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COVID-19 Pandemic: What every Otolaryngologist – Head & Neck Surgeon Needs to Know for Safe Airway Management

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Abstract (150 words):

The novel coronavirus disease (COVID-19) pandemic has unfolded with remarkable speed, posing unprecedented challenges for healthcare systems and society. Otolaryngologists have a special role in responding to this crisis by virtue of expertise in airway management. Against the backdrop of nations struggling to contain the virus's spread and to manage hospital strain, otolaryngologists must partner with anesthesiologists and front-line healthcare teams to provide expert services in high-risk situations and reduce transmission. Airway management and airway endoscopy, whether awake or sedated, expose operators to infectious aerosols, posing risks to staff. This commentary provides background on the outbreak, highlights critical considerations around mitigating infectious aerosol contact, and outlines best practices for airway-related clinical decision-making during the COVID-19 pandemic. What otolaryngologists need to know and what actions are required are considered alongside the implications of increasing demand for tracheostomy. Approaches to managing the airway are presented, emphasizing safety of patients and healthcare team.

Keywords: Covid-19, Coronavirus Disease, Airway Management, Difficult Airway, Intubation, Tracheostomy, Infection, Patient Safety, Quality Improvement,

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MANUSCRIPT BODY (900 WORDS)

Introduction

As specialists in airway management, otolaryngologists require in-depth understanding of the 2019 novel coronavirus (COVID-19, or 2019-nCoV) to minimize personal exposure and iatrogenic transmission. The outbreak in Wuhan, China was declared a public health emergency on January 30, 2020 and a pandemic on March 11, 2021. COVID-19 is caused by SARS-CoV-2, an RNA virus closely related to coronaviruses responsible for Middle East Respiratory Syndrome Coronavirus (MERS) and Severe Acute Respiratory Syndrome (SARS) outbreaks. Transmission occurs via respiratory droplets, with diagnosis confirmed by RT-PCR or antibody assays. Otolaryngologists can draw important insights from prior outbreaks and experience to date.[1]

COVID-19 in context

Most SARS and MERS cases involved nosocomial transmission in hospitals via aerosol-generating procedures.[2] Whereas even routine examination of nasal passages or oropharynx necessitates great care, risks are magnified with endoscopy and airway procedures. Many carriers are asymptomatic, and undocumented infections accelerate the dissemination of COVID-19.[3] Airway maneuvers performed in patients who may be infected with COVID-19 have high risk of transmission via inhalation or mucosal contact with infected respiratory secretions. This risk is maximal during intubation, tracheostomy, or open airway procedures, where the

exposure will occur in close proximity, often involving positive pressure ventilation. Understanding how to mitigate these risks represents a critical knowledge gap.

Comparisons to SARS and MERS outbreaks

Whereas awareness around social distancing and hygiene has achieved wide penetration, there is less awareness of steps to minimize infectious aerosol production and exposure which will also be critical to "flattening the curve" (**Figure 1**). Since the first SARS and MERS outbreaks, advances in public health infrastructure and molecular diagnostics have enhanced transparency, communication, and public health response to COVID-19.[4,5] The accrued data on mitigating infectious aerosols represents decisive progress. Building on prior outbreaks and experience to date with COVID-19, this commentary provides practical advice to safely assess, secure, and manage the airway while ensuring safety of patients and the healthcare team.

What otolaryngologists need to know

Why aerosols matter

Aerosols are pervasive in clinical practice. Otolaryngologists are exposed to exhaled pathogens during routine physical examination and most procedures. While patients' restful breathing, coughing, and sneezing are potential sources of exposure, particular care is warranted in airway endoscopy and elective or emergent airway management. Aerosolized COVID-19 particles may

remain airborne for up to three hours and may survive on surfaces for much longer.[1] Despite rapid proliferation of general guidelines for COVID-19 containment and mitigation, far fewer resources explicitly address the proven strategies for reduction and management of infectious aerosols. Awareness of best practices is imperative because infectious aerosols arising from airway procedures were a key etiologic factor in prior coronavirus outbreaks (**Figure 2**).[6]

What airway guidance is available

Guidelines addressing airway management with COVID-19 are limited. The Spanish otolaryngology society released coronavirus recommendations for patients with tracheotomy,[7] paralleling recommendations from anesthesiology[4] and intensive care[8] on minimizing aerosol production and exposure. Recognizing concerns in endoscopy, The American Society for Gastrointestinal Endoscopy recommended PPE use, endoscopy in negative-pressure rooms, and decontamination of endoscopes and rooms.[9] The American Academy of Otolaryngology – Head & Neck Surgery released COVID-19 related resources, including patient screening algorithms and post-exposure risk classification. Postponing non-urgent surgery frees up capacity in the health system and avoids outpatients contracting illness or introducing undiagnosed carriers.

Airway assessment and high-risk situations

Airway assessment includes identifying anatomical factors that may present difficultly in airway securement and risk for deterioration. Many pediatric airway and adult laryngology operations

are performed with spontaneous, non-intubated ventilation without a closed circuit. Surgeons must consider whether such procedure can be safely postponed, and if not whether a micro-endotracheal tube or temporary tracheostomy is appropriate. As jet ventilation and Transnasal Humidified Rapid-Insufflation Ventilatory Exchange (THRIVE) are key therapeutic tools, shared decision making and direct surgeon participation is essential in critical triage discussions as part of responsibilities inherent in the surgeon-patient relationship.

Best Practices for Otolaryngologists

All airway surgery is aerosol generating,[6] and any patient may harbor infection. Airway management strategies to mitigate infectious risk (**Table 1**), include designating experienced providers, closing circuits, and minimizing bag-mask ventilation. Awake intubation should be avoided unless required. THRIVE, jet ventilation, or positive pressure ventilation without a cuffed tracheal tube are strongly discouraged. Any open circuitry airway procedure increases aerosol generation, as will rescue/maintenance bag-valve-mask ventilation. Proper use of protective equipment is imperative with N95 mask/Powered Air Purifying Respirator (**Table 2**). We recommend staff rehearse donning/ doffing PPE and check equipment provides adequate vision, hearing and fidelity to safely conduct procedures. A number of measures may improve the safety of airway surgery (**Table 3**), and lessons can be taken from Hong Kong's experience, where swift implementation of current safety measures was informed by the SARS outbreak (**Table 4**).

Special consideration for tracheostomy

The number of tracheostomies performed in critically ill patients will likely surge during the pandemic, to facilitate long-term ventilation or weaning from ventilation. Median duration of viral shedding is reported at 20 days, but longer in the critically ill.[10] In patients at risk of failed primary extubation, cuffed tracheostomies allow better infection control than aerosol-generating extubations, involving CPAP/high flow oxygen, and urgent re-intubation. Decreased sedation with tracheostomy also will reduce ventilator time, potentially reducing critical care resource strain. Surgeons must safely manage tracheostomized inpatients, particularly in isolated units with limited expertise in tracheostomy.

Conclusions

Confirmed cases of COVID-19 continues to increase despite aggressive public health measures, with many patients requiring ventilator support. Otolaryngologists, as experts in airway management, share a critical role in providing high quality care, minimizing nosocomial spread from aerosol-generating procedures, and protecting themselves and others. We recommend preparation, planning, vigilance, and mindful application of lessons garnered from the SARS, MERS, and the current COVID-19 outbreak.

Figure 1: *Flattening the Curve*

Figure 2: *Case Study from SARS Outbreak (Callout Box)*

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Table 1

Measures to Minimize Generation of Infectious Aerosols

PRINCIPLE	PRACTICAL IMPLEMENTATION
Avoid elective airway surgery	Limit procedures, especially airway procedures, to urgent cases
Optimize personnel	Experienced individuals should perform procedure expeditiously with the fewest assistants possible.
Close circuits when possible	Tracheal intubation with cuffed tube (closed system) is preferred over supraglottic airway devices or facemasks (partially closed systems) or THRIVE/jet ventilation (open systems)
Use rapid sequence induction	Pre-oxygenation followed by rapid sequence induction minimizes bag-masking and associated high risk exposures
Minimize bag-masking	Laryngeal mask airway (LMA) is generally a preferable stop-gap measure to bag-masking when airway is not immediately secured
Avoid awake intubations	Such procedures involve atomized analgesia that promotes coughing, with the endoscopist in close proximity to airway

Table 2

Proper use of Personal Protective Equipment (PPE) to Avoid Exposure

PRINCIPLE	PRACTICAL IMPLEMENTATION
Adhere to respiratory droplet Precautions	Protection from aerosol droplets requires eye protection, gown, gloves, mask; the healthcare team requires updated fit N95 mask or particulate respirator for procedures.
Practice Donning/Doffing	Clinicians should become proficient with safely donning and removing PPE prior to entering high risk areas.
Confirm Visibility	Ensure that line of vision is not obstructed or obscured. Some equipment may be incompatible with microscope; if alternative options are unavailable, procedure is done without microscope.
Maintain Communication	Be cognizant of impaired ability to speak and hear, which can impede safety and communication; minimize ambient noise.
Assess fidelity	Confirm adequate maneuverability and tactile sense to ensure adequate dexterity to accomplish the intended procedure.
Perform safe endoscopy	Standards are evolving; in addition to PPE worn by the clinician, patient should wear a loop mask (drop mask below the nose for trans-nasal scope) that captures droplets, should patient cough.
Be alert to carriers	Many cases of COVID-19 are undocumented, with patients that are asymptomatic or in prodromal state; clinical should be alert to the possibility of any patient harboring COVID-19 infection.

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Table 3

Airway Surgery Pearls in the time of COVID-19

CONSIDERATION	RECOMMENDED MEASURES
Indications	The most common surgical indications in near term may relate to patients receiving invasive ventilation for COVID-19 respiratory failure or weaning (surge in tracheostomy, managing laryngeal complications of intubation).
Timing	Viral shedding can exceed 20 days. When airway procedures cannot be postponed, the focus is on closed-circuit airway management, minimizing aerosol generation in order to maximally protect clinicians and staff.
Location	The decision to perform surgery in the intensive care unit versus in the operating room is multifaceted, involving infection control infrastructure, technical capabilities, and equipment; negative pressure is preferable.
Patient factors	Body habitus (obesity/OSA), anticoagulation, morbidities, and ability to leave intensive care unit impact timing, location, and urgency of surgery; such factors may also affect decision for percutaneous or open technique.
Surgeon, staff, and bystanders	A small, experienced team that maximizes speed is preferred, thereby limiting duration of potential infectious exposure. Measures should be taken to avoid risk of transmission to nearby patients, staff, or equipment.
Equipment	Careful preparation for procedures also improves speed and safety, reducing risk of exposure; instrument trays need to be standardized, and suction, cautery, lighting, and positioning should all be optimized.

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Table 4

Hong Kong Perspective: Approaches to Preventing Healthcare Worker Transmission of COVID-19

CONSIDERATION	PRACTICAL IMPLEMENTATION
Culture of Learning	"Many of us in Hong Kong experienced SARS 17 years ago, where many health care workers were infected and quite a few died. As a result, many of our responses to COVID-19 were quite instantaneous, implementing measures aiming at 0% infection rates amongst healthcare workers". -- Anthony Y.B., Teoh, FRCSEd (Gen), FACS, FASGE, MBChB
Rapid Response Team	The daily situation of COVID-19 infections can change rapidly in the community and hospital. Hence, response teams should be setup in each unit for rapid dissemination of COVID-19 related information and communication of hospital strategic plans. The status of staff infection and the level of PPE stock should be made transparent.
Staff monitoring	Staff would be monitored for symptoms of COVID-19. All staff will have their body temperature measured daily when reporting to work. Alerts will be raised to any unusual clustering among staff.
PPE "Buddy" Checks	It is standard operating procedure in Hong Kong to observe another colleague gowning up and down to check for any breach in the protocol. The highest risk of infection is during gowning down, where viruses shed on the surface of PPE can be accidentally contaminate the healthcare worker and cause infection.
Shoes and Apparel	Having a dedicated pair of shoes for inside the hospital has been implemented to decrease spread of infection. Similarly, keeping hospital attire within the hospital furthers decreases risk of community spread.
Gowning Sites/Signs	A dedicated physical space exists for putting on and removing gowns to minimize risk of transmission. These locations have prominent signs that provides clear instructions for proper sequence in donning PPE gear.
Procedural Sites	Many procedures, such as endoscopy, are considered to be aerosol generating procedures (AGP). Conducting AGP in a dedicated location is performed to decrease risk to healthcare workers and for patients.
Dedicated Personnel	A dedicated proceduralist, who does not engage otherwise in seeing patients, is assigned to perform endoscopy, thereby allowing for specialization in carrying out these procedures and reduced PPE usage.

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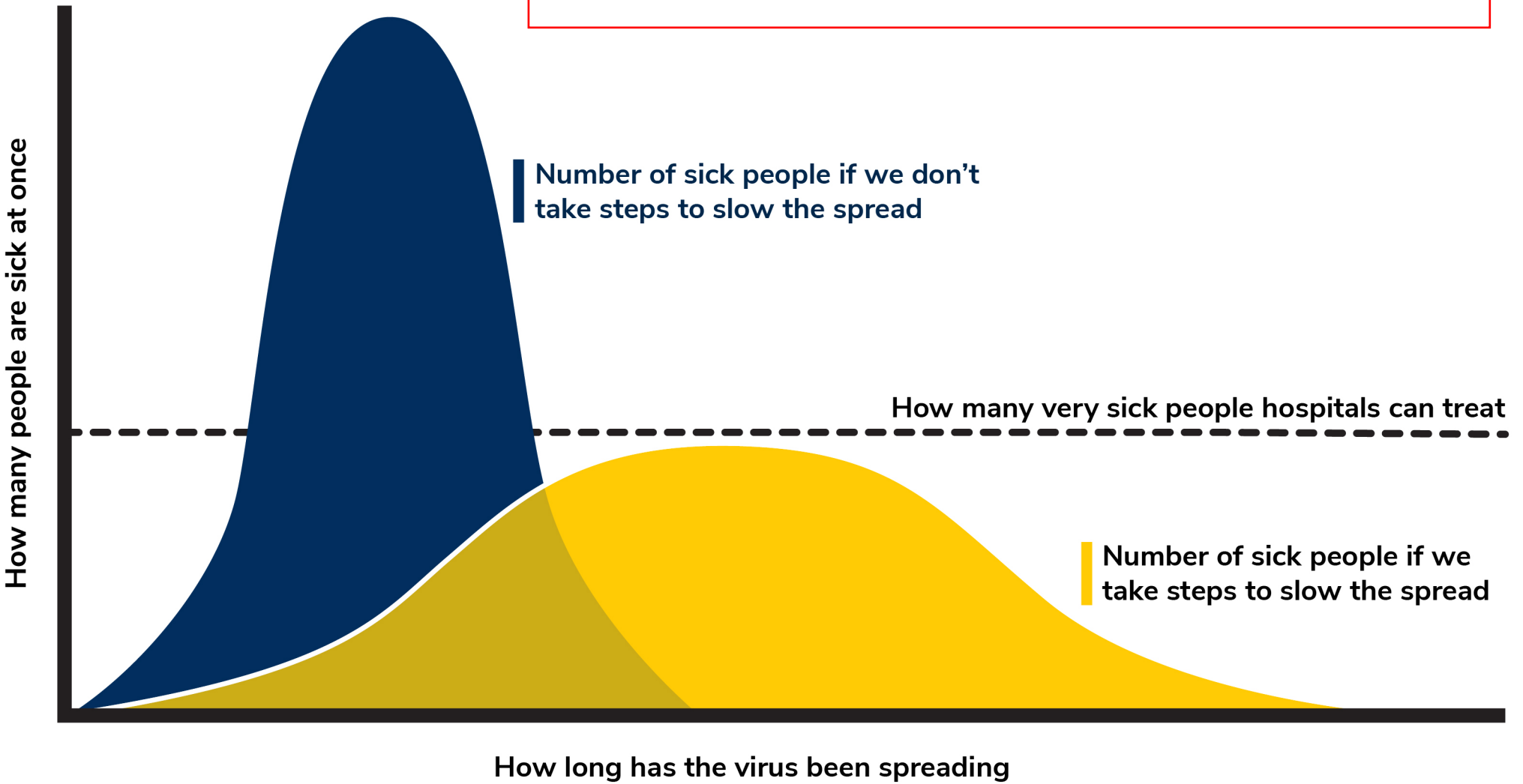

Adapted from the CDC

Case Study: Infectious Aerosols

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Aerosol-generating procedures were implicated as a leading cause of infection during the SARS outbreak in 2003. Many healthcare workers were infected while caring for these patients in medical wards. In one instance, a jet ventilation procedure in a patient presenting with respiratory infection resulted in a super-spreading event linked to 138 patients, many of whom were healthcare workers subsequently hospitalized after exposure. This incidence was attributed to jet ventilation compounded by overcrowding of beds and poor ventilation. Super-spreading events of SARS were documented in hospitals in mainland of China, Hong Kong, Canada, and other countries. Procedures with highest risk of SARS transmission were tracheotomy, non-invasive ventilation, endotracheal intubation, and bag-mask ventilation prior to intubation. Jet ventilation, nasal cannula, and non-invasive ventilation can disperse exhaled respiratory droplets for a radius of roughly 1 meter, with this radius increasing with higher inspiratory pressures.[6]