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REVIEW

Should nasogastric tube insertion during the COVID-19 pandemic be considered as an aerosol-generating procedure?

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Abstract

Nasogastric tubes are used frequently in surgical patients for bowel decompression, provision of enteral nutritional support and preventing aspiration of gastric contents. There is no conclusive research into the risk of COVID-19 transmission associated with nasogastric tube insertion, although evidence from the severe acute respiratory syndrome outbreak appears to suggest that there is no increased risk of transmission. However, close contact with a COVID-19 patient, especially those displaying respiratory symptoms, is likely to increase the risk of transmission. Nasogastric tube insertion requires increased time spent at a patient's bedside and can also cause pharyngeal irritation, resulting in coughing. In addition, the nasogastric tube can expose the healthcare worker to potentially infectious saliva. Therefore, there is a clear need for increased evidence regarding the risk of transmission associated with nasogastric tube insertion, to ensure that such risks can be mitigated.

Key words: COVID-19; Gastrointestinal intubation; Personal protective equipment; Severe acute respiratory syndrome coronavirus 2

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Introduction

A novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), emerged in Wuhan, China in December 2019 (Zhu et al, 2020). The most common clinical features of the disease it causes are fever, cough and myalgia (Huang et al, 2020). As of 28 May 2020, there had been over 5.4 million cases of COVID-19, causing over 356 000 deaths (World Health Organization, 2020a). The SARS-CoV-2 pandemic is one of the greatest public health crises in a generation, so there is an urgent need to determine the ways in which the virus can be transmitted between humans and put in measures to prevent such spread. This is particularly pressing in the case of protecting healthcare workers who, through the course of their work, will habitually be exposed to COVID-19 patients. Indeed, a single COVID-19 positive patient, who was cared for by 121 different healthcare workers, resulted in 35.5% of these healthcare workers developing symptoms of COVID-19 within 14 days of exposure, and 2.5% of the healthcare workers testing positive for COVID-19 (Heinzerling et al, 2020).

A variety of different healthcare-related interactions could cause transmission between patients and healthcare workers. Public Health England's (2020) list of aerosol-generating procedures includes intubation and extubation, upper airway suctioning, and sputum induction, among others. Such procedures require the use of a fluid-repellent gown, a filtering face piece class 3 (FFP3) mask, a face shield or visor, and gloves. However, Public Health England (2020) does not provide guidance as to whether the insertion of nasogastric tubes should be considered a higher risk procedure. Given the potential to induce saliva through insertion or removal, and the risk for increased aerosolisation caused by coughing as a result of irritation, there is a risk that such procedures could increase the transmission of COVID-19. Nasogastric tubes are frequently used in surgical patients for a variety of reasons, such as bowel decompression following large and small bowel obstruction, postoperative gastric and oesophageal surgery, provision of enteral nutritional support and preventing aspiration of gastric contents in unconscious or intubated patients (Nelson et al, 2007). The COVID-19 pandemic has resulted in a variety of new considerations, and

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recommendations for changes in surgical practice (Heffernan et al, 2020). Despite this, at present there appears to be no guidance available regarding the risk of nasogastric tube insertion in COVID-19 patients, nor are there recommendations for whether a higher level of personal protective equipment should be considered for healthcare workers performing nasogastric tube insertion.

This article summarises the evidence regarding modes of transmission of SARS-CoV-2 and how these may relate to nasogastric tube insertion, as well as the current body of empirical evidence regarding the associated risk. Overall, while the risk may be small, it is theoretically existent. Nasogastric tubes are unlikely to generate aerosols in the manner in which other aerosol-generating procedures do; however, they are likely to increase the risk of COVID-19 transmission to the healthcare workers inserting and removing them as a result of increased droplet transmission and exposure to saliva.

Transmission of SARS-CoV-2

SARS-CoV-2 is a respiratory virus which spreads via human-to-human contact (Li et al, 2020). It is highly contagious, with estimates of the basic reproduction rate (R0) in China ranging from 2 to 4 (Li et al, 2020; Riou and Althaus, 2020; Zhao et al, 2020). The exact mechanisms of transmission of the virus appear to be through respiratory droplet transmission (World Health Organization, 2020b), as well as via fomites (Ong et al, 2020). Vehicles of droplet transmission are respiratory droplets (respiratory aerosols >5 µm in diameter) or respiratory droplet nuclei (≤5 µm in diameter) (World Health Organization, 2014). COVID-19 appears to be spread by the former, transmission of which can arise through close contact (<1 m) with an infected person who coughs or sneezes (World Health Organization, 2020b). Airborne transmission of fine respiratory aerosols can also occur in specific incidences, such as aerosol-generating procedures (World Health Organization, 2020b). SARS-CoV-2 has been found to be stable in experimentally generated aerosols for 3 hours (van Doremalen et al, 2020), although it was not possible to isolate the virus from air samples from the rooms of infected patients (Ong et al, 2020). However, it obviously is not feasible to assess for the virus in the full volume of air that has been exposed to the patient (Ong et al, 2020).

Nosocomial COVID-19 infections have been reported, affecting both healthcare workers and other patients (Wang et al, 2020). Potential routes of infection include aerosol-generating procedures or close proximity to symptomatic or asymptomatic infected patients or healthcare workers. As such, there have been recommendations to consider that transmission may be related to the duration of time spent in contact with the patient, rather than particular procedures. In addition, it has been suggested a COVID-19 patient who is dyspnoeic and coughing is likely to create more pathogen aerosolisation than some aerosol-generating procedures (Wilson et al, 2020). Hence caution should be exercised in any procedure that causes a healthcare worker to be in prolonged contact with a patient and in patients who have respiratory symptoms such as a cough.

Current evidence regarding nasogastric tubes

There is currently no evidence or advice regarding the risk of inserting nasogastric tubes in COVID-19 patients. The evidence available comes from investigating other respiratory pathogens. A systematic review found that procedures that increased the risk of transmission were tracheal intubation, non-invasive ventilation, tracheotomy and manual ventilation before intubation (Tran et al, 2012). All of these procedures are deemed to be aerosol generating, and hence require higher levels of personal protective equipment, according to Public Health England's COVID-19 personal protective equipment guidelines (Public Health England, 2020). A variety of other procedures, several of which are also deemed to be aerosol-generating procedures by Public Health England (2020), including endotracheal aspiration, high flow oxygen and collection of sputum, were not found to cause a significant increase in the risk of transmission of respiratory infection (Tran et al, 2012). The authors also found that insertion of a nasogastric tube did not cause a significantly increased risk of transmission, although only two papers investigating this were included in the study (Tran et al, 2012).

These two studies both investigated the risk of transmission of severe acute respiratory syndrome (SARS), another coronavirus, during nasogastric tube insertion, among other procedures. Loeb et al (2004) conducted a retrospective cohort study of critical care nurses looking after patients with SARS. They analysed the rate of infection with SARS in nurses exposed to certain patient care activities, compared to those who were not exposed to those activities. They found that two out of six nurses who inserted a nasogastric tube contracted SARS (33%), compared to six out of 26 (23%) of those who did not insert a nasogastric tube. The relative risk of contracting SARS when inserting an nasogastric tube was therefore 1.44. This was non-significant with a 95% confidence interval of 0.38–5.47, although the low power study could, in part, account for this (Loeb et al, 2004).

A retrospective cohort study by Raboud et al (2010) found that the same proportion (8%) of healthcare workers who inserted a nasogastric tube in intubated SARS patients contracted SARS, compared to those who did not insert a nasogastric tube, suggesting that there is no increased risk inherent to nasogastric tube insertion. However, they concluded that close contact with the airway of an infected person (along with not following standard personal protective equipment procedures) likely increases transmission of SARS. This may explain why healthcare workers who developed SARS were significantly more likely to have performed an electrocardiogram on infected patients than healthcare workers who did not develop SARS. Such an activity would not be aerosol generating but would require the healthcare worker to prolong the time spent in close contact with a SARS patient (Raboud et al, 2010). One could assume, although no evidence was found in this study, that inserting a nasogastric tube could increase the risk of transmission in a similar manner.

However, there are no data available regarding the use of nasogastric tubes in the current COVID-19 pandemic. While these results from SARS studies, albeit limited, may be translatable, the risk of transmission of SARS-CoV-2 during nasogastric tube insertion also needs to be assessed.

Theoretical risks

In addition to the increased risk solely from increased exposure to an infected patient while inserting and removing a nasogastric tube, there may be further risks from the procedure itself. Some complications of nasogastric tube placement include irritation of the oropharynx and nasopharynx, causing a sore throat or rhinorrhoea (Padilla et al, 1979). Such irritation could increase the likelihood of producing respiratory aerosols by causing coughing or sneezing during nasogastric tube insertion; these aerosols would come into contact with the healthcare workers who would be within 1 m of the patient during the procedure. Nasogastric tubes can also cause coughing (and associated respiratory droplet dissemination) when they are misplaced (Prabhakaran et al, 2012; Koo, 2016).

It is interesting to consider here that other procedures, such as bronchoscopy, gastroscopy, laryngoscopy and upper airway procedures, including dental procedures that involve suctioning, have been labelled as aerosol-generating procedures by Public Health England (2020), requiring higher levels of personal protective equipment, yet nasogastric tube insertion has not been considered to be an aerosol-generating procedure. These procedures have been included as aerosol-generating procedures on the basis of the use of suctioning resulting in aerosolisation of sputum, which nasogastric tube insertion does not, in theory, produce. This considered, it is not beyond possibility that sputum could be generated during the insertion of a nasogastric tube, in particular if the tube was misplaced into a main bronchus, resulting in coughing and subsequent sputum production.

In addition to this, although sputum generation is deemed an aerosol-generating procedure (Public Health England, 2020), procedures involving saliva are not, despite there being sufficient quantities of SARS-CoV-2 in saliva to enable its use as a diagnostic tool (Xu et al, 2020). Saliva could be generated and expelled by coughing during nasogastric tube insertion, but could also contaminate the nasogastric tube and, by extension, the gloves of a healthcare worker inserting it. Indeed, nasopharyngeal and oropharyngeal swabs are the recommended specimens for SARS-CoV-2 diagnosis and such areas also come into contact with the nasogastric tube (To et al, 2020). If the nasogastric tube was then retracted

(for example, in the case of a difficult insertion) or removed, this could expose healthcare workers to SARS-CoV-2 in the saliva on the tube. Such upper respiratory tract specimens, especially nasal specimens, can harbour high viral loads, particularly early in the disease course (Zou et al, 2020). In addition, the viral loads in asymptomatic patients have been found to be similar to those in symptomatic patients, suggesting that caution is required when inserting nasogastric tubes in any patient regardless of suspicion of COVID-19 (Zou et al, 2020).

Recommendations from other specialities

The Royal College of Speech and Language Therapists published a report reviewing the research and evidence surrounding assessment of oropharyngeal dysphagia and aerosol-generating procedures during COVID-19 (Bolton et al, 2020). It described how reflexive coughing secondary to aspiration is a common occurrence during a dysphagia assessment (Bolton et al, 2020), noting that coughing is an unpredictable risk of the assessment. They referenced that ear, nose and throat surgeons have been labelled to be at high risk of contracting COVID-19 as a result of prolonged exposure to patients and the risk of procedures inducing a cough; this draws parallels to the risk of reflexive coughing in an oropharyngeal dysphagia assessment and, indeed, nasogastric tube placement. They concluded that evidence to support risk of transmission of COVID-19 during a dysphagia assessment is absent; however, procedures resulting in increased exposure or contact with respiratory secretions, which includes a dysphagia assessment, could be considered to be an aerosol-generating procedure (Bolton et al, 2020). Therefore, this requires the provision of adequate personal protective equipment while conducting dysphagia assessments as a result of exposure to the patient and risk of aerosolisation. This recommendation could be extrapolated to include nasogastric tube insertion because of the risks discussed above. In response to the report, the National Tracheostomy Safety Project and the British Thoracic Society wrote in support of the request for dysphagia assessment to be considered an aerosol-generating procedure (Bolton et al, 2020). The British Association of Stroke Physicians wrote that both dysphagia assessment and nasogastric tube insertion carry risks of aerosolisation and therefore determined that both of these procedures should be considered aerosol-generating procedures requiring appropriate personal protective equipment to be used during the pandemic (Bolton et al, 2020).

Conclusions

While nasogastric tube insertion is not necessarily an aerosol-generating procedure, there is the potential for infectious material to be produced and disseminated during this procedure. Evidence surrounding the risk of COVID-19 transmission relating to nasogastric tube insertion in the current COVID-19 pandemic is sparse, but equally there was little evidence evaluating the risk of transmission of respiratory viruses during nasogastric tube insertion before December 2019. A variety of organisations support other similar non-aerosol-generating procedures, which expose healthcare workers to respiratory droplets, to be considered procedures that require a higher level of personal protective equipment to ensure the safety of the healthcare workers. Certainly, there is the risk that nasogastric tube insertion would make a patient more likely to cough, and if the patient was already known to be COVID-19 positive, there would be grounds to be concerned about the increased risk of transmission to healthcare workers. Given the ubiquitous nature of nasogastric tube insertion on general surgical wards, it is important to assess the risk to allow precautions to be taken if necessary. The authors recommend increased investigation into the risk of nasogastric tube insertion to healthcare workers and suggest retrospective cohort studies investigating the risk associated with nasogastric tube insertion in patients with COVID-19, compared to other patient care.

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Key points

- Sars-CoV-2 is a new and highly infectious respiratory virus, which is spread via respiratory droplets.
- Healthcare workers can acquire COVID-19 nosocomially via procedures that generate potentially infectious aerosols.
- Nasogastric tube insertion is not currently classed as an aerosol-generating procedure by Public Health England and therefore does not warrant a higher level of personal protective equipment.
- Evidence from the SARS outbreak appears to suggest that nasogastric insertion did not significantly increase the risk of transmission to healthcare workers, but there were few studies, which were not highly powered.
- Theoretical risks of transmission of COVID-19 associated with nasogastric insertion include increasing the amount of time that a healthcare worker spends in the vicinity of a potentially infected person and that nasogastric insertion can cause pharyngeal irritation, which could cause coughing which produces respiratory droplets.
- A number of organisations have suggested that procedures that cause increased exposure to respiratory secretions (including nasogastric tube insertion) should be deemed aerosol generating.
- More evidence is urgently needed to empirically assess the risks associated with nasogastric tube insertion in the era of COVID-19 and to ensure the safety of healthcare workers.

Conflict of interest
The authors declare no conflicts of interest.

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