



Review Article

Airway management of angioedema patients during the COVID-19 pandemic

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Abstract *Importance:* The COVID-19 pandemic is characterized by high transmissibility from patients with prolonged minimally- or asymptomatic periods, with a particularly increased risk of spread during aerosol-generating procedures, including endotracheal intubation.

Observations: All patients presenting with upper airway obstruction due to angioedema during this time should be carefully managed in a way that is safest for both patient and provider.

Conclusions: For patients requiring emergent airway management during the COVID-19 pandemic, minimization of aerosols while taking the necessary precautions to protect health-care workers should be critical principles for their management.

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Background and purpose

The novel coronavirus SARS-CoV-2, which is responsible for the disease known as novel coronavirus disease 2019 (COVID-19), has caused a global pandemic characterized by rapid respiratory decompensation and subsequent need for endotracheal intubation and mechanical ventilation in severe cases.^{1,2} The virus is highly transmissible through droplets but can also be spread via aerosols created during aerosol generating procedures (AGPs) such as intubation and endoscopy.^{3–5} Current recommendations aim to minimize the generation of aerosols as much as possible, including through the avoidance of nebulizers, mucosal topical treatments, and bronchoscopy. However, given the high rates of minimally-, pre-, or asymptomatic COVID-19 patients, it has become necessary to treat all patients as positive until proven otherwise in order to protect health-care workers from avoidable occupational exposures.

Here we seek to present the best practices based on the available literature for airway management in patients with upper airway obstruction, in which intubation via direct or video laryngoscopy would pose a significant challenge. For cases such as angioedema, awake fiberoptic intubation is typically preferred when securing the airway as the use of medications that cause muscle relaxation and decreased airway tone for direct or video laryngoscopy may lead to a “cannot ventilate, cannot intubate” situation. However, awake fiberoptic intubation often involves adequate topicalization for mucosal anesthesia, instrumentation of the nasopharynx, and significant coughing with endotracheal tube placement, all of which are highly aerosolizing and can increase the risk of transmission.

The purpose of these guidelines is to determine an algorithm for management of upper airway obstruction, especially angioedema, in the COVID positive or unknown patient in a way that is safest for both patient and provider.

Triage and initial management

In patients presenting with upper airway swelling or obstruction who are not in immediate respiratory distress, maximal medical therapy should be implemented immediately. For patients with angioedema, this includes systemic antihistamines (H1 and H2 blockers) and high dose steroids. Systemic epinephrine administered intramuscularly or subcutaneously should also be considered if the process appears to be anaphylactic or allergic-mediated. Fresh frozen plasma has also been described as a treatment option for angiotensin-converting enzyme inhibitor-induced angioedema.⁶ Tranexamic acid is also an option in this instance.⁷ For cases of hereditary angioedema, bradykinin pathway inhibitors should also be administered if available.

Assessment of the patient should include a complete head and neck exam as well as fiberoptic evaluation of the upper aerodigestive tract. Because these procedures can also be potentially aerosol-generating, appropriate PPE should be worn. This includes a powered air-purifying respirator (PAPR) or an N95 mask with closed eye protection, as well as gown and gloves. A PAPR and appropriately fitted N95 with closed eye protection may be considered to be equivalent in their ability to reduce transmission of

SARS-CoV-2, though no randomized studies exist comparing the two.⁸ Topical anesthesia should be avoided. The fiberoptic exam should assess the degree and levels of obstruction to help guide further management. In addition, a targeted airway ultrasound may be performed to obtain a baseline assessment of airway edema, if the provider has expertise in airway evaluation through this modality.⁹ Ultrasound evaluation can be limited by anatomical variables including a short neck and obesity.

If available, rapid SARS-CoV-2 testing should be performed if the patient is stable enough to tolerate the test in order to guide PPE use for non-AGPs and overall patient care following acute airway management.¹⁰ However, if the patient requires urgent airway management, care should not be delayed in order to perform the test or in anticipation of the final test result. In such cases, testing should be deferred until the patient is stable. Given the high rate of asymptomatic COVID-19-positive patients, the PPE described above should be worn by the treatment team during any AGP.

Escalation of care

Frequent clinical reassessment of the patient’s symptoms must be performed. If the patient remains clinically stable, the airway may be serially reassessed through ultrasound as described previously.⁹ Frequent fiberoptic reexaminations are not recommended due to their aerosol generating potential. Signs of increased work of breathing, stridor, hoarseness, intolerance of secretions, worsening swelling, fatigue, and oxygen desaturations despite maximal medical management should prompt the provider to prepare for intubation.

Recommendations for performing awake fiberoptic intubation in COVID-19 positive or patients under investigation

Location

The procedure should be performed in a negative pressure room to minimize the risk of transmission.

Personnel

Team members in the room should be kept to the minimal critical number, and preferably with highly experienced personnel. Three people should be present (one maneuvering the fiberoptic scope, one assisting with tube advancement, and one administering anesthesia).

Proper donning and doffing of PPE for each person in the room is essential. As an intubation is considered an AGP, airborne and droplet precautions should be followed. Each person should wear a PAPR or an appropriately fitted N95 mask with closed eye protection, as well as gown and gloves. Higher rates of transmission in health-care workers has been shown in groups who did not wear PPE for airborne precautions.¹¹

Procedure

Minimizing aerosolization during the procedure itself is critical. An oral fiberoptic intubation is preferable, as instrumentation of the nasal cavity and nasopharynx should be avoided due to the higher viral load in the nasal cavity and nasopharynx compared to the oral cavity and oropharynx.¹²

Anesthesia

Nebulized or atomized topical anesthesia should be avoided. Topicalization should be performed with liquid or viscous lidocaine that can be swished and gargled by the patient. Lidocaine ointment should also be applied to the posterior oral tongue, base of tongue, and palate via a coated oral airway device. Local nerve blocks are preferred, including bilateral superior laryngeal nerve blocks and bilateral glossopharyngeal nerve blocks.¹³ These can also be performed under ultrasound guidance for improved efficacy.¹⁴ Transtracheal injections should be avoided to reduce coughing.

Sedation should be used with extreme caution. Dexmedetomidine affords relative protection of respiratory drive while producing anxiolysis and some drying of secretions.¹⁵ Opioids are all respiratory depressants and should be used with caution but can afford profound cough-suppression that is important in the COVID-19 patient. Remifentanyl is an ultra short-acting opioid (half-life 3 min) that has been used as a primary sedative for awake airway management.¹⁶ Similarly, ketamine is a sedative that preserves respiratory drive and produces dissociative sedation and reflex blunting that can facilitate airway management.¹⁷ Glycopyrrolate may also be given to reduce the amount of secretions.

Intubation

Once adequate anesthesia and sedation has been achieved, an endoscopy mask should be secured to the patient, which would assist in containing secretions and aerosols generated from coughing during the procedure while still allowing access for the scope and passive oxygenation.¹⁸ The mask contains a central membrane with a small port to accommodate the fiberoptic scope and endotracheal tube while creating a seal around the tube (Fig. 1).



Fig. 1 An endoscopy mask can be used to create a seal around the endotracheal tube and fiberoptic scope while minimizing the spread of aerosolized secretions during the procedure and providing passive oxygenation to the patient (Courtesy of <https://aam.ucsf.edu/article/endoscopy-mask>).

A disposable bronchoscope is preferred. Once the vocal cords are visualized, final topicalization with 2–3 ml of 2% or 4% lidocaine solution through the bronchoscope directly onto the vocal cords and into the trachea may be performed. Previously administered medications and nerve blocks should help reduce coughing from this maneuver. This final administration of topical anesthetic should help to minimize vigorous coughing once the scope and endotracheal tube are advanced past the vocal cords.

Once the endotracheal tube is placed and the scope is removed, the cuff should be fully inflated and a viral filter should be placed in line with the circuit. Ventilation should not commence until this is performed. Tube placement should be confirmed with end tidal CO₂ and appropriately secured. Hospital protocol for decontamination of non-disposable equipment exposed to secretions of COVID-19 patients upon completion of the procedure should be followed. Management of intubated patients should follow standard hospital guidelines depending on COVID-19 status.

In the event of rapid progression and failure of intubation, providers should be prepared for an emergency surgical airway in a “can’t intubate, can’t ventilate” situation. Given the high degree of aerosolization in an emergency surgical airway, adopting an approach of early oral intubation is preferred and recommended.

Recommendations for extubation

Standard criteria for extubation should be followed, using cuff leak to help determine candidacy. A fiberoptic examination prior to or immediately following extubation is not recommended for the aerosol-generating potential. Decisions for reintubation should be made on clinical findings, including a complete head and neck exam as well as consideration of repeat airway ultrasound. Unless the patient has been proven to be COVID-negative based on testing and overall clinical picture, extubation should be performed in a negative pressure room. The number of providers in the room should again be kept to a minimum essential number and appropriate PPE (PAPRs or fitted N95 with closed eye protection) should be worn by all.

Key points

- Maximal medical management should be immediately initiated in patients presenting with angioedema of the upper airway
- The decision to escalate to awake fiberoptic intubation should be based on worsening signs and symptoms of upper airway obstruction but should not include repeated flexible fiberoptic examinations due to their aerosol-generating potential.
- Aerosols should be minimized or contained as much as possible through avoidance of nebulizers, topical sprays, or any cough-inducing maneuvers.
- Appropriate PPE should be worn at all times during AGPs, including flexible fiberoptic laryngoscopy and fiberoptic intubation

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Declaration of Competing Interest

All other authors have no other disclosures or conflicts of interest.

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