

SYNOPSIS

02/06/2020

2019-nCoV - What We Know So Far About... Fecal-Oral Transmission

Preamble

“What Do We Know So Far...” documents are intended to provide a brief overview of some of the published and unpublished reports related to emerging issues with respect to the 2019 novel coronavirus (2019-nCoV). The reports are found through ongoing scanning of the published literature and scientific listservs (e.g., [ProMed](#), [CIDRAP](#), [Johns Hopkins Situation Reports](#)), as well as media reports. It is recognized that there may be additional information not captured in this document. As this is a rapidly evolving situation, the information will be current as of date written. Should you be aware of additional data or information regarding fecal-oral transmission, please contact cd@oahpp.ca.

Key Findings

- Diarrhea was common with severe acute respiratory syndrome virus (SARS-CoV) and transmission from feces is believed to have occurred.
- Diarrhea has been reported with 2019-nCoV, but less commonly than with SARS-CoV.
- 2019-nCoV RNA has been detected by PCR in feces from some infected patients.
- The gastrointestinal tract contains receptors that are believed to be used by the 2019-nCoV to enter cells.
- Respiratory droplets are likely the predominant mode of transmission for the 2019-nCoV. The extent to which fecal-oral transmission contributes to the spread of 2019-nCoV is not yet known.

Background

Among humans, coronaviruses are transmitted most readily through respiratory droplets produced when an infected individual coughs or sneezes and possibly through fomites (inanimate objects including surfaces or objects contaminated with infectious droplets).

It has been established that the SARS-CoV was excreted in feces and was potentially transmissible from feces as indicated by the following evidence:

- In the 2002–03 SARS outbreak, it was [reported](#) that 20%-25% of patients presented with diarrhea. In total, diarrhea occurred in 40%-70% of patients, with a tendency to develop approximately one week after symptom onset. ([Hui et al.](#))
- A [prospective study](#) of 75 SARS patients in Hong Kong found that 55 (73%) of patients developed diarrhea within a week of symptom onset. Based on stools collected later in the illness (mean 14.2 days from onset), SARS RNA was detected by PCR in 65 (97%) of 67 patients. ([Peiris et al.](#))

What Do We Know So Far About Fecal-Oral Transmission of 2019-nCoV?

Gastrointestinal Symptoms with 2019-nCoV

- Four studies were identified that described diarrhea in patients diagnosed with 2019-nCoV. ([Chen et al.](#), [Huang et al.](#), [Chan et al.](#) and [Holshue et al.](#))
- In the two larger studies, diarrhea was an uncommon finding (2.0% and 2.6% of patients). ([Chen et al.](#) and [Huang et al.](#))
- In one family cluster, two of six infected family members presented with diarrhea. ([Chan et al.](#))

Fecal Testing for 2019-nCoV

- In a family cluster of six cases, stool samples were collected from four individuals, including two with diarrhea (which was present at onset in both). All samples were **negative for 2019-nCoV by PCR**. ([Chan et al.](#))
- A case report from the United States describes a patient who had diarrheal illness on day six and seven after symptom onset. A stool sample collected on day seven was **positive for 2019-nCoV by PCR**. ([Holshue et al.](#))
- Five patients admitted to an intensive care unit in Wuhan were **negative by PCR for 2019-nCoV on anal swabs**; however, these swabs were performed long after symptom onset (18-29 days). ([Zhou et al.](#))
- [Media reports](#) are indicating that **2019-nCoV has been detected by PCR in stool** specimens of infected patients in China.

Receptors for 2019-nCoV in the Gastrointestinal Tract

- Similar to SARS-CoV, 2019-nCoV is believed to enter cells via the angiotensin-converting enzyme 2 (ACE2) receptors ([Hoffmann M. et al.](#)). [ACE2 receptors are found](#) in the gastrointestinal tract, as well as in the lungs, kidney and heart.

Reports

Evidence of Fecal-Oral Transmission in SARS-CoV

1. Hui DSC, Zumla A. **Severe acute respiratory syndrome: historical, epidemiologic, and clinical features.** Infect Dis Clin North Am. 2019;33(4):869-89. Available from: <https://www.sciencedirect.com/science/article/pii/S0891552019300571?via%3Dihub>.
2. Peiris JS, Chu CM, Cheng VC, Chan KS, Hung IFN Poon LL, et al. **Clinical progression and viral load in a community outbreak of coronavirus-associated SARS pneumonia: a prospective study.** Lancet. 2003;361(9371):1767-72.

Gastrointestinal Symptoms with 2019-nCoV and No Fecal Testing

3. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020 Jan 29 [Epub ahead of print]. Available from: <https://www.thelancet.com/pb-assets/Lancet/pdfs/S0140673620302117.pdf>.

Epidemiologic and clinical characteristics of 99 confirmed cases of 2019-nCoV who were hospitalized in a single centre in Wuhan, China. **Two of 99 patients presented with diarrhea.**

4. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020 Jan 24 [Epub ahead of print]. Available from: [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(20\)30183-5/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30183-5/fulltext) .

Case series of 41 patient admitted to hospital in Wuhan. **One of 38 patients assessed had symptoms of diarrhea.**

Gastrointestinal Symptoms with 2019-nCoV and Fecal Testing

5. Chan JF, Yuan S, Kok KH, To KK, Chu H, Yang J, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. Lancet. 2020 Jan 24 [Epub ahead of print]. Available from: [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(20\)30154-9/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30154-9/fulltext) .

A family cluster of six symptomatic people, two of whom developed diarrhea at onset of their illness. Stool samples were collected from four people and **2019-nCoV was not detected.**

6. Holshue ML, DeBolt C, Lindquist S, Lofy KH, Wiesman J, Bruce H, et al. **First case of 2019 novel coronavirus in the United States.** N Engl J Med. 2020 Jan 31 [Epub ahead of print]. Available from: <https://www.nejm.org/doi/full/10.1056/NEJMoa2001191>.

A detailed clinical case report of the first case of 2019-nCov infection confirmed in the United States. The patient had diarrhea on illness day six and seven. The only stool sample, which was collected on day seven, **was positive for 2019-nCoV by PCR.** The authors note that extrapulmonary RNA does not necessarily mean that infectious virus is present.

Fecal Testing Only

7. Zhou P, Yang XL, Wang XG, Hu B, Zhang L, Zhang W, et al. **A pneumonia outbreak associated with a new coronavirus of probable bat origin.** Nature. 2020 February 3. Available from: https://www.nature.com/articles/s41586-020-2012-7_reference.pdf.

Genomic analysis of seven patients admitted to the intensive care unit in Wuhan with symptom onset between December 12 and 23, 2019. Bronchial alveolar lavage and oral swabs were collected from all patients on December 30, 2019 and one or both tested positive for 2019-nCoV by PCR. Additional testing, including anal swabs, were collected from five patients on January 10, 2020 (18 to 29 days after symptom onset), all of which were **negative for 2019-nCoV**.

Media Reports

8. The [media is reporting](#) that **viral nucleic acids has been found in stool and anal swabs from 2019-nCoV** infected patients in China, suggesting that fecal-oral transmission of 2019-nCoV is possible. It was also reported that diarrhea is sometimes the first symptom, as opposed to fever.

Receptors in the Gastrointestinal Tract

9. Hoffmann M, Kleine-Weber H, Krueger N, Mueller MA, Drosten C, Poehlmann S. The novel coronavirus 2019 (2019-nCoV) uses the SARS-coronavirus receptor ACE2 and the cellular protease TMPRSS2 for entry into target cells. bioRxiv. 2020 Jan 31 [Epub ahead of print]. Available from: <https://www.biorxiv.org/content/10.1101/2020.01.31.929042v1>.

This paper examines 2019-nCoV cell entry using viral pseudotypes, which are artificial viruses that express the 2019-nCoV spike (S) protein. Amino acid analysis and cell culture experiments show that, **like SARS-CoV, 2019-nCoV S protein binds to ACE2 receptors on cells.**

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