An Innovative Way to Achieve Safe Lung Deflation During One-Lung Ventilation in a Potential Coronavirus Disease 2019 Patient: A Case Report

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A novel coronavirus pandemic may be particularly hazardous to health care workers. Airway management is an aerosol-producing high-risk procedure. To minimize the production of airborne droplets, including pathogens such as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), from the endotracheal tube during procedures requiring lung deflation, we devised a technique to mitigate the risk of infection transmission to health care personnel. (A&A Practice. 2020;14:e01244.)

GLOSSARY
BB = bronchial blocker; COVID-19 = coronavirus disease 2019; DLT = double-lumen tube; FOB = fiberoptic bronchoscopy; OLV = one-lung ventilation; SARS-CoV-2 = severe acute respiratory syndrome coronavirus 2; ULPA = ultra-low-penetration air

One-lung ventilation (OLV) is a technique widely used to improve surgical exposure during intrathoracic surgical procedures. Traditionally, this can be accomplished using a double-lumen tube (DLT) or a bronchial blocker (BB) facilitating ventilation to the desired lung. With the current coronavirus disease 2019 (COVID-19) pandemic, care must be taken to prevent aerosolization of viral particles. In this case, we report the use of a laparoscopy smoke evacuation system to safely deflate the lung without exposing operating room personnel to aerosolization particles.

CASE REPORT
A 68-year-old man with medical history significant for hypertension, congestive heart failure, and chronic obstructive pulmonary disease presented for a right-sided video-assisted thoracoscopic surgery and decortication for a lung empyema. To facilitate OLV during the procedure, the patient was intubated with a left-sided DLT, and the tracheal cuff was inflated immediately following intubation. Correct placement of the bronchial lumen in the left main bronchus was confirmed via fiberoptic bronchoscopy (FOB) by visualization of the inflated bronchial cuff without cuff herniation over the carina. After the patient was placed in a left lateral decubitus position, FOB was repeated to confirm appropriate positioning of the DLT, and the tracheal port connector was clamped to initiate OLV of the nonoperative dependent lung and deflation of the operative nondependent right lung. Health Insurance Portability and Accountability Act authorization has been obtained from the patient.

Various methods to achieve lung deflation include spontaneous collapse. In this case, we attached a laparoscopy smoke evacuation system to the tracheal lumen distal to the clamp applied to the tracheal port connector of the DLT (Figures 1 and 2). This allowed the lung to deflate passively with the filter on the evacuation system trapping any viral particles preventing spread into the operating room. The patient did not exhibit clinical COVID-19–related symptoms, and testing performed before the procedure was negative for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). However, due to the reported high rates of false negatives associated with the current testing techniques,1 vigilance is necessary, especially when performing procedures involving the lungs and airway due to the high risk of aerosolization.

DISCUSSION
The SARS-CoV-2 outbreak has progressed rapidly worldwide, evolving into a pandemic. The understanding of the risk of transmission is continuously evolving,2 but it is believed that person-to-person spread of the virus occurs primarily by respiratory droplets. An individual can transmit the infection to another person by coughing, sneezing, or talking, because the viral particles can travel up to 6 feet in the environment. It has also been demonstrated in experiments that the virus can linger in the air for hours. Therefore, airborne precautions are recommended for cases, especially when risk of aerosolization is high.3

In addition, the reliability of testing available for SARS-CoV-2 varies based on the quality of the sample obtained or the testing method. Negative tests have been reported in cases where radiographic evidence of viral pneumonia suggested COVID-19 and patients ultimately retested positive.4 Even though our patient tested negative for SARS-CoV-2, he was still treated with appropriate droplet and airborne
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precautions due to the possibility of a false-negative result. During the patient’s intrathoracic procedure, we utilized a device commonly used for smoke evacuation in laparoscopic procedures to protect operating room personnel from toxins found in the smoke. The device is a piece of tubing with a filter attached to its end. It is a passive disposable multistage filter system that provides an effective barrier against 99.99% of 0.1 micron aerosolized particles. The ultra-low penetration air (ULPA) filter functions to prevent smoke particles and pathogens from aerosolizing into the surrounding environment while also consisting of an activated charcoal membrane that eliminates chemical toxins and odors. Due to the unique properties of the filter, we hypothesized that the filter can be utilized safely for lung isolation to trap any potential SARS-CoV-2 particles. By attaching the device to the tracheal port of the DLT (Figure 2), the operative lung is allowed to deflate passively without exposing operating room personnel to an added risk of viral aerosolization.

CONCLUSIONS
We believe that this lung deflation mechanism can be utilized effectively in the setting of airborne pathogens, including SARS-CoV-2, providing a safe environment for OLV intrathoracic procedures, to mitigate the risk of infection transmission to health care personnel.

DISCLOSURES
Name: Peter Magharious, MD.
Contribution: This author helped research, write, and edit the manuscript.
Name: Draginja Cvetkovic, MD.
Contribution: This author helped research, write, and edit the manuscript.
Name: Tracey Weigel, MD.
Contribution: This author helped edit the manuscript.
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Figure 1. The laparoscopic smoke evacuation system attached to the DLT. Solid arrow indicates the filter tubing. Star indicates the ULPA filter. DLT indicates double-lumen tube; ULPA, ultra-low penetration air.

Figure 2. A magnified picture of the system with the solid arrow demonstrating the direct connection between the filter tubing and the tracheal port of the DLT without the need for an adapter. DLT indicates double-lumen tube.