INTRODUCTION

The coronavirus disease 2019 (COVID-19) outbreak drastically changed our view of the world and forced us to adjust safety measures considering viral spread during clinical research. Here, the focus lays on dealing with the airborne transmission, for example, aerosol particles. Respiratory pathogens can remain in the air for 3 h in a room without proper ventilation. To secure the safety of healthcare workers (HCWs) and patients, hospitals have installed air purifiers to reduce particle spread. A recent South Korean pilot...
Aerosol particle data (particles-per-cubic-meter) are presented as mean ± SD. SAS University Edition Software (SAS Institute, Cary, NC, USA) was used for all the analyses. Data were logarithmically transformed for repeated one-way ANOVA with stepdown Bonferroni adjustments for multiple testing. Significance was set at p < 0.05.

3 | RESULTS

Log number of aerosol particles are presented in Figure 2. After the installation of the air purifier in the motility room, 13 patients underwent an HRM examination.
higher levels compared with the start of the examination (before placement of catheter). Actually, all bigger-sized particles were still significantly lower in number ($p < 0.0001$; $p < 0.0001$; $p < 0.0001$; and $p = 0.0012$ in ascending particle size order).

4 | DISCUSSION

Since the COVID-19 outbreak, awareness for pathogen spread via aerosol has grown. All options to reduce the number of airborne particles are being explored, ranging from wearing mouth masks, limiting the number of people inside a room to optimization of room ventilation. In a dental clinical study, the use of an air purifier showed a reduced exposure of airborne droplets and aerosol particles to HCWs when an air cleaner was placed in a suitable position.\(^4\) The U.S. Environmental Protection Agency also suggested that air purifiers can help reduce airborne contaminants via appropriate use.\(^5\) However, currently, the U.S. Centers for Disease Control and Prevention has not provided recommendations to use air purifiers with HEPA filter for decontamination of airborne COVID-19. Furthermore, the use of air purifiers has been questioned as a pilot study observed increased local air flow when a test amount of aerosols and droplets were released near the exhaust outlets.\(^3\) In a recent study, we found that the placement and removal of an HRM catheter or a 24 h multichannel intraluminal impedance-pH monitoring probe, with a number of precautionary measures, do not increase the number of floating aerosol particles of any size, and only results in little droplet spread in the patient’s environment.\(^6\) This study was performed without the presence of a purifier in the room. Here, the efficiency of aerosol reduction by an air purifier was evaluated during an HRM examination.

During the placement of the catheter, there is no difference in aerosol particle levels with or without purifier. The 0.3 and 0.5 $\mu m$ remained unchanged, and the heavier particles dropped in numbers. Without purifier, no increase in particles has been seen after catheter removal.\(^6\) After the device’s installation, an elevation for particle sizes 0.5; 1.0; 3.0; 5.0; and 10.0 $\mu m$ occurred after probe removal. The hospital safety measures oblige to keep the examination room doors open between visits and closed when the patient enters. With the HRM examination taking on average 35 min to be finished, enough time might pass by for the purifier to filter the number of particles. This is confirmed in our study for particles sizes 1.0; 3.0; 5.0; and 10.0 $\mu m$, but not for 0.3 and 0.5 $\mu m$. Such reduction during the examination had not been observed in our study without the purifier.\(^6\) We suggest two plausible explanations: 1) lower numbers of particles right before catheter removal makes a small increase after more noticeable or 2) there is an actual increase of particle spread by the presence of the purifier. In any case, the increased amount of particles does never reach significantly higher levels compared with the moment the patient entered the room.

Based on our observation, utilization of portable HEPA purifiers for COVID-19 should be considered with caution in a clinical setting. These cannot be installed to convey a false feeling of safety, and other safety measures should be respected at all times. Further large-scale clinical trials to investigate this aspect are required.

DISCLOSURES

Tim Vanuytsel 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. Jan Tack has given Scientific advice to AlfaWassermann, Allergan, Christian Hansen, Danone, Grünenthal, Ironwood, Janssen, Kiowa Kirin, Menarini, Mylan, Neutec, Novartis, Novoventure, Nutricia, Shionogi, Shire, Takeda, Theravance, Tramedico, Truvion, Tsumura, Zealand, and Zeria pharmaceuticals and has served on the Speaker bureau for Abbott,
Allergan, AstraZeneca, Janssen, Kyowa Kirin, Menarini, Mylan, Novartis, Shire, Takeda, Truvion, and Zeria.

AUTHOR CONTRIBUTIONS
WV, AG, IH, LT, HT, HG, LC, JS, RH and HM performed the experiments; WV analyzed the data; WV, AG, FC, HD, TV and JT designed the research study; WV wrote the manuscript. All authors edited and revised the manuscript.

ORCID
Wout Verbeure https://orcid.org/0000-0001-9934-4636
Annelies Geeraerts https://orcid.org/0000-0003-4941-3263
I-Hsuan Huang https://orcid.org/0000-0002-9390-6180
Hannelore Geysen https://orcid.org/0000-0001-8960-932X
Florencia Carbone https://orcid.org/0000-0003-1790-7904
Jolien Schol https://orcid.org/0000-0003-0537-969X
Hideki Mori https://orcid.org/0000-0001-8830-4671
Tim Vanuytsel https://orcid.org/0000-0001-8728-0903
Jan Tack https://orcid.org/0000-0002-3206-6704

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