Evidence-Based Guidelines for Management of Head and Neck Mucosal Malignancies during the COVID-19 Pandemic

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Due to the current Coronavirus Disease 2019 (COVID-19) pandemic, otolaryngologists face novel challenges when treating patients with head and neck cancer. The purpose of this review is to evaluate the current evidence surrounding the management of these patients during this pandemic and to provide evidence-based recommendations with attention to increased risk in this setting.

Data Sources

A review of the literature was performed using PubMed. Because recently published articles on this topic may not yet be indexed into PubMed, otolaryngology journals were hand searched for relevant articles. Guidelines from national organizations were reviewed to identify additional relevant sources of information.

Review Methods

Two groups of search terms were created; one with terms related to COVID-19 and another with terms related to head and neck cancer and its management. Searches were performed of all terms in each group as well as combinations of terms between groups. Searches and subsequent exclusion of articles was performed in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Additional articles were identified after relevant journals and guidelines from national organizations were reviewed.
Conclusions

Patients with head and neck mucosal malignancy require continued treatment despite the current pandemic state. Care must be taken at all stages of treatment to minimize the risk to patients and healthcare workers while maintaining focus on minimizing use of limited resources.

Implications for Practice

Patient care plans should be guided by best available evidence to optimize outcomes while maintaining a safe environment in the setting of this pandemic.
Introduction

In November 2019, a novel respiratory illness, Coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), emerged in Wuhan in the Hubei province of China.\(^1\) Since that time, COVID-19 has spread rapidly around the world and has been designated as a pandemic by the World Health Organization (WHO).\(^2\) COVID-19 has many presentations ranging from asymptomatic to lethal disease. Many symptomatic patients report fever, cough, fatigue, shortness of breath, headache, myalgias, and sore throat.\(^1\) It has been reported that the secretions of the nasopharynx and oropharynx have particularly high viral load, putting otolaryngologists at particularly high risk.\(^3,4\) In fact, the first reported physician fatality was that of an otolaryngologist in Wuhan.\(^5\) It is also important to note that the viral load is similar in asymptomatic and symptomatic patients, making asymptomatic patients a significant risk for transmission of the disease.\(^3\) While many otolaryngologic operations are elective and can be delayed until the pandemic is under control, treatment of patients with head and neck mucosal malignancy cannot be deferred for an extended period of time. These patients not only represent a high-risk group for spreading the virus during intervention, but also have a higher risk of severe disease if they are infected.\(^1\) Furthermore, management of these patients increases the risk of infection among healthcare workers, including otolaryngologists, which could result in further spread of SARS-CoV-2 and limit the number of healthy healthcare workers who can care for patients. For these reasons, special attention is required to ensure safe and appropriate care of this important subset of patients.

On April 8, 2020, the number of cases of COVID-19 exceeded 1.5 million worldwide with 431,838 cases in the United States.\(^6\) The death toll continues to climb with 88,444 deaths around
the globe and 14,768 deaths in the United States. As these numbers began to rise, it became clear
that regulations were needed to minimize the spread and impact of this pandemic. On March 13,
2020 the American College of Surgeons (ACS) released a statement recommending the cessation
of elective surgical procedures.\textsuperscript{7} The ACS presented a tiered system for determining surgical
acuity. Tier 3 represents high acuity surgery with the recommendation to proceed with
intervention. Virtually all head and neck mucosal malignancy falls into this category as delay in
treatment could lead to increased risk of morbidity or mortality. However, significant concern
has been raised regarding the increased risk of spread of disease when operating on the mucosal
surfaces of the head and neck given the increased viral load in this area with the potential for
aerosolization of viral particles.\textsuperscript{8}

Guan et al. evaluated the impact of comorbid disease states on outcomes of 1,590 patients
infected with COVID-19 throughout China between December 11, 2019 and January 31, 2020.\textsuperscript{1}
They found that patients diagnosed with COVID-19 with preexisting comorbidities such as
hypertension, cardiovascular disease, cerebrovascular disease, diabetes, hepatitis B infection,
chronic obstructive pulmonary disease, chronic kidney disease and malignancy were at increased
risk of severe disease states. Patients with these comorbidities were more likely to require
admission to the intensive care unit (ICU) or invasive ventilation and progress to death. Notably,
after adjusting for age, smoking status, and COPD, malignancy had the highest risk (HR 3.50,
95\%CI 1.60-7.64) of disease progression to these severe endpoints compared to all
comorbidities. With this in mind, it is critical that we consider not only mechanisms for
protection of healthcare workers when treating these patients, but also the need for special
emphasis on protection of this at-risk patient population.
The goal of this review is to evaluate the current evidence surrounding the management of patients with mucosal malignancies of the head and neck and to provide evidence-based recommendations for the care of these patients at all stages of treatment with attention to the increased risk posed to both patients and providers. A summary of these recommendations is in Table 2.
Methods

Search terms were determined and divided into two groups. Group 1 included terms related to COVID-19. Group 2 included terms related to head and neck mucosal cancer and its management. The full list of search terms is shown in Appendix 1. Pubmed Central was queried on April 8, 2020 for all of the search terms. In addition, searches were performed with each of the Group 1 search terms and Group 2 search terms (e.g. “COVID-19” AND “head and neck”). Duplicates were removed. Non-English articles and those not relevant to either the Group 1 or Group 2 terms were excluded. The Pubmed searches and subsequent exclusion of articles was performed in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and reported with the PRISMA flowchart.9

Because of the concern that recently published articles may not have been indexed into Pubmed at the time of the search, otolaryngology journals were hand searched for relevant articles. Guidelines from national organizations were reviewed to identify additional relevant sources of information. After reviewing the best evidence available, recommendations and guidelines were developed by the authors. Topics of uncertainty were also developed and these were stratified by level of uncertainty into two groups (no evidence to develop recommendations and limited evidence to develop recommendations).
Discussion

The database search was performed as described above. The number of search results and unique publications is shown in Table 1. Forty additional articles were identified after relevant journals and guidelines from national organizations were reviewed. The search strategy proceeded as described, which yielded a total of 45 articles to be included in this evidence-based review (Figure 1). These were reviewed by the authors; guidelines and recommendations were developed. Summary recommendations are shown in Table 2. Areas of uncertainty are shown in Table 3.

Initial Assessment

Despite the risks identified for transmission of COVID-19 during the physical exam of patients with head and neck mucosal malignancies, their treatment cannot be delayed due to increased risk of morbidity and mortality. Patient referrals for evaluation of newly identified malignancy should continue despite the pandemic. Centers for Medicare & Medicaid Services (CMS) has expanded telemedicine access during the pandemic. This type of patient-physician interaction has quickly become more common for evaluation and management of patients, but may be less appropriate for patients with new diagnoses of head and neck mucosal malignancy. Physical exam of these patients is critical in order to determine the extent of involvement of mucosal and soft tissues as well as potential fixation of the lesion to underlying bone. This exam, in conjunction with imaging, is necessary to ascertain the most appropriate treatment paradigm. A new diagnosis of head and neck malignancy is understandably a difficult emotional experience for the patient and their families. Patients often seek comfort and guidance from the interactions with their surgeon. Operations for head and neck mucosal malignancies often carry a high level
of morbidity that inevitably changes the life of the patient in dramatic ways. Discussion of these
types of procedures are highly anxiety provoking. While some of this discussion could be carried
out through telehealth modalities, it is likely reassuring to a patient to have met their surgeon in
person at least once prior to these discussions when possible.\textsuperscript{10}

Many mucosal lesions of the head and neck are located in difficult to examine areas and require
mirror examination or flexible fiberoptic laryngoscopy (FFL) for visualization. Although FFL is
often part of the standard head and neck exam, the COVID-19 pandemic has led to the need for
special consideration of these procedures in the clinic setting. FFL has been designated an
aerosol generating procedure due to the disruption of the mucosal surfaces known to harbor high
viral loads of COVID-19.\textsuperscript{4,8} The CDC recommends that aerosol generating procedures performed
on COVID-19 positive patients should be performed in negative pressure rooms, not commonly
found in the outpatient clinic setting.\textsuperscript{11} Additionally, high level personal protective equipment
(PPE), including gown, gloves, eye protection, and at least an N-95 respiratory are required.
Because testing remains limited and asymptomatic infection is common, all patients should be
managed as if they are COVID-19 positive to minimize the risk of unknown exposure and
transmission.

The necessity of FFL should be considered carefully, and in the midst of this pandemic should be
reserved for truly necessary or life threatening conditions. If it is determined to be necessary,
appropriate precautions should be taken. Full PPE is required for the provider throughout the
duration of the procedure and the remainder of the visit as viral particles have been shown to
remain aerosolized for up to three hours and can live on solid surfaces for days.\textsuperscript{12} All
nonessential people should be excused from the room during the procedure and for the remainder of the visit. Patients are often decongested and anesthetized using high pressure aerosolized spray. These sprays risk aerosolizing viral particles and should be replaced with application of these medications by saturating pledgets and placing them intranasally. It is best if the procedure is done utilizing video capabilities rather than looking through the eye piece in order to increase distance between the face of the provider and the face of the patient. If available, disposable flexible laryngoscopes should be used in order to minimize possible exposure during transportation and cleaning. If reusable scopes are utilized, they should be completely covered at the conclusion of the procedure and taken directly for cleaning. Since it has been shown that his virus persists in the air and on solid surfaces, the room should be properly decontaminated after any aerosol generating procedure. Patients are often referred to head and neck surgeons with incomplete work up. If biopsy has not been obtained to confirm the diagnosis, this can often be performed in the office setting. Given mucosal barriers will be breached and viral particles could be aerosolized, the same care should be taken with all biopsies as was described for FFL.

Patients undergoing treatment for malignancy often rely heavily on their friends and family for support. They often bring one or more people to their initial visit and attention should be given to ensuring that these family members are also protected throughout the visit due to high risk of exposure. If they are to be present during the procedure, they also require full PPE. As PPE is limited, strong consideration should be given to asking family members to leave during the procedure. Once the procedure is completed all parties should reconvene in a clean room to continue discussion. It is also important to consider the risk of the patient developing COVID-19 between the initial visit and their surgery date. Testing remains limited so consideration could be...
given to asking patients and those with whom they are in frequent direct contact with to self-quarantine during this critical time to minimize their risk of contracting the disease. This is especially important given the risk of severe presentations of COVID-19 infection in the setting of malignancy.¹

**Determination of Treatment Plan**

Decision-making in patients with head and neck mucosal cancer is complex and is best performed in a multidisciplinary fashion, which has been shown to improve outcomes.¹³⁻¹⁵ Decision-making should be guided by National Comprehensive Care Network (NCCN) guidelines as well as individual factors: chances of oncologic cure, anticipated effects on quality of life, potential side effects of treatment, ability of patient to tolerate treatment, patient comorbidities and frailty, and patient pre-treatment functional status.¹³⁻¹⁵ During the COVID-19 pandemic, decision-making with consideration of this added factor is likely best made with a similar multidisciplinary approach. Factors to consider include the patient’s risk of infection, risk to healthcare providers, and risk to the community, especially if the patient resides in a group setting (e.g. long-term care facility (LTCF)).

Much of the initial decision-making is whether the patient will undergo surgical treatment or non-surgical treatment up front. NCCN guidelines recommend surgery for resectable oral cavity cancers.¹⁶ Therefore, for these cancers, surgery will often be chosen during the current pandemic. However, timing of surgery has to be dependent on local and regional factors (i.e. impact of COVID19 pandemic, availability of healthcare resources including PPE) and the patient-related factors described above. The risks of delaying surgery (i.e. progression of disease, need for more
extensive surgery, and the possibility of the cancer becoming unresectable) should be weighed
with the infectious risks incurred when proceeding with surgery. Furthermore, local availability
of preoperative testing for COVID-19 could influence timing decision.

Some head and neck mucosal malignancies will require microvascular free tissue transfer for
reconstruction. Given the amount of resources required for patients undergoing these procedures,
close attention to decision-making is required. Current evidence shows variability across
institutions regarding microvascular reconstruction practice patterns during the COVID-19
pandemic.

With the exception of T4a cancers, most oropharyngeal, laryngeal, and hypopharyngeal cancers
can be treated with either surgical or non-surgical modalities, with comparable outcomes, even
though some patients may require surgical salvage if treated with definitive
radiation/chemoradiation. For cases in which surgery and non-surgical treatment are
comparable from an oncologic and functional standpoint, it is unclear how best to treat those
patients. It is important to weigh the COVID-19-related risks of surgery (as described above) as
well as the COVID-19-related risks of radiation/chemoradiation (repeated visits,
imunosuppression).

Patients who are surgical candidates require preoperative medical clearance. In addition, it is
important to assess perioperative risk to allow for quality improvement and appropriate decision-
making. Older age, male sex, smoking, anticoagulation, recent weight loss, functional
dependence, free tissue transfer, tracheotomy, duration of surgery, wound classification, anemia,
leukocytosis, and hypoalbuminemia were associated with increased risk of postoperative adverse events and death in a study using data from the American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP). An analysis using the National Inpatient Sample showed that increasing age, male sex, higher number of comorbidities, and metastatic cancer were associated with increased in-hospital morality. Many of these patient-level variables for adverse events overlap with the variables associated with COVID-19 severity and mortality. Therefore, the decision about whether to proceed with surgery should only occur with close attention to these patient factors.

Operating Room Management

Operating on the mucosal surfaces of the upper airway has been reported to have increased risk of COVID-19 transmission due to the high viral load in this region and in the saliva itself. Head and neck operations cause extensive disruption of the mucosal barriers and working in pooled saliva is inevitable. With this risk in mind, patients should ideally be tested for COVID-19 within 48 hours of surgery and preferably undergo a second test within one day of surgery. If both tests are negative, surgery should continue as planned. This strategy requires the availability of rapid testing and is still not an option at many institutions. Another strategy has been a single test 48 hours prior to surgery with the patient being quarantined after the test; this would only be reliable if the specific test being used has a high level of accuracy. Currently, COVID-19 testing remains limited; testing that is completed is fraught with a higher than desired rate of false negative results. This leads to a situation in which the surgical team is potentially uncertain of the true COVID-19 status of a patient. Given the rate of asymptomatic disease, patients with an unknown status should be treated as if they were COVID-19 positive and appropriate
precautions should be employed. If testing is not available, the patient should be assumed COVID-19 positive and all precautions should be taken.

Since risk of potential aerosolization of viral particles and transmission of disease is significant, the operating room staff should be informed of these cases in advance to allow time for proper preparation and resource delegation. These cases should be performed in negative pressure operating rooms. All members of the surgical team should don full PPE including disposable gowns, disposable surgical caps, gloves, and at least N95 respirator with face shield with preference for powered air-purifying respirator (PAPR). Only essential and highly experienced personnel should be in the room to minimize the risk of lapses in protective measures. It has also been suggested to use adhesive and sterile drapes to separate mucosal from non-mucosal sites (e.g. separating oral cavity from neck dissection) during surgical resection to minimize risk to operating room staff.

Airway Management

Managing the airway of a patients with head and neck mucosal malignancies often presents significant challenges to even the most seasoned teams under the best conditions. COVID-19 has introduced a new level complexity to airway management in these already challenging patients. When a variety of clinical specimens were evaluated in patients with known COVID-19, it was found that the highest viral load was present in specimens from bronchoalveolar lavage, followed by sputum cultures. Airway interventions were reviewed systematically and subsequently ranked in order of risk of aerosol generation; intubation had the highest risk of aerosol generation. The high viral load in the sputum and respiratory tract combined with the
The generation of aerosolized viral particles during intubation make head and neck mucosal cancer patients a particularly high risk group.

Because of the risks associated with airway management, it is recommended that the most senior team member perform all airway interventions. This is of particular importance in the head and neck malignancy population as they often present with distorted and difficult anatomy. Additionally, all nonessential team members should be excused from the operating room during manipulation of the airway (and procedures involving the mucosa of the head and neck).

Many common airway interventions have been classified as aerosol generating procedures including bag mask ventilation, disconnecting the ventilatory circuit, tracheal suction in an open system, and extubation; the number of aerosol generating procedures should be minimized or avoided when possible. Although supportive literature is lacking, Cheung et al. recommend placement of a supraglottic device instead of bag mask ventilation when required as this is more likely to create a seal and minimize aerosolization of the virus. Flexible fiberoptic intubation is often considered in the airway management plan of patients with head and neck malignancy as direct laryngoscopy is often difficult. Flexible laryngoscopy and bronchoscopy are also noted to be aerosol generating procedures and should be avoided when possible. However, it should be considered if this is the safest means of securing a patient’s airway. If flexible fiberoptic intubation is required, video should be set up to ensure the practitioners face is further from that of the patient. When possible, disposable airway management tools should be used in order to minimize risk of transmission from handling this equipment for processing and cleaning.
The need for tracheotomy in many patients with mucosal malignancy of the head and neck is an important consideration in the setting of the COVID-19 pandemic. Tracheotomy and the associated post-operative care are aerosol-generating procedures. Tracheotomy should be avoided when possible; but when indicated, all safety precautions must be implemented. All tracheotomies should be performed in a negative pressure room. Tay et al. performed a retrospective review of tracheotomies performed during the Severe Acute Respiratory Syndrome (SARS) outbreak in 2003 and recommended the following strategies to minimize risk of aerosolization of the virus: complete paralysis to avoid coughing, stop ventilation prior to entering the airway, and reduce suctioning during the procedure.\textsuperscript{30} Of note, open tracheotomy is thought to be lower risk than percutaneous methods given the need for flexible bronchoscopy and serial dilation of the trachea required to perform the latter procedure. For these reasons, open tracheotomy was the preferred surgical airway method during the SARS outbreak and is thus recommended when required in the setting of this current pandemic.

Postoperative Care

Patients often require postoperative inpatient care after surgical resection of head and neck mucosal cancers. This requires use of PPE and careful attention from staff, which are critical resources during the COVID-19 pandemic. Prior research has found that various institutions have developed strategies to optimize use of resources and minimize length of stay (LOS).\textsuperscript{31-33} These strategies include use of enhanced recovery after surgery (ERAS) protocols and clinical care pathways and as well as involvement of an inpatient coordinator. Utilizing these strategies during the COVID-19 pandemic will help preserve critical resources during this while minimizing LOS.
Many patients undergoing head and neck cancer resection have a tracheotomy, laryngectomy stoma, or an open mucosal defect (i.e. radical tonsillectomy defect). Appropriate PPE and precautions should be taken with these patients.\textsuperscript{34,35} Efforts should be made for timely (and safe) decannulation and discharge.

**Surveillance**

NCCN guidelines recommend routine surveillance for patients after treatment of the head and neck mucosal cancer. This includes a combination of history, physical examination, mirror or flexible fiberoptic examination of the larynx and pharynx, and imaging.\textsuperscript{16} Clinical surveillance intervals start at every one to three months and are then gradually lengthened. Although post-treatment surveillance is recommended, one study using data from Surveillance, Epidemiology, and End Results (SEER) showed that surveillance intensity was not associated with survival.\textsuperscript{36} However, there was a benefit to more intense surveillance for patients with glottic cancer, presumably by detection of recurrence on FFL. Although patients with glottic cancer benefit from intense surveillance, the risk of COVID-19 with FFL calls into question the necessity and frequency of surveillance for this specific group during the COVID-19 pandemic.

Head and neck cancer survivors are at risk for depression, anxiety, distress, lymphedema, dysphagia, pain, sexual dysfunction, and decreased quality of life.\textsuperscript{37-44} Since some of their non-urgent needs may not be met during the COVID-19 pandemic, it will be important to ensure that particular attention is put on their care when there are greater resources and fewer restrictions relating to social distancing.\textsuperscript{45}
The COVID-19 pandemic will directly and indirectly impact all facets of management of patients with head and neck mucosal malignancies. Decisions regarding patient care should be guided by best available evidence and personalized to individual patients by a collaborative and multidisciplinary team. There remain multiple areas of uncertainty which require further investigation. In addition to optimizing outcomes for patients with head and neck mucosal malignancies, consideration should be given to protecting patient’s family members, caregivers, healthcare workers, and communities.
### Table 1

Database search results

<table>
<thead>
<tr>
<th>Search terms</th>
<th>Number of search results in Pubmed</th>
<th>Number of unique publications in Pubmed</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Group 1 terms</td>
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<td>-</td>
</tr>
<tr>
<td>All Group 2 terms</td>
<td>925,324</td>
<td>-</td>
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<tr>
<td>“COVID-19” AND all Group 2 terms</td>
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<td>22</td>
</tr>
<tr>
<td>“SARS” AND all Group 2 terms</td>
<td>30</td>
<td>27</td>
</tr>
<tr>
<td>“MERS” AND all Group 2 terms</td>
<td>56</td>
<td>36</td>
</tr>
<tr>
<td>“Novel coronavirus” AND all Group 2 terms</td>
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<td>Group 1 AND Group 2 terms</td>
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</tr>
</tbody>
</table>

Group 1 included terms related to COVID-19.

Group 2 included terms related to head and neck mucosal cancer and its management.

Abbreviations: COVID-19: coronavirus disease 2019; MERS: Middle East respiratory syndrome; SARS: severe acute respiratory syndrome
<table>
<thead>
<tr>
<th>Topics</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Assessment</td>
<td></td>
</tr>
<tr>
<td>Location of initial visit</td>
<td>No evidence to develop recommendation.</td>
</tr>
</tbody>
</table>
| Flexible Fiberoptic Laryngoscopy | Should be reserved for concern for imminent risk to life in patients with unknown COVID-19 status. PPE required for any person in room during procedure.  
Scope should be covered when removed from the room.  
Room should be decontaminated after aerosol generating procedure. |
| Personal protective equipment | PPE should be utilized by any healthcare worker present during or after any potential aerosol generating procedure until room has been properly decontaminated. |
| Self-quarantine until surgery | No evidence to develop recommendation.                                                                                                           |
| Determination of Treatment Plan |                                                                                                                                                  |
| Decision-making        | Decision-making should be guided by NCCN guidelines in a multidisciplinary setting. Risks of COVID-19 infection to the patient, healthcare workers, and community should be considered. |
| Timing of surgery      | Timing of surgery should be made after weighing risks of disease progression against risk of COVID-19 infection and availability of resources.    |
Use of microvascular reconstruction | The necessity of microvascular reconstruction should be carefully considered. Alternative forms of reconstruction may be appropriate in some cases. Availability of institutional resources should be considered with decision-making regarding reconstructive options.

Risk-benefit consideration for surgical treatment vs non-surgical treatment | No evidence to develop recommendation.

Operating Room Management

Role of COVID-19 testing | Two separate tests; one 48 hours in advance and one point of care test, within 24 hours of surgery. If point of care testing is not available, test 48 hours in advance and then quarantine.

Surgical team planning | No evidence to develop recommendation.

Surgical draping | Use adhesive sterile drapes to separate mucosal from non-mucosal sites during surgical resection.

Airway Management

Surgical team | Limit to essential members. Limit to experienced healthcare workers.

PPE | PPE for all healthcare workers throughout the entirety of the case until the room has been decontaminated

Intubation considerations | Most senior member of the team should perform intubation. Avoid bag mask ventilation. Avoid flexible
<table>
<thead>
<tr>
<th>Role of tracheostomy</th>
<th>Avoid tracheotomy unless absolutely necessary. Favor open tracheotomy over percutaneous tracheotomy. Ensure patient is paralyzed prior to entering the airway. Hold ventilation before entering the airway. Minimize suctioning throughout the procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postoperative Care</td>
<td>Strategies to optimize use of resources, protect patients and healthcare workers, and minimize LOS should be implemented.</td>
</tr>
<tr>
<td>Patients with tracheotomy or laryngectomy</td>
<td>Appropriate PPE and precautions should be implemented by healthcare workers who come into contact with these patients, especially during aerosol generating procedures.</td>
</tr>
<tr>
<td>Surveillance</td>
<td>Surveillance intensity should be guided by the patient’s risk of recurrence and balanced with risks to patients, healthcare workers, and the community.</td>
</tr>
</tbody>
</table>

**Abbreviations:** COVID-19: coronavirus disease 2019, LOS: length of stay; NCCN: National Comprehensive Care Network; PPE: personal protective equipment
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<th>Limited evidence to develop recommendations</th>
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<td>Flexible fiberoptic laryngoscopy</td>
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<tr>
<td>Personal protective equipment in clinic</td>
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<td>X</td>
</tr>
<tr>
<td>Self-quarantine until surgery</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>Determination of Treatment Plan</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decision-making</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Timing of surgery</td>
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<tr>
<td>Use of microvascular reconstruction</td>
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</tr>
<tr>
<td>Risk-benefit consideration for surgical treatment vs non-surgical treatment</td>
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<td></td>
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<tr>
<td><strong>Operating Room Management</strong></td>
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<tr>
<td>Role of COVID-19 testing</td>
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<td></td>
</tr>
<tr>
<td>Surgical team planning</td>
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<tr>
<td>Surgical draping</td>
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<tr>
<td><strong>Airway Management</strong></td>
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<td></td>
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<tr>
<td>Personal protective equipment in the operating room</td>
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<tr>
<td>Section</td>
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<tr>
<td>Intubation considerations</td>
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<tr>
<td>Role of tracheostomy</td>
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<td>Postoperative Care</td>
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<tr>
<td>Postoperative inpatient care</td>
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<tr>
<td>Patients with tracheotomy or laryngectomy</td>
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<td></td>
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<tr>
<td>Surveillance</td>
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<td></td>
</tr>
<tr>
<td>Appropriate surveillance intensity</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1

PRISMA flowchart for identifying studies to include in evidence-based review

Group 1 included terms related to COVID-19.

Group 2 included terms related to head and neck mucosal cancer and its management.

Appendix 1

Search Terms

Group 1 (COVID-19-related):

COVID-19
SARS
MERS
Novel coronavirus

Group 2 (head and neck cancer-related):

Head and neck
Head and neck cancer
Oral cancer
Oral cavity cancer
Oropharyngeal cancer
Oropharynx cancer
Laryngeal cancer
Larynx cancer
Hypopharyngeal cancer
Hypopharynx cancer
Tracheal cancer
Composite resection
Glossectomy
<table>
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<tr>
<th>Page</th>
<th>Term</th>
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<tbody>
<tr>
<td>439</td>
<td>Mandibulectomy</td>
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<tr>
<td>440</td>
<td>Pharyngectomy</td>
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<td>441</td>
<td>Mandible split</td>
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<td>Tracheotomy</td>
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<td>446</td>
<td>Difficult airway</td>
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<td>447</td>
<td>Difficult intubation</td>
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<tr>
<td>448</td>
<td>Cancer survivorship</td>
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<tr>
<td>449</td>
<td>Survivorship</td>
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6. Coronavirus COVID-19 Global Cases by the Center for Systems Science and Engineering at Johns Hopkins University.


10. Eric Adjei Boakye P, MA, Wiley Jenkins, PhD, MPH, Arun Sharma, MD, MS,..


Figure 1

This manuscript has been accepted for publication in Otolaryngology-Head and Neck Surgery.
Appendix 1

Search Terms

Group 1 (COVID-19-related):
COVID-19
SARS
MERS
Novel coronavirus

Group 2 (head and neck cancer-related):
Head and neck
Head and neck cancer
Oral cancer
Oral cavity cancer
Oropharyngeal cancer
Oropharynx cancer
Laryngeal cancer
Larynx cancer
Hypopharyngeal cancer
Hypopharynx cancer
Tracheal cancer
Composite resection
Glossectomy

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Pharyngectomy
Mandible split
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Difficult intubation
Cancer survivorship
Survivorship