw secondary cases throughout a chronic carrier's inpatient stays over a 10-month period, probably including immunocompetent staff members.

Prior room occupancy is the single biggest risk factor for acquiring healthcare associated micro-organisms.[7] Utilising a norovirus PCR to assess the environment after cleaning may be an important tool in providing assurance that it is safe to admit patients into bedspaces previously occupied by norovirus shedders.

ACKNOWLEDGEMENTS

We would like to thank the Infection Prevention and Control Team during the norovirus outbreak, staff on the clinical haematology ward and Facilities at Queen Elizabeth Hospital Birmingham, University Hospitals Birmingham NHS Foundation Trust.

REFERENCES

1. Bok K, Green KY. Norovirus gastroenteritis in immunocompromised patients. *N Engl J Med* 2016;367:2126-32.
2. Schorn R, Hohne M, Meerbach A, Bossart W, Wuthrich RP, Schreier E, Muler NJ, Fehr T. Chronic norovirus infection after kidney transplantation: molecular evidence for immune-driven viral evolution. *Clin Infect Dis* 2010;51:307-14.
3. Ludwig A, Adams O, Laws HJ, Schroten H, Tenenbaum T. Quantitative detection of norovirus excretion in pediatric patients with cancer and prolonged gastroenteritis and shedding of norovirus. *J Med Virol* 2008;80:1461–7.
4. Roddie C, Paul JPV, Benjamin R, Gallimore CI, Xerry J, Gray JJ, Peggs KS, Morris EC, Thomson KJ, Ward KN. Allogeneic hematopoietic stem cell transplantation and norovirus gastroenteritis: a previously unrecognized cause of morbidity. *Clin Infect Dis* 2009;49:1061–8.
5. Garvey MI, Bradley CW, Jumaa P. Environmental decontamination following occupancy of a burns patient with multiple carbapenemase-producing organisms. *J Hosp Infect* 2016;93:136-40.
6. Cepheid Xpert norovirus manufacturers guidance, Cepheid, 2015. http://mail.csvlab.com.br/Norovorus-Bula-Cepheid.pdf [Last accessed 11 February 2019].
7. Mitchell BG, Dancer SJ, Anderson M, Dehn E. Risk of organism acquisition from prior room occupants: a systematic review and meta-analysis. *J Hosp Infect* 2015;91:211-7.

TABLE

Table 1. Norovirus PCR results from environmental sampling of 7 surfaces in the patient's room using polywipe sponges (surface area ~30cm^2).

Surface tested	Enhanced Clean – Norovirus PCR result	Enhanced Clean with UV – Norovirus PCR result
Surface areas in vicinity of patient		
Bed Frame	+	-
Table	+	-
Cardiac monitor	-	-
Floor	-	-
Communal area surfaces tested		
Bathroom handles	+	-
Door handles	-	-
Fridge	+	-

Key: + = positive PCR for norovirus; - = negative PCR for norovirus. The enhanced room clean comprised of a detergent/ disinfectant (1,000ppm; Chlor Clean), steam-cleaning, double-strength hypochlorite solution (2,000ppm; Chlor Clean) followed by hydrogen peroxide misting (OxyPharm) at 12% concentration. The only difference with the enhanced clean with UV irradiation was the addition of UV (Hygiene Solutions, UK) after the enhanced clean of the side room.