A Simple Technique for Droplet Control During Mastoid Surgery

For more than 100 years, mastoidectomy has been a common procedure in otalaryngology in the management of cholesteatoma and infections and cochlear implantation. Concerns about droplets and virus aerosolization have been raised during the coronavirus disease 2019 (COVID-19) crisis, particularly after an endoscopic hypophysectomy in Wuhan, China, supposedly led to 14 members of the surgical team becoming infected with the novel coronavirus.1-3 The goal of this case-control study was to devise a drape system to control the droplet spray during mastoidectomy.

Methods | The procedure was carried out on a cadaveric temporal bone in an operating room with a surgeon and a surgical technician. The Zeiss Exitar 300 microscope (Carl Zeiss Meditec AG) was covered with a Zeiss-brand microscope drape. Two different clear drapes were then attached to the lens cap apparatus: the Steri-Drape 1015 (3M) and the C-Armor (Tidi). The Steri-Drape 1015 was attached to the microscope drape using the adhesive along the split and then zipped to itself, with the surgeon putting her arms under the drape. The much larger C-Armor drape was attached by making a 4- to 5-cm incision in the drape and then stretching it tightly around the lens cap cover apparatus of the microscope drape. Because of the large size of the drape, both forearms were inserted through 2 small cuts in the drape to keep a tight fit. Both drapes were then stretched over a Mayo stand at the patient’s head. The clear drape was attached to the surgical drape over the patient chest area using Ioban (3M) to limit aerosol spread toward the anesthesiologist. Mastoidectomy was then performed in the usual fashion under both drapes, with added methylene blue after the preferred drape was determined to look for gross droplet soiling as well as in a suction scavenger placed near the mastoid. The study was exempt from institutional review board review because it involved single use of deidentified cadaveric tissue.

Results | Surgical visualization was unimpeded with both drapes, and the collection of bone dust and droplets did not cause undue sagging of the drapes. While the split-drape adhesive design of the 1015 drape was easier to attach to the microscope, the C-Armor’s larger size gave much better coverage and overlap with the surgical drape (Figure I). Furthermore, visualization of the instruments for the technician...
was easier with the C-Armor rather than the matte finish of the Steri-Drape 1015. Although the surgical procedure was accomplished without the drape getting in the way, extensive irrigation and large bone dust and irrigation droplets were collected on the drape and inside the scavenger suction within minutes (Figure 2).

Discussion | The middle ear cleft is directly connected to the nasopharynx via the eustachian tube and therefore could be considered a possible route of spread for coronavirus or other infections. Furthermore, drilling of the mastoid creates a large cloud of irrigation and bone dust that can easily come in contact with facial skin or be inhaled. While the technique described here is far from airtight, it controls large droplet spray very well using readily available surgical drapes. Other large, clear drapes will probably adapt even better than the 2 tried in this study.

Mastoidectomy is usually an elective procedure and is typically deferred until severe infection is controlled. While rapid COVID-19 screening should ultimately diminish the risk of infecting surgical staff, false negatives will occur, especially in asymptomatic early infections. The risk to the surgeon and staff should be evaluated according to risk stratification protocols, and proper N95 masks and personal protective equipment should be used when indicated. However, it has been our observation that using a microscope with a face shield is virtually impossible, and the method described herein avoids the need for face shields to allow for otherwise normal drilling conditions.

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Negative-Pressure Aerosol Cover for COVID-19 Tracheostomy

Because of the high virulence of the novel coronavirus responsible for causing COVID-19, many patients infected with the virus become critically ill, requiring prolonged intubation, and may ultimately require tracheostomy. Mucosal surfaces have been shown to be reservoirs for high concentrations of the virus, which can become aerosolized for up to 3 hours following manipulation.1,2 Surgeons performing tracheostomies are at high risk for exposure, and recently published guidelines recommend against elective, non–time-sensitive procedures.3 In the event that a tracheostomy is indicated in a patient with confirmed or suspected COVID-19, interventions that limit the spread of aerosols are critical to reducing exposure.4,5 Here we present the creation of a novel negative-pressure aerosol cover made out of readily available operating room materials as an additional barrier to limit the spread of aerosols during tracheostomy.

Figure 2. Spray on Drape After 5 Minutes of Drilling
Methods | A patient was admitted to the hospital and required time-sensitive tracheostomy. The patient was negative for COVID-19 symptoms, and preoperative testing results for coronavirus were also negative. Written informed consent was obtained for the tracheostomy; however, we did not specifically obtain consent for the use of the cover because it was considered an extension of personal protective equipment. As a quality improvement safety initiative, formal institutional review board review was not required per our institution’s human research protection office guidelines.

Following intubation, the patient was prepared and draped in the standard manner. The laryngoscope suspension apparatus was placed at the head of the bed and was covered using an x-ray cassette drape. A sterile C-arm drape was cut along one seam and draped over the suspension arm and patient. A smoke evacuator and high-efficiency particulate air filtration unit was secured near the surgical field to create a negative-pressure environment. “Hand ports” for the surgeon and assistant were created by making 8-cm vertical cuts on each side of the tented drape in an ergonomic position for optimal movement during the procedure. An additional 20-cm horizontal “chest port” was cut into the drape to allow for passage of instruments to the surgeons. A flap was created over the chest port by applying an adhesive drape to cover the opening to limit aerosol spread while passing instruments. The tracheostomy was then performed using the standard surgical technique without complications (Figures 1 and 2). To allow safe removal of the drape, the high-efficiency smoke evacuator remained in effect while the cover was systematically folded starting from the center in a manner that continually kept the contaminated undersurface of the drape sequestered from contact. This was performed by 1 person to limit possible exposure to other members of the team.

Discussion | We present the creation of a negative-pressure aerosol reduction cover made out of readily available materials. We were able to perform a complete open tracheostomy procedure while operating entirely under this cover; however, as the highest risk for aerosolization begins when the airway is entered, it is reasonable to deploy the cover immediately prior to this portion of the procedure. The cover setup was generally easy to perform and able to be completed in less than 5 minutes. The plastic cover allows for generally good mobility of the surgeon’s hands; however, there is some limitation in forearm movement. Surgical instruments were able to be passed from the scrub technician to the surgeon with use of this cover. Although the drape used was translucent as a monolayer, there was some degree of glare if it became overlapped. This was overcome by changing one’s forearm position within the drape.

In patients with COVID-19 who require tracheostomy, limiting aerosol spread during the procedure is critical to reducing viral exposure of the health care team. We present the use of a novel negative-pressure aerosol reduction cover for use during tracheostomy. This cover was easy to create and deploy using readily available materials found in operating centers.

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The ability to detect and identify odorants was estimated using 5 odorants commonly used to test human olfaction: phenyl-ethyl-alcohol (flower rose), cyclotene (caramel), isovaleric acid (goatcheese), undecalactone (fruits), and ska-tolene (manure). The task was to detect and try to identify each odorant. None of these odorants were identified or detected by the patient.

The patient underwent a computed tomographic scan of the nasal cavity (Figure 1) that showed bilateral inflammatory obstruction of the olfactory clefts that was confirmed on magnetic resonance imaging (MRI) of the nasal cavity (Figure 2). There were no anomalies of the olfactory bulbs and tracts. Because her husband was also suspected to be infected by SARS-CoV-2, the patient underwent real-time polymerase chain reaction (RT-PCR) for SARS-CoV-2, which yielded positive results.

**Discussion** | Upper respiratory tract infection is one of the most commonly identified causes of olfactory loss, accounting for 22% to 36% of cases. Herein, we describe a patient with COVID-19 who presented with bilateral obstructive inflammation of olfactory clefts on imaging, which severely impaired the olfactory function by preventing odorant molecules from reaching the olfactory epithelium.

The origin of this obstruction remains unknown and has been reported in patients following a severe nasopharyngeal infection. However, in this patient no nasal obstruction or rhinorrhea was noticed. Trotier et al have reported persistence of the symptoms despite inhaled corticosteroids or oral corticoid treatments associated with antibiotics. In addition, corticosteroids should be avoided in patients infected by SARS-CoV-2.

**Figure 1. Nasal Cavity Computed Tomographic Image of Coronal Section**

Bilateral obstruction of the olfactory cleft (yellow arrowheads) without obstruction in the rest of the nasal cavities.

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**OBSERVATION**

**Sudden and Complete Olfactory Loss of Function as a Possible Symptom of COVID-19**

The novel coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infects the human respiratory epithelial cells. The clinical features of patients infected with SARS-CoV-2 included lower respiratory tract infection with fever, dry cough, and dyspnea. In contrast, upper respiratory tract symptoms are less common, suggesting that the cells targeted by the virus could be located in the lower respiratory tract.

Herein we present a case where the main symptom expressed by the patient infected by SARS-CoV-2 was the sudden and complete loss of the olfactory function without nasal obstruction.

**Report of a Case** | A woman in her 40s presented with an acute loss of the olfactory function without nasal obstruction. There was no dysgeusia because the patient reported no changes in salty, sweet, sour, and bitter. A few days before presentation, she also experienced a dry cough associated with cephalalgia and myalgia. She had no fever or rhinorrhea. The otoscopic and anterior rhinoscopic examination results (without endoscopic examination) were normal.