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Coronavirus Pandemic

Alert for pharynx-centered gastrointestinal and respiratory cross-infection and cryptic cross-transmission routes of 2019-nCoV

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Abstract

We proposed that the pharynx, as a common organ of the respiratory and digestive tracts, may be a respiratory and digestive tract cross cryptic transmission pathway for 2019-nCoV infection from the nasal cavities to the pharynx and lung, then to nasal cavities by aerosol (respiratory route) to the pharynx and the gastrointestinal tract, then to the oral cavity by feces (fecal-oral route) and to pharynx, lungs, or gastrointestinal tract.

Key words: 2019-nCoV; pharynx; gastrointestinal tract; respiratory tract; aerosol route; fecal-oral route; cross-transmission routes.

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To the Editor,

Currently, the 2019-nCoV Omicron variant is still infecting people and spreading worldwide [1]. It is important to elucidate the precise transmission route of the 2019-nCoV Omicron variant to effectively control its transmission.

Infection of the human body with 2019-nCoV requires communication, contact, and exchange between the internal and external environment of the human body. The internal environment has two main internal channels that communicate with the external environment and make contact and exchange. One is the respiratory tract through the nasal cavity to communicate with the external ambient air, and the second is the digestive tract through the oral cavity to take in food.

2019-nCoV infects humans through tissue cell membrane angiotensin-converting enzyme 2 (ACE2) [2]. ACE2 is expressed in both respiratory tract tissue cells, including alveolar cell membranes, and digestive tract tissue cells, including gastric and intestinal cell membranes. Therefore, 2019-nCoV can infect both the respiratory and digestive tracts, and whether 2019-nCoV infects the respiratory or digestive tract may depend on differences in the amount of ACE2 expressed and the affinity of 2019-nCoV for the receptor in the different tissues.

Notably, the respiratory tract, especially the lung, is more sensitive than the gastrointestinal tract to the inflammatory response caused by 2019-nCoV infection, and the consequences of pneumonia are more serious than those of gastroenteritis, which may explain the worldwide emphasis on the prevention and treatment of 2019-nCoV infection-induced pneumonia and the neglect of 2019-nCoV infection-induced gastroenteritis [3]. 2019-nCoV belongs to the coronavirus superfamily, and gastrointestinal infections are also caused by common coronaviruses. Presumably, the number of gastrointestinal 2019-nCoV infections worldwide is large, though these infected people have no obvious clinical symptoms and cannot be detected unless they seek medical attention or take the initiative to perform faecal 2019-nCoV nucleic acid testing.

However, excretion by many asymptomatic gastrointestinal 2019-nCoV-infected people may be a large source of occult transmission of 2019-nCoV-induced pneumonia, which explains how these pneumonia patients might have had no contact with other 2019-nCoV-induced pneumonia patients but still become infected. 2019-nCoV is transmitted through

faeces from the gastrointestinal tract [4]. Thus, the use of masks cannot block the faecal-oral transmission of 2019-nCoV, though frequent hand washing before meals and after stools, as well as bathroom disinfection, is necessary.

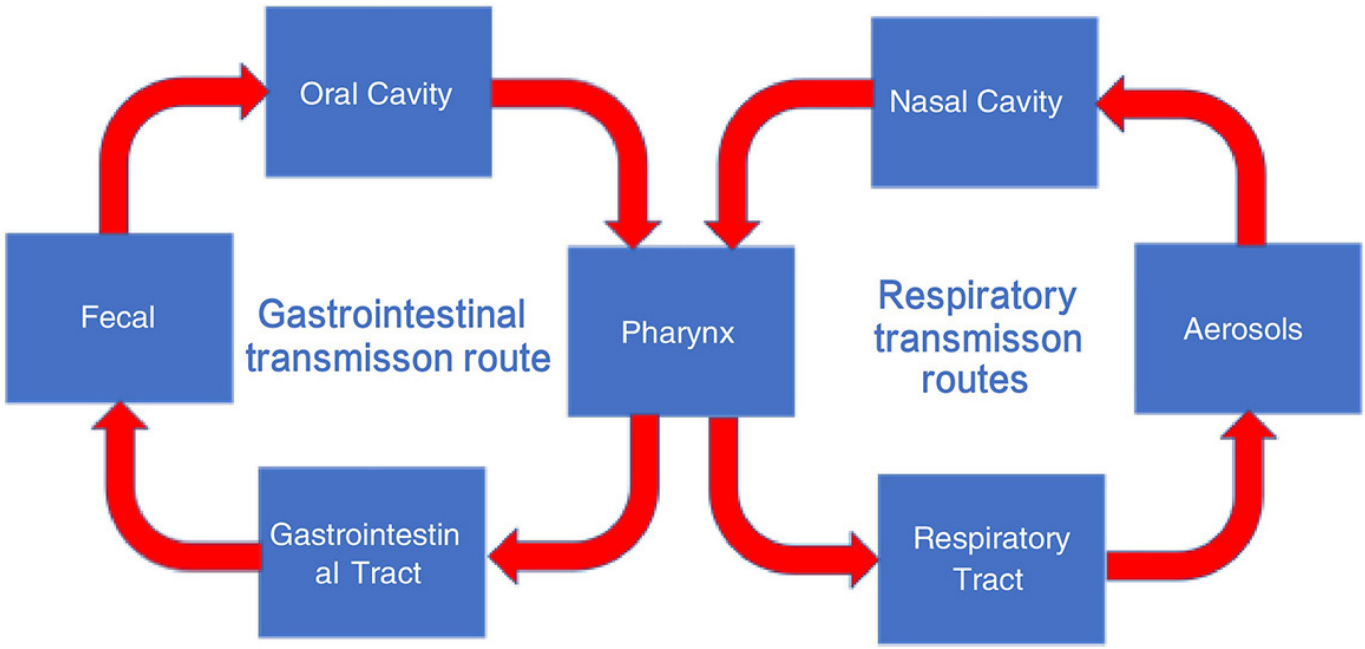
2019-nCoV mutation often occurs because of a poor survival environment, whereby the virus adapts to this environment. The survival of 2019-nCoV in the gastrointestinal tract is poorer than that in the respiratory tract, and we hypothesize that 2019-nCoV is more likely to mutate in gastrointestinal-infected populations than in respiratory-infected populations. Although there is no direct evidence, we hypothesize that the 2019-nCoV Alpha and Omicron variant strains occurred in populations with gastrointestinal infections.

We believe that 2019-nCoV is transmitted through the respiratory tract and the digestive tract and that the two transmission routes are not isolated; rather, they interact. The pharynx, including the nasopharynx, oropharynx, and laryngopharynx, is an important organ of the body, and the pharynx belongs to both the respiratory and digestive tracts, comprising a common and intersecting part of both. The nasopharynx, oropharynx, and laryngopharynx can all be infected with 2019-nCoV[5]. 2019-nCoV in the pharynx can either enter the digestive tract via food, causing asymptomatic or symptomatic gastroenteritis, and eventually be excreted through faeces; alternatively, it can enter the respiratory tract directly with airflow, causing pneumonia, and be excreted from the nasal cavity via exhalation (with or without coughing).

We believe that pharynx-centered cross-contamination of 2019-nCoV through the respiratory and digestive tracts and cryptic cross-transmission through the respiratory and faecal routes are among the main reasons why masks and isolation of 2019-nCoV respiratory-infected patients are still unable to control 2019-nCoV infections in social workers. A concerted effort by respiratory infectious disease specialists and gastrointestinal infectious disease specialists as well as disease prevention and control specialists is needed to interrupt pharynx-centered gastrointestinal and respiratory cross-transmission routes.

The cross-infection and cryptic cross-transmission pathway of 2019-nCoV, which is located in the pharynx and respiratory tract, is characterized by pharyngeal infection, gastrointestinal infection, viral faecal infection, faecal-oral transmission, oral cavity infection, pharyngeal infection, tracheal infection, pulmonary infection, aerosol transmission, and nasopharyngeal infection (Figure 1). Since the nasopharynx and laryngopharynx are generally not in contact with food in the oral cavity, we hypothesize that 2019-nCoV in the nasopharynx and laryngopharynx is less likely to enter the gastrointestinal tract and cause gastroenteritis; instead, the virus is more likely to enter the respiratory tract through airflow and cause pneumonia. The oropharynx can be in contact with food, and oropharyngeal infections caused by 2019-nCoV are more likely to lead to gastroenteritis. Based on the conjecture that the 2019-nCoV Omicron variant may occur in the population with intestinal infection, it

Figure 1. Pharynx-centered gastrointestinal and respiratory cross-infection and cryptic cross-transmission routes of a novel coronavirus.



is suggested that pharyngeal infection with the Omicron variant is more likely to lead to gastrointestinal infection, which may be one of the reasons why the so-called 2019-nCoV Omicron variant is less pathogenic but more transmissible.

Conclusions

There may be respiratory and digestive tract cross-cryptic transmission pathways for 2019-nCoV infection through the pharynx. A portion of asymptomatic 2019-nCoV infections may be mildly symptomatic gastrointestinal infections. This population cannot be detected by oropharyngeal swabs, suggesting that wearing masks and isolation do not prevent the transmission of gastrointestinal 2019-nCoV infections and that interrupting faecal-oral transmission is highly important for preventing 2019-nCoV mutations and preventing and controlling its infection.

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