Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Novel Approach to Reduce Transmission of COVID-19 During Tracheostomy

Peter Foster, DO, Tiffany Cheung, DO, Patrick Craft, DO, Kelsey Baran, DO, Mark Kryskow, DO, Ross Knowles, DO, Alyssa Toia, DO, Christian Galvez, MD, FACS, Adam Bowling, DO, Michael DiSiena, DO, FACS

Severe infection involving the novel coronavirus 2019 (COVID-19) has been associated with acute respiratory distress syndrome, which subsequently requires patients to be intubated and dependent on mechanical ventilation. In the setting of the recent pandemic, there is a greater need to perform tracheostomy for these patients. With the high transmissibility of the virus, there has been an increasing concern for the development of techniques to perform surgical intervention while mitigating the risk for infecting hospital staff. As more data emerge pertaining to viral shedding in various bodily fluids, it has become more important to give special attention to precautions. In this article, we submit a novel approach for better protection and therefore, reduced transmission for tracheostomy in a COVID-19 positive patient. Importantly, this technique is functional, easy to set up, and can be used for additional operations that involve risk of aerosolization or droplet exposure to operating room staff.

COVID-19 has been associated with the highly contagious, novel strain of coronavirus (SARS-CoV-2). The severity of the disease ranges broadly between a mild cough and development of acute respiratory distress syndrome, for which some patients require intubation and mechanical ventilation. Its predilection for high transmissibility is threefold, as the virus can be spread via contact, droplets, and aerosol.1 This presents particular challenges for the healthcare team providing surgical intervention, especially tracheostomy, while mitigating the risk for increasing the spread of the disease.

Berkshire Medical Center is a 307-bed community teaching hospital located in Pittsfield, MA. The first COVID-19 positive patient in the county was recognized on March 7, 2020. By March 26, 2020, Pittsfield, MA had the ninth highest concentration of confirmed COVID-19 cases per 1,000 people by metro area in the entire world.2 Currently, there is little evidence or regulatory guidance to mitigate the intraoperative transmission of SARS-CoV-2 during a tracheostomy. Therefore, we propose a protocol that is used by our surgery department to perform a tracheostomy for patients who suffer prolonged respiratory failure requiring mechanical ventilation support.

PROTOCOL AND SET-UP
At our institution, an anteroom is used, directly abutting our negative pressure operating room, for donning and doffing of personal protective equipment (PPE), including protective boot covers, a sterile gown, under gloves, a surgical mask, powered air-purifying respirators (PAPRs), and an overlying pair of sterile gloves. On transfer to the operating room from the ICU, the patient is accompanied by an anesthesia provider in full PPE. Once in the operating room, the patient is placed in the supine position on the operating table and draped in the usual sterile fashion with a thyroid drape.

Next, a magnetic instrument mat is placed overlying the patient’s upper chest. An Omni-Tract retractor is mounted to the bed at the level of mid-abdomen, opposite the surgeon. The retractor arms are placed in a wide-V configuration, over the upper body. The Ecolab Scope Pillow Warmer Drape is a clear plastic material that is stretched over the retractor arms, forming a barrier between the operative field and the surgeon, while still allowing for good visualization of the operative field. The drape is then secured with snaps to the self-retaining retractor to maintain the tightness of the drape; this will improve visibility (Fig. 1).

Additional self-retraining retractors that would suffice include a Bookwalter or Thompson retractor set; both can be used (Fig. 2). This is used as a protective shield for droplet precautions.

Finally, the Buffalo Filter smoke evacuator tubing is connected to 2 heat moisture exchange (HME) filters and placed under the drape to provide further air filtration (Figs. 3 and 4). The reason for the multifilter system is to attempt maximum efficiency in filtering viral particles.

Disclosure Information: Nothing to disclose.

Received April 3, 2020; Accepted April 6, 2020.
From the Department of Surgery, Berkshire Medical Center, Pittsfield, MA.
Correspondence address: Peter Foster, DO, 725 North St, Pittsfield, MA 01201. email: pfoster@bhs1.org
According to the respective manufacturers, Buffalo Filter has 4 stages of filtration that reportedly ensure 99.999% efficiency, down to 0.1 to 0.2 microns, and HME filters provide bacterial and viral filtration exceeding 99.9%.

The operator and assistant will proceed with hands underneath the drape, allowing both the technician to pass instruments under the additional protection and the anesthesia team to access the airway (Fig. 5). A practice run was conducted to ensure smooth operation of the protocol, including the donning and doffing procedure and transferring of patients.

DISCUSSION

As with every hospital system, there is a constant and fluid balance between the number of patients and the resources available to provide optimal care. The COVID-19 pandemic will soon present a new problem: prolonged ventilation and the need for tracheostomy. At our institution, we have yet to be forced to use these procedures to free up resources (including ventilators), and recommend they be performed in a controlled and safe environment to minimize transmission to providers. This protocol has
been used on 1 patient who, over 28 days of intubation, had improved ventilator settings and had an opportunity of recovery. Before the implementation of this protocol, we conducted numerous dry runs with special attention to the mechanics, ease of use and set-up, and visibility of surgical site. Importantly, it was noted that if there is any malfunction regarding the overlying clear drape, simple removal of the drape can be done without redraping or further complication to the operation. Ultimately, this protocol allows the hospital staff to minimize the risk and exposure of the virus to the hospital staff.

**CONCLUSIONS**

In the setting of the current global coronavirus pandemic, acute respiratory distress syndrome and respiratory failure requiring mechanical ventilation have become commonplace. An increasing number of tracheostomy consults will be obtained by our medical colleagues for these patients. The aforementioned is a plausible and technically feasible set up for any hospital to perform tracheostomy safely while reducing droplet and aerosol exposure.

**Author Contributions**

Study conception and design: Knowles, Galvez, Bowling
Acquisition of data: Toia
Analysis and interpretation of data: Foster, Cheung
Drafting of manuscript: Foster, Cheung, Baran
Critical revision: Craft, Kryskow, DiSiena

**REFERENCES**

1. Zuo MZ, Huang YG, Ma WH, et al. Expert recommendations for tracheal intubation in critically ill patients with novel coronavirus disease 2019. Chin Med Sci J 2020 Feb 27 [Epub ahead of print].
2. Cohn N, Katz J, Sanger-Katz M, Quealy K. (2020 27). Some US cities could have coronavirus outbreaks worse than Wuhan’s. Available at: https://www.nytimes.com/interactive/2020/03/27/upshot/coronavirus-new-york-comparison.html. Accessed April 13, 2020.