

Overview of Upper Airway Management During COVID-19 Outbreak: Head and Neck Surgeon's Perspective

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Abstract: At the end of December, 2019, a new virus was named severe acute respiratory syndrome coronavirus 2 appeared in Wuhan, China, and the disease caused is called as coronavirus disease 2019 (COVID-19) by World Health Organization, which to date having infected more than 3,588,773 people worldwide, as well as causing 247,503 deaths. A human to human transmission is thought to be predominantly by droplet spread, and direct contact with the patient or contaminated surfaces. This study aims to provide a comprehensive overview as well as to highlight essential evidence-based guidelines for how head and neck surgeon and healthcare providers need to take into consideration during their management of the upper airway during the COVID-19 pandemic safely and effectively to avoid the spread of the virus to the health provider.

Key Words: Airway, coronavirus disease 2019, laryngoscopy, overview, pandemic, severe acute respiratory syndrome coronavirus 2, tracheostomy

The novel coronavirus disease 2019 (also known as COVID-19) pandemic has spread with remarkable speed, thus posing significant challenges for healthcare systems and healthcare workers around the world.¹ To date, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) transmission is thought to be through respiratory droplets, direct contact with infected patients or surfaces, or aerosol transmission.^{2,3} Although there are many manifestations of COVID-19, commonly including symptoms such as cough, sore throat, dyspnea, anosmia, and nasal congestion, it primarily presents as a (viral pneumonia), with patients frequently requiring urgent upper airway management. Thus, COVID-19 poses a unique challenge to the head and neck surgeons worldwide, as the basis of the head and neck surgeon's job involves performing examination and procedures on the upper airway in close contact with the patient, exposing them to infected droplets and aerosols, and posing a significant threat to the operator.

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Received May 12, 2020.

Accepted for publication May 27, 2020.

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The authors report no conflicts of interest.
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ISSN: 1049-2275

DOI: 10.1097/SCS.0000000000006798

As such, head and neck surgeons require in depth knowledge about COVID-19 and SARS-CoV-2, as well as clear guidelines for how to manage upper airway disease during the SARS-CoV-2 pandemic, to minimize iatrogenic transmission of the disease and personal risk. This comprehensive overview will explore and highlight evidence based guidelines for how head and neck surgeon should manage the upper airway during the COVID-19 pandemic, from nasal and throat examination, fiberoptic laryngoscopy, difficult intubation, and tracheostomies.

TRANSMISSION

The main route of transmission of SARS-CoV-2 from person to person is through respiratory droplets, released when an infected patient coughs or sneezes, or through close contact with respiratory secretions such as during ENT examination.² There is also evidence of environmental contamination by SARS-CoV-2, with the viable virus being detected in aerosols up to 3 hours after aerosolization, 4 hours on copper, 24 hours on cardboard, and 2 to 3 days on plastic and stainless steel,²⁻⁴ as well as contamination of personal protective equipment,⁴ thus providing a source of infection through contact with contaminated surfaces followed by direct contact with the nasal cavity or oral cavity.

While the average incubation period of the virus is around 4 to 5 days,^{5,6} it is thought to reach up to 14 days.⁶ As such, presymptomatic transmission of the virus poses a major challenge in controlling its spread, as presymptomatic patients may be infectious.⁷

CLINICAL PRESENTATION

The COVID-19 presents with a wide range of clinical manifestations, the majority of which are ear, nose, and throat manifestations, as reported in numerous studies. Thus, head and neck surgeon need to be well informed on the possible head- and neck-related manifestations of COVID-19, and how to minimize the risk to themselves when performing procedures on COVID-19 patients.

Fever appears to be the most prevalent initial symptom of COVID-19, followed by dry cough, fatigue and myalgia.^{5,8-20} Less commonly, patients may present with sputum production, hemoptysis, headache, diarrhea, dyspnea, sore throat, rhinorrhea, nasal congestion,^{5,8-20} and even dizziness,¹⁰ with cough being the most prevalent ear nose and throat (ENT) manifestation of COVID-19.^{5,8-20}

Multiple reports have also shown that hyposmia/anosmia and dysgeusia are common symptoms of COVID-19, be it in association with other symptoms, or with patients presenting with isolated anosmia and dysgeusia in the absence of other symptoms of the disease.²¹⁻²⁵ Reports from South Korea show that up to 30% of COVID-19 patients had anosmia as a major presenting symptom. In Germany, almost 2 in 3 confirmed patients have anosmia.²¹ Other reports claim that between 20% and 60% of COVID-19 patients have some degree of loss of smell or taste.²³

CLINICAL DIAGNOSIS

In the presence of clinical suspicion of SARS-CoV-2 infection (presence of common symptoms, recent travel or exposure to known COVID-19 patients), an accurate diagnosis of COVID-19 is critical to control the spread of the disease. Currently, the most commonly used test to diagnose SARS-CoV-2 is the real time reverse transcriptase polymerase chain reaction (RT-PCR) test.^{2,26-34} Samples are most commonly taken using nasopharyngeal swabs,^{2,26-28,30-34} although sputum, endotracheal aspirate, oropharyngeal swabs, and bronchoalveolar lavage may be used as well.^{27,30,31} While RT-PCR is thought to be highly specific for SARS-CoV-2, its sensitivity is under question, with some studies showing it to range from 60% to 70%.²⁸ Thus, to rule out SARS-CoV-2 infection, we should obtain at least 2 negative RT-PCR tests from the patient.

The value of additional chest computed tomography (CT) findings in diagnosis COVID-19 has also been studied. The most common chest CT findings in COVID-19 patients were ground glass opacities and subsegmental consolidation. These findings were also found in asymptomatic patients.^{26–29} In 1 study, 97% of COVID-19 patients confirmed by RT-PCR tests showed positive findings on chest CT. The same study showed that of the COVID-19 patients studied, 59% had positive RT-PCR results and 88% had positive chest CT findings signifying the potential of chest CT in diagnosis of COVID-19.²⁹

AIRWAY MANAGEMENT CONSIDERATIONS: HEAD AND NECK SURGEON'S PERSPECTIVE

Head and Neck Examination

Head and neck examination, including endoscopic examination of the nose, pharynx, and larynx such as fiberoptic laryngoscopy, require close contact with the patient's upper airway, and expose the physician to respiratory droplets from the patient. Therefore, in the case of a COVID-19 patient examination, this would expose the physician to a high viral load of SARS-CoV-2, as the upper airway, nose, and nasopharynx have been shown to be reservoirs for high concentrations of SARS-CoV-2.^{35,36} Often, head and neck examination results in manipulation of the infected mucosa, as well as induction of cough, which can lead to aerosolization of SARS-CoV-2, with viral particles found to remain viable in the air for up to 3 hours.³ Thus, current recommendations state that the same precautions should be taken with head and neck examination and procedures of COVID-19 patients as with other aerosol generating procedures. Below is a list of aerosol generating procedures commonly performed by head and neck surgeon, classified as such by multiple international institutions and studies.

Aerosol generating procedures in ENT^{37–55}:

- Any examination or procedure performed on the aerodigestive tract (middle ear/nose/nasopharynx/oral cavity/oropharynx/hypopharynx/larynx/esophagus)
- Open suctioning of nasal or airway secretions (including tracheostomy suctioning)
- Sputum induction
- Nasal endoscopy
- Flexible laryngoscopy
- Nasogastric tube placement
- Bronchoscopy
- Endotracheal intubation or extubation
- Tracheostomy and tracheostomy procedures

Therefore, when examining or performing any ENT procedure on a suspected/confirmed COVID-19 patient, we recommend using the appropriate personal protective equipment (PPE) in accordance with international guidelines and studies. Studies have shown that proper use of PPE and standard protective measures can significantly reduce the rate of infection of healthcare workers.^{56–58}

Appropriate PPE for head and neck examination and procedures on a COVID-19 patient^{40–47,49–55,59–64}:

- Proper hand hygiene before and after patient contact
- Use of disposable gloves (separate gloves for each patient seen) (double gloving preferred)
- Use of a properly fit tested FFP2/N95 of FFP3/N99 mask (surgical mask is insufficient)
- Use of a disposable, fluid repellent surgical gown, and head cover

- Use of eye protection, preferably face shield. If unavailable, then use goggles

If the above PPE is unavailable, the examination should be postponed until proper protective equipment is made available to the physician. In addition to the above guidelines^{40–46,51,52,54,55,59,60,63,64}:

- Proper donning and doffing protocols must be followed in all situations
- All PPE should be single use only
- The examination/procedure should take place in a negative pressure room, or in an isolation ward allocated for COVID-19 patients
- Only the healthcare staff required to perform the examination/procedure should be present in the room, and if possible, only the most senior or experienced staff member.
- All nonurgent examinations or procedures should be delayed to minimize unnecessary risk to healthcare personnel.

Fiberoptic Laryngoscopy

As mentioned previously, flexible laryngoscopy is among the most common diagnostic procedures performed in airway examination, exposing the physician to the respiratory droplets of the patient, and commonly inducing cough/gag reflex. As such, it is considered an aerosol generating procedure. Below we highlight general guidelines for the performance of flexible laryngoscopy on a confirmed/suspected COVID-19 patient:

- Flexible laryngoscopy should only be performed if absolutely indicated, such as in patients with hemoptysis, dysphagia/odynophagia limiting oral intake, or airway compromise. All nonurgent patients should be delayed.^{44,45,55,60,65}
- The procedure should be done by the most experienced/senior healthcare staff present, without the presence of observers.^{55,60,65}
- The procedure should take place in a negative pressure room or isolation room.^{44,60,55,65,66}
- Appropriate PPE protocol as outlined above must be followed throughout the procedure.
- The patient should wear a surgical face mask throughout the examination, brought below the nose for the transnasal scope, to protect the examiner from droplets if the patient coughs.^{44,55,65}
- Topical anesthesia should be used to minimize discomfort to the patient. Anesthetic gel or anesthetic coated swabs should be used. Atomized anesthetics or anesthetic sprays should be avoided, to reduce aerosolization of viral particles.^{44,60,65}
- If a video screen to project the examination to is available, it should be used to keep a distance between the physician and the patient.⁶⁰
- A disposable endoscope sheath must be used for each examination if available.⁶⁰
- Laryngoscope disinfection should be done immediately after the procedure is performed. The laryngoscope should be placed in a closed container/protective cover before leaving the room, and transported for high level decontamination. The healthcare worker transporting the laryngoscope must wear appropriate PPE during transport (double gloves, N95 mask, surgical gown, eye protection). The laryngoscope must not be used on another patient until full decontamination has taken place.^{44,60,55,65–67}
- The room where the examination has taken place must be sanitized after each endoscopy, with all exposed surfaces fully disinfected.^{44,55,65,66}

Tracheostomy

Tracheostomies are of the most common emergency airway surgeries performed by head and neck surgeon. Given that COVID-19 commonly presents as a viral pneumonia, with critically ill patients often requiring mechanical ventilation,^{68–71} it is expected that the number of tracheostomies required for these patients will surge during this pandemic. Performing tracheostomies on critically ill/mechanically ventilated COVID-19 patients may offer a variety of benefits, such as decreased risk of subglottic stenosis, decreased intensive care unit stay, decreased airway resistance, decreased need for sedation, improved pulmonary toilet, and in some patients, decreased mortality rate.^{55,69–74} As highlighted before, surgical tracheostomies are considered high risk aerosol generating procedures, bringing the surgical team in close contact with the respiratory secretions of the patient for prolonged periods of time. As such, it is crucial to develop a clear guideline for head and neck surgeon and anesthesiologists to follow to protect healthcare staff involved in this procedure, while still providing the care required for critically ill patients. Below, we aim to highlight and review evidence-based guidelines and protocols for safely performing tracheostomies during the COVID-19 pandemic.

General guidelines:

- Any case of emergency tracheostomy should be dealt with as a COVID-19-positive patient, even if COVID status is unknown, as delaying the surgery to wait for results can lead to patient death.^{46,75}
- Performing tracheostomy on nonurgent patients should be delayed as much as possible. If there is an alternative to tracheostomy, such as intubation, it should be performed instead.^{60,73,75,76} In the case of a reversible cause of airway obstruction, intubation is also preferred.^{46,75} The best time to perform tracheostomy on a mechanically ventilated COVID-19 patient to reduce the risk of subglottic stenosis is widely debated considering the high viral load present early on in the disease and the risk to healthcare personnel. Therefore, the decision should be made on a patient to patient basis, balancing the risks of performing tracheostomy to the patient and the healthcare staff, and the possible benefits to the patient.^{60,70,71,73,76}

Surgical considerations:

- The procedure should ideally be performed in a negative pressure operating theatre.^{55,68–71,73,74,77,78}
- Only the most senior/experienced healthcare staff available should be present.^{70,71,73–75,78}
- Appropriate PPE should be used by all staff involved in the procedure as highlighted above (N95 mask, coverall, surgical gown, double gloves, head cover, shoe cover, face shield).^{68–71,73–75,77–80} Some studies recommend the use of a powered air purifying respirator if available, as tracheostomy involves prolonged exposure to infected respiratory droplets.^{45,55,68,70,71,76,77} Proper donning and doffing protocol for PPE must be followed.
- If the patient is intubated, when switching from the ventilator to the anesthetic machine, the endotracheal tube should be clamped temporarily to avoid aerosolization of viral particles.⁷⁸
- Before starting the procedure, deep closed-circuit suctioning of the endotracheal tube should be done.⁷⁸
- Deep neuromuscular blockade with complete paralysis of the patient should be achieved to minimize cough reflex.^{60,68,72,77,70,78,74,71,76}
- Endotracheal tube should be advanced with the cuff reaching distal to the tracheal window site, to reduce airflow

through the surgical tracheotomy. Cuff should be hyperinflated.^{69,70,72–74,76–78}

- Preoxygenation with PEEP: When adequate oxygenation is achieved, cease ventilation after an exhalation.^{71,73,74,77,78}
- Incision to create tracheal window, while avoiding damaging the endotracheal tube cuff.^{46,69,71,76–78} (electrocautery should be avoided to reduce vapor plumes)^{71–73}
- Ventilation must be stopped with endotracheal tube clamped, followed by deflation of the ETT cuff, and lifting the tube until the bottom portion lies just proximal to the tracheal window.^{46,60,68,69,71,73–78}
- Insert cuffed, nonfenestrated tracheostomy tube, remove introducer and replace it with nonfenestrated inner tube connected to a heat and moisture exchanger, and immediately inflate tracheostomy tube cuff. Reattach the circuit and resume ventilation.^{70,71,73,74,76–78}
- Once tracheostomy tube position is confirmed (using end tidal CO₂ values to avoid contamination of stethoscope), clamped endotracheal tube can be removed and discarded.^{70,71,74–78}
- Securing the tracheostomy tube with stay sutures and dressing.
- Avoid tracheostomy change until COVID-19 status is negative. Avoid changing dressing unless absolutely necessary.^{60,70,72,74,75,77}

CONCLUSION

As evidenced by this overview, head and neck surgeons are among the most at risk healthcare personnel during the COVID-19 pandemic, with most head and neck examinations and procedures on the upper airway routinely done exposing them to respiratory droplets and possibly high viral loads of SARS-CoV-2, and posing significant risk to their wellbeing. Being knowledgeable about COVID-19 and following protective guidelines and protocols, which this literature review has highlighted above, is therefore crucial to minimize personal risk, iatrogenic transmission of the disease, and to give the head and neck surgeons the confidence to deal with the upper airway during the COVID-19 pandemic safely and effectively.

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