

Aerosol generation and droplet spread during nasogastric intubation in the COVID-19 era

We read with interest the recent article by Repici *et al* who reported that gastrointestinal (GI) endoscopy seems relatively safe for medical staff wearing adequate protective measures, with 4.3% of 968 healthcare workers (HCW) in the endoscopy setting infected with COVID-19.¹ Similar to GI endoscopy, oesophageal motility studies are common practice and potentially also high-risk medical procedures as COVID-19 may spread through generation of aerosols and droplets during insertion and removal of oesophageal high resolution manometry (HRM) and 24 hours multichannel intraluminal impedance-pH monitoring (pH-MII) probes.² Current guidelines recommend high-level protection with N95 mask, Filtering FacePiece (FFP)2 or FFP3, double gloves, face shield and gown for HCW during oesophageal physiologic procedures to minimise the

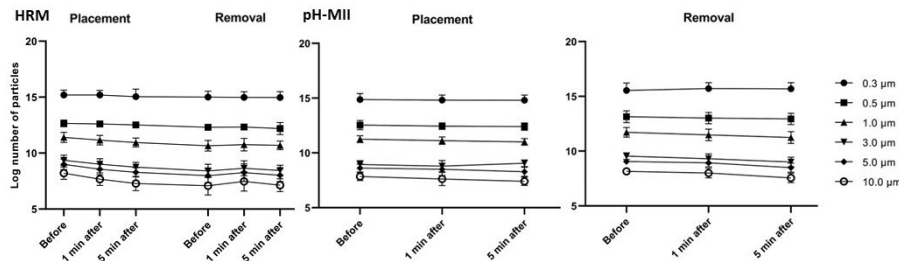


Figure 1 The number of aerosol particles for different sizes (0.3; 0.5; 1.0; 3.0; 5.0 and 10.0 μm) during a complete esophageal high-resolution manometry examination ($n=21$) and during placement ($n=12$) and removal ($n=10$) of a 24-hour pH-MII probe. Number of particles is shown on a logarithmic scale. Data are presented as mean \pm SD.

risk of transmission.^{3,4} However, there is a lack of scientific evidence on the spread of aerosols and droplets during nasogastric intubation. Therefore, we performed a prospective study, addressing these concerns.

Patients with a negative COVID-19 test by PCR undergoing nasogastric intubation for HRM or pH-MII were included. During the procedures, patients wore a mask over the mouth and were seated in a lowered position in front of the HCW. Quantification of aerosol (0.3, 0.5, 1.0, 3.0, 5.0 and 10 μm) was done using the Lasair II Particle Counter (Particle Measuring Systems, Boulder (Colorado), USA). For both probe positioning and removal, measurements were performed before and after 1 and 5 min. For droplet visualisation, fluorescein was applied to the nasal cavity at the beginning of the investigation. Patients were covered with a white sheet and HCW wore an apron allowing quantification of droplet spread. After the procedure, fluorescent drops on the sheet and apron were visualised with a Woods ultraviolet light, photographed and analysed using ImageJ. Aerosol particle counts were logarithmically transformed and presented as particles-cubic-metre. Statistical analyses were performed using repeated one-way analysis of variance (ANOVA) with stepdown Bonferroni adjustment. Data are presented as mean \pm SD and significance was set at $p<0.05$. Fluorescent droplet spread data were presented as total amount of detected spots and total surface per body region.

For aerosol particles generation, we studied 21 HRM examinations (both placement and removal), 12 pH-MII probe placements and 10 removals. One minute after HRM catheter placement, a general significant reduction in aerosol particles of all sizes compared with baseline except for 0.3 and 0.5 μm was observed ($p=0.71$; $p=0.36$; $p=0.01$; $p=0.01$; $p=0.002$;

$p=0.003$, in ascending size order, respectively) (figure 1). Five minutes after placement, the number of particles was further reduced except for 0.3 μm ($p=0.54$). The removal of the HRM catheter did not affect particle spread within 5 min ($p=0.053$; $p=0.75$; $p=1.00$; $p=0.75$; $p=0.77$; $p=0.77$, respectively). The placement of the pH-MII probe did not affect aerosol counts of any size, except for a decrease of 1.0 μm -sized particles 5 min after placement (from 11.25 ± 0.32 to 11.00 ± 0.31 ; $p=0.026$). For every particle size, except 0.3 μm , the removal was associated with a reduction in aerosol particle numbers. For sizes 0.5, 1.0 and 3.0 μm , this occurred 1 min after ($p=0.003$; $p=0.004$ and $p=0.017$, respectively), while for the two bigger sizes 5.0 and 10 μm , the reduction occurred after 5 min ($p<0.0001$ and $p=0.001$, respectively).

Additionally, little droplet spread was found on the white apron covering the HCW. The highest amount of fluorescein droplet spread was located in the right-sided neck region on the sheet covering the patient, with the highest intensity on pH-MII probe removal.

Our findings showed that oesophageal motility procedures, with a mask covering the patients' mouth and position adjustments protects from significant aerosol spread and generates only sporadic droplets and this is likely to have a low risk of COVID-19 transmission.

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Competing interests TV is a senior clinical investigator of the Flanders Research Foundation (FWO Vlaanderen) and has given Scientific Advice to Takeda, VectivBio, Shire, Dr. Falk Pharma, Tramedico, Truvion and Zealand Pharma and has served on the Speaker bureau for Abbott, Kyowa Kirin, Menarini, Takeda, Tramedico and Truvion.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not required.

Ethics approval The study protocol was approved by the Ethics Committee for clinical research of the University Hospitals Leuven (S64237).

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