

A Commentary on Safety Precautions for Otologic Surgery during the COVID-19 Pandemic

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Abstract

There are insufficient data regarding the safety of otologic procedures in the setting of the coronavirus disease 2019 (COVID-19) pandemic. Given the proclivity for respiratory pathogens to involve the middle ear and the significant aerosolization associated with many otologic procedures, safety precautions should follow current recommendations for procedures involving the upper airway. Until preoperative diagnostic testing becomes standardized and readily available, elective cases should be deferred and emergent/urgent cases should be treated as high risk for COVID-19 exposure. Necessary otologic procedures on positive, suspected, or unknown COVID-19 status patients should be performed using enhanced personal protective equipment, including an N95 respirator and eye protection or powered air-purifying respirator (PAPR, preferred), disposable cap, disposable gown, and gloves. Powered instrumentation should be avoided unless absolutely necessary, and if performed, PAPR or sealed eye protection is recommended.

Keywords

COVID-19, coronavirus, otology, exposure, safety precautions

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The coronavirus disease 2019, or COVID-19, was first reported in Wuhan, Hubei province, China, in December 2019 and has since spread exponentially, resulting in a worldwide outbreak and a significant burden on the finite resources, including personal protective equipment (PPE), of many health care systems.¹ Given the known high viral load in the upper airway of infected patients, the current COVID-19 pandemic presents a significant occupational hazard for otolaryngologists.² Due to this risk, the American Academy of Otolaryngology has recommended all otolaryngologic procedures, particularly those involving the upper airway, be deferred unless deemed medically necessary or until preoperative COVID-19 testing can be reliably performed.

Most otologic procedures are classified as elective and should be postponed during this time; however, a need will

remain for some urgent/emergent procedures. Acute mastoiditis with convalescence, complicated mastoiditis, and complicated acute otitis media (AOM) often require prompt myringotomy and ventilation tube insertion and/or cortical mastoidectomy. Other urgent cases include intracranial tumors with brainstem compression, acute facial nerve palsy, advanced cholesteatoma, high-volume cerebrospinal fluid leak, temporal bone malignancy, postmeningitic cochlear implantation, and removal of infected implants.

It is well known that viral upper respiratory tract infections (URIs) directly or indirectly result in middle ear effusion/infection via the eustachian tube. Unfortunately, there are limited data on the viral load of the middle ear and mastoid cavity in the setting of a concurrent respiratory infection. To understand the risk of otologic procedures in the setting of an airborne viral pandemic, considerations must be made to both the viral load present in the middle ear and the inherent risk of aerosolization during otologic procedures, particularly with high-speed instrumentation. **Table 1** displays compiled recommendations for otologic procedures (elective, semielective, semiurgent, and urgent/emergent) based on the following discussion.

Discussion

Viral Load

Generally, AOM represents a respiratory polymicrobial infection of bacterial and viral etiology. Respiratory viruses have been identified by polymerase chain reaction (PCR) in middle ear effusions in 55% of cases.³ Viral pathogens have been also found to cause AOM even without nasopharyngeal bacterial colonization.⁴ Certain viruses respiratory viruses, including respiratory syncytial virus (RSV) and rhinovirus, are commonly isolated from the middle ear during URIs across studies, and there is high concordance (82%–98%) of

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Table 1. Compiled Recommendations for Otologic Procedures during the COVID-19 Pandemic.

Category/Procedures	Recommendation
Examination Otoscopy, binocular microscopy, cerumen debridement	Suspected or known COVID-19 patient encounters requiring examination within 3 feet should proceed only with enhanced PPE. ^a
Elective Tympanoplasty for dry/stable perforation, stapes surgery, ossicular reconstruction, adult cochlear implantation, bone-anchored hearing aid	All elective surgical cases (quality-of-life–related hearing rehabilitation) should be postponed indefinitely pending resolution of the COVID-19 pandemic in efforts to decrease patient interaction and exposure.
Semielective <i>Performed within 3-6 months</i> Tympanomastoidectomy for cholesteatoma with persistent infection or progression, pediatric cochlear implantation, bilateral otitis media with effusion in a child, repair of low-flow cerebrospinal fluid leak, resection of enlarging VS	Semielective cases in which patient health may be affected by a prolonged delay in care (progression of disease, development of complications, delay in speech development) may proceed following COVID-19 testing 48 hours prior to surgery, strict quarantine pending test results, and repeat testing the day of surgery if rapid tests are available.
Semiurgent <i>Performed as soon as possible but may be performed in over 48 hours</i> Facial nerve decompression for acute facial nerve paralysis High-volume cerebrospinal fluid leak repair Tympanomastoidectomy for complicated cholesteatoma Postmeningitic cochlear implantation TL, RS, and MCF approach for intracranial tumors with brainstem compression Temporal bone malignancy	Patients should be medically stabilized prior to surgery. When preoperative testing becomes widely available, may proceed following COVID-19 testing 48 hours prior to surgery, strict quarantine pending test results, and repeat testing the day of surgery if rapid tests are available. Until preoperative diagnostic testing is readily available. Urgent surgical cases should be performed under the presumption that patients are COVID-19 positive. Enhanced PPE ^a should be used. Clinical staff should be limited to essential personnel (ie, senior attending anesthesiologist, experienced attending surgeon, senior surgical resident/clinical fellow, surgical technologist, and registered nurse) with enhanced PPE ^a in a negative-pressure operating room with high-efficiency particulate air filtration.
Urgent/emergent <i>Performed as soon as possible, often requiring treatment within 24-48 hours</i> Ventilation tube insertion for acute convalescent mastoiditis, complicated mastoiditis, complicated otitis media Cortical mastoidectomy for acute convalescent mastoiditis, complicated mastoiditis	Urgent/emergent surgical cases should be performed under the presumption that patients are COVID-19 positive. All patients presenting with uncomplicated acute mastoiditis should be treated on intravenous antibiotic therapy and monitored closely for improvement. Myringotomy and tube insertion for complicated OM or acute mastoiditis only if patients fail intravenous antibiotic therapy or clinically worsen over 24 to 48 hours. Enhanced PPE ^a is recommended and consideration should be made to avoid bag mask ventilation in favor of laryngeal mask airway or intubation (preferred). Cortical mastoidectomy with high-speed drill should only be performed in patients with complicated mastoiditis. Enhanced PPE ^a is mandatory with a strong preference for use of PAPR. Airtight (nonvented) eye protection or full-face shield is recommended if PAPR is unavailable. If enhanced PPE ^a is unavailable due to limited resources and patient is acutely ill requiring only a cortical mastoidectomy for acute mastoiditis, consideration should be made for Hammer and Gouge cortical mastoidectomy.

Abbreviations: COVID-19, coronavirus disease 2019; MCF, middle cranial fossa; OM, otitis media; PAPR, powered air-purifying respirator; PPE, personal protective equipment; RS, retrosigmoid; TL, translabyrinthine; VS, vestibular schwannoma.

^aEnhanced PPE includes an N95 respirator plus face shield or PAPR (preferred), disposable surgical cap, disposable gown, and gloves.

PCR viral results from the middle ear and nasopharynx.^{3,5} Viral cultures may have a lower sensitivity than PCR but are able to demonstrate viable micro-organisms. High rates of

positive viral cultures from middle ear effusions have been demonstrated with coexisting upper respiratory infections with RSV (74%), influenza (42%), and parainfluenza (52%).⁶

The role of viral pathogens as a primary agent is debated, but coexistence of the same URI pathogens in the nasopharynx and middle ear supports the potential for an appreciable viral load in this location of a COVID-19-positive patient.

Aerosolization

Aerosolization of the COVID-19 virus may be extremely high during sinonasal and upper airway procedures, particularly when powered instruments are employed.² The exposure risk during otologic procedures is unclear, but it stands to reason that virus aerosolization can also occur during middle ear procedures given the continuity with the nasopharynx. As discussed previously, the need for emergent/urgent ventilation tube insertion will continue to be necessary in some cases. This procedure is typically performed with bag mask ventilation in the operating room; however, the inferior seal with this form of ventilation has the highest risk of generating aerosols. Current anesthesiology guidelines recommend avoidance of bag mask ventilation or even supraglottic airway in favor of rapid sequence intubation techniques.⁷ Furthermore, myringotomy creates an open system with the environment and the nasopharynx, providing another possible route for aerosol generation. Accordingly, we recommend that tympanostomy tube insertion be performed with endotracheal intubation to decrease the risk of aerosolization.

Transmastoid procedures present a heightened risk of aerosol generation and exposure given the standard use of high-speed drills. There is a lack of data on viral exposure risk with use of powered instruments during mastoidectomy. Bone dust generation alone does not meet OSHA criteria for respirator utilization; however, surgical masks are ineffective at preventing inhalation of bone dust particles.⁸ Conversely, the N95 respirator has been shown to significantly decrease particulate exposure in this setting.⁸ Bony microspicules generated with drilling can penetrate the cornea in animal models and serve as a possible vector for viral transmission.⁹ The operative microscope may offer protection for the eyes in practice, but there are no studies to verify this to date, and transconjunctival spread of COVID-19 has been reported.¹⁰ Given the risk of exposure to potentially infectious aerosols with the use of high-speed drills in patients with COVID-19, we recommend the preferential use PAPR to mitigate both inhalational and transconjunctival exposure. If PAPR is not available, an N95 respirator and eye protection, preferentially in the form of a full-face mask or sealed goggles, should be used.

Conclusion

There is a scarcity of literature on the viral load in the middle ear/mastoid and the infectious potential of viral exposure during otologic procedures. In the face of the COVID-19 pandemic, necessary otologic procedures on positive, suspected, or unknown COVID-19 status patients should be performed using enhanced PPE, including an N95 respirator and eye protection. Furthermore, we recommend the use of PAPR if high-speed drills are required. Preoperative

testing 48 hours prior to surgery, strict quarantine pending test results, and repeat testing on the day of surgery should be used for elective, semielective, and semiurgent procedures.

Author Contributions

Robert A. Saadi, conception and design; acquisition and interpretation of data; drafting manuscript; **Darrin V. Bann**, conception; acquisition and interpretation of data; drafting manuscript; **Vijay A. Patel**, conception and design; acquisition and interpretation of data; drafting manuscript; **David Goldenberg**, conception and design; interpretation of data; revising manuscript; **Jason May**, conception and design; interpretation of data; revising manuscript; **Huseyin Isildak**, conception and design; acquisition and interpretation of data; drafting manuscript.

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References

1. Emanuel EJ, Persad G, Upshur R, et al. Fair allocation of scarce medical resources in the time of Covid-19 [published online March 23, 2020]. *N Engl J Med*.
2. Chan J, Wong E, Lam W. Practical aspects of otolaryngologic clinical services during the 2019 novel coronavirus epidemic: an experience in Hong Kong [published online March 20, 2020]. *JAMA Otolaryngol Head Neck Surg*.
3. Sawada S, Okutani F, Kobayashi T. Comprehensive detection of respiratory bacterial and viral pathogens in the middle ear fluid and nasopharynx of pediatric patients with acute otitis media. *Pediatr Infect Dis J*. 2020;38(12):1199-1203.
4. Ruohola A, Pettigrew MM, Lindholm L, et al. Bacterial and viral interactions within the nasopharynx contribute to the risk of acute otitis media. *J Infect*. 2013;66(3):247-254.
5. Yatsyshina S, Mayanskiy N, Shipulina O, et al. Detection of respiratory pathogens in pediatric acute otitis media by PCR and comparison of findings in the middle ear and nasopharynx. *Diagn Microbiol Infect Dis*. 2016;85(1):125-130.
6. Heikkinen T, Thint M, Chonmaitree T. Prevalence of various respiratory viruses in the middle ear during acute otitis media. *N Engl J Med*. 1999;340(4):260-264.
7. Brewster DJ, Chrimes NC, Do TBT, et al. Consensus statement: Safe Airway Society principles of airway management and tracheal intubation specific to the COVID-19 adult patient group [published online March 16, 2020]. *Med J Aust*.
8. Norris BK, Goodier AP, Eby TL. Assessment of air quality during mastoidectomy. *Otolaryngol Head Neck Surg*. 2011;144(3):408-411.
9. Hilal A, Walshe P, Gendy S, Knoles S, Burns H. Mastoidectomy and trans-corneal viral transmission. *Laryngoscope*. 2005;115(10):1873-1876.
10. Xia J, Tong J, Liu M, Shen Y, Guo D. Evaluation of coronavirus in tears and conjunctival secretions of patients with SARS-CoV-2 infection [published online February 26, 2020]. *J Med Virol*.