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A survey of personal protective equipment use among US otolaryngologists during the COVID-19 pandemic

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ABSTRACT

Objective: Describe current practices and challenges in personal protective equipment (PPE) use among US otolaryngologists during the COVID-19 pandemic.

Study design: Online survey.

Setting: Academic and non-academic healthcare institutions.

Subjects and methods: Subjects included US otolaryngology physicians. Emails were sent on April 17, 2020 to program coordinators at 121 residency programs, who were requested to forward the email to program directors for distribution. Further recruitment occurred through snowball recruitment. The survey was closed on June 15, 2020.

Results: Sixty-one participants completed the survey. 95.1% reported routine access to full PPE (N95 ± powered air purifying respirator [PAPR], gown, gloves, eye protection) for aerosol-generating procedures (AGPs) in COVID-19 patients, while 68.9% had routine access to full PPE for AGPs in patients without confirmed COVID-19. 88.5% had routine access to full PPE for potential aerosol-generating procedures (pAGPs) in COVID patients, while 80.3% had routine access to full PPE for pAGPs in patients without confirmed COVID. All participants felt that they “always” or “usually” had necessary PPE to safely perform procedures and surgeries on COVID patients. 83.6% received N95 fitting in the past year, and 93.4% reported adequate PPE training.

Conclusion: The majority of participants reported routine access to full PPE for AGPs and pAGPs in all patients, regardless of COVID status. There was a high perception of security, as well as adequate N95 fitting and PPE training. Areas for improvement include: optimizing PPE availability for AGPs in patients without confirmed COVID and wider recognition of otolaryngologic procedures as high risk for aerosolization.

1. Introduction

There is currently a pandemic of the 2019 novel coronavirus (SARS-CoV-2), which has resulted in 27,032,617 confirmed cases and 881,464 deaths as of September 7, 2020 [1]. Otolaryngologists are vulnerable to viral transmission through mucus, blood, and aerosolized particles when examining or operating in the aerodigestive tract. Furthermore, the need to perform aerosol-generating procedures (AGPs) and potential aerosol-generating procedures (pAGPs) poses a unique infection risk to otolaryngologists. The Centers for Disease Control and Prevention (CDC) defines AGPs as procedures that generate higher concentrations of infectious respiratory aerosols compared to coughing, sneezing, talking, or breathing [2].

The appropriate use of personal protective equipment (PPE) can minimize infection of health care workers and health care-associated transmission, which is critical as healthcare providers resume elective procedures. The Centers for Disease Control and Prevention (CDC) defines AGPs as procedures that generate higher concentrations of infectious respiratory aerosols compared to coughing, sneezing, talking, or breathing [2].

Abbreviations: AGP, aerosol-generating procedure; pAGP, potential aerosol-generating procedure; PPE, personal protective equipment; PAPR, powered air purifying respirator

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procedures and patient visits. The American Academy of Otolaryngology-Head and Neck Surgery’s (AAO-HNS) “Guidance for Return to Practice for Otolaryngology-Head and Neck Surgery” provides general recommendations for minimal suggested PPE based on COVID-19 testing status, instrumentation, and disruption of respiratory mucosa, while acknowledging that PPE use will vary across settings based on the intervention performed, supply availability, and local recommendations [3]. For any COVID-positive patient, regardless of instrumentation or disruption of respiratory mucosa, minimal suggested PPE consists of N95 or powered air purifying respirator (PAPR), eye protection, gown, and gloves. For any procedure using thermal or potential aerosol-generating instrumentation or disrupting respiratory mucosa, minimal suggested PPE also consists of N95 or PAPR, eye protection, gown, and gloves, regardless of COVID-19 status. Given healthcare system and supply chain strains, particularly early in the pandemic, it is unclear to what extent otolaryngologists have been able to follow these recommendations. However, no studies to date have surveyed US otolaryngologists about their experiences with PPE.

Through an online survey, this study aims to describe current practices and challenges in the use of PPE among US otolaryngologists during the COVID-19 pandemic.

2. Methods

2.1. Study design

A fourteen-question online survey was developed on SurveyMonkey (San Mateo, CA) to assess PPE availability and usage, perception of safety, and PPE education and fitting (Table 1). Survey questions were based in part on a similar survey conducted by the British Association of Otorhinolaryngology (ENTUK) of their membership [4]. The survey comprised 13 multiple choice questions and one free response question. Inclusion criteria encompassed US otolaryngology physicians practicing in any setting with various levels of training (i.e., resident, fellow, attending). An invitation to complete the survey was sent via email on April 17, 2020 to program coordinators at 121 US residency programs, who were requested to forward to their respective program directors for distribution. Further recruitment relied on snowball recruitment, in which survey participants were requested to share the survey with colleagues. The survey was closed to further responses on June 15, 2020. This study was granted exemption by the Northwestern University Institutional Review Board.

2.2. Statistical analysis

Standard descriptive statistics were used, with statistical analysis performed in Microsoft Excel.

2.3. Definitions

- Full PPE: N95 with or without PAPR, gloves, gown, and eye protection.
- AGP: Procedures including but not limited to tracheostomy, bronchoscopy, and airway management including placement, exchange, and removal of an artificial airway.
- pAGP: Procedures including but not limited to flexible laryngoscopy or nasal endoscopy, epistaxis control, peritonsillar abscess drainage, mastoidectomy.

3. Results

3.1. Participant characteristics

A total of 61 otolaryngology physicians practicing in the US participated in the survey. Of these, there were 41 (67.2%) attending physicians, 17 (27.9%) residents, and three (4.9%) fellows. Forty-seven

Table 1

| Online survey questions.                                      |
|---------------------------------------------------------------|
| I am an otolaryngology resident, fellow, or attending practicing in the US. |
| □ Yes                                                |
| □ No                                                 |
| Which of the best describes your practice?                |
| □ Academic/teaching in an urban environment              |
| □ Academic/teaching in a suburban or rural environment   |
| □ Non-teaching in urban environment                      |
| □ Non-teaching in suburban or rural environment          |
| Which of the best describes your level of training?      |
| □ Resident                                            |
| □ Fellow                                              |
| □ Attending                                           |

Which of the following describes your institution’s provision of personal protective equipment (PPE) for aerosol generating procedures (AGP) (e.g., tracheostomy, bronchoscopy, airway management including placement, exchange, and removal of an artificial airway) in suspected or COVID-positive patients?

- Eye protection, powered air purifying respirator (PAPR) with or without N95 respirator, gowns, and gloves are routinely provided
- Eye protection, N95 respirator, gowns, and gloves are routinely provided
- Eye protection, respirator (N95 or PAPR), gowns, and gloves are occasionally provided
- Only surgical face masks, gowns, and gloves are provided
- I am not reliably provided surgical face masks, gowns, and gloves
- I don’t know what PPE is available

If required in a suspected or COVID-positive patient, what PPE is provided when performing procedures with potential for aerosolization (e.g., flexible laryngoscopy or nasal endoscopy, epistaxis control, peritonsillar abscess drainage, mastoidectomy)?

- Eye protection, PAPR with or without N95 respirator, gowns, and gloves are routinely provided
- Eye protection, N95 respirator, gowns, and gloves are routinely provided
- Eye protection, respirator (N95 or PAPR), gowns, and gloves are occasionally provided
- Only surgical face masks, gowns, and gloves are provided
- I am not reliably provided surgical face masks, gowns, and gloves
- I don’t know what PPE is available

If required in a patient WITHOUT confirmed or suspected COVID, what PPE is provided when performing procedures with potential for aerosolization (e.g., flexible laryngoscopy or nasal endoscopy, epistaxis control, peritonsillar abscess drainage, mastoidectomy)?

- Eye protection, PAPR with or without N95 respirator, gowns, and gloves are routinely provided
- Eye protection, N95 respirator, gowns, and gloves are routinely provided
- Eye protection, respirator (N95 or PAPR), gowns, and gloves are occasionally provided
- Only surgical face masks, gowns, and gloves are provided
- I am not reliably provided surgical face masks, gowns, and gloves
- I don’t know what PPE is available

If required in a patient WITHOUT confirmed or suspected COVID, what PPE is provided when performing procedures with potential for aerosolization (e.g., flexible laryngoscopy or nasal endoscopy, epistaxis control, peritonsillar abscess drainage, mastoidectomy)?

- Eye protection, PAPR with or without N95 respirator, gowns, and gloves are routinely provided
- Eye protection, N95 respirator, gowns, and gloves are routinely provided
- Eye protection, respirator (N95 or PAPR), gowns, and gloves are occasionally provided
- Only surgical face masks, gowns, and gloves are provided
- I am not reliably provided surgical face masks, gowns, and gloves
- I don’t know what PPE is available

Overall, appropriate PPE is readily available for me to safely perform necessary procedures or surgeries on suspected or COVID-positive patients.

- Always
- Usually
- About half the time
- Seldom
- Never

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(77.1%) of participants reported practicing in an academic or teaching institution in an urban environment, while five (8.2%) participants reported practicing in an academic or teaching institution in a suburban or rural environment. Seven (11.5%) participants reported practicing in a non-teaching institution in an urban environment, while two (3.3%) participants reported practicing in a non-teaching institution in a suburban or rural environment. Forty (65.6%), 18 (29.5%), and three (4.9%) participants completed the survey in April, May, and June 2020, respectively.

3.2. PPE availability

When performing AGPs in patients with suspected or confirmed COVID-19, 58 (95.1%) participants reported routine access to full PPE. Of these, 34 (58.6%) participants reported routine access to a PAPR. The remaining three (4.9%) participants reported occasional access to full PPE.

When performing AGPs in patients without confirmed or suspected COVID-19, 42 (68.9%) participants reported routine access to full PPE. Seven (11.5%) participants reported occasional access to full PPE. Eleven (18.0%) participants reported that only surgical masks, gowns, and gloves were provided. One (1.6%) participant reported not knowing what type of PPE was available.

After performing an AGP, 13 (21.3%) participants reported “always” or “usually” discarding their N95 following use, while the remaining 48 (78.7%) participants reported discarding their N95 “about half the time,” “seldom,” or “never” following use.

When performing pAGPs in patients with confirmed or suspected COVID-19, 54 (88.5%) participants reported routine access to full PPE. Four (6.6%) participants reported occasional access to full PPE. One (1.6%) participant reported that only surgical masks, gowns, and gloves were provided. The remaining two (3.3%) participants reported that available PPE depended on the specific procedure.

When performing pAGPs in patients without confirmed or suspected COVID-19, 49 (80.3%) participants reported routine access to full PPE. Four (6.6%) participants reported occasional access to full PPE. Seven (11.5%) participants reported that only surgical masks, gowns, and gloves were provided, and one (1.6%) reported that surgical masks, gowns, and gloves were not reliably provided.

3.3. Perception of safety

Thirty-four (55.7%) participants reported feeling that appropriate PPE was always readily available to safely perform necessary procedures or surgeries on suspected or COVID-positive patients. The remaining 27 (44.3%) participants reported feeling that appropriate PPE was usually available to safely perform necessary procedures or surgeries on suspected or COVID-positive patients.

Forty-seven (77.1%) participants reported feeling confident that they would be given PPE to safely provide necessary care as demand for care in their institution peaked. The remaining fourteen (23.0%) participants reported feeling concerned about their safety due to uncertainty about PPE availability. No participants described feeling “extremely concerned.”

3.4. PPE education and fitting

Fifty-seven (93.4%) participants reported receiving adequate training in donning and doffing of PPE. Fifty-one (83.6%) participants reported receiving fitting for an N95 respirator in the past year.

3.5. Additional concerns

Concerns elicited through the free response question included: 1) reuse of PPE, particularly N95 masks following AGPs; 2) discordance between otolaryngologists and institutional leadership regarding what procedures constitute an AGP and thus, the level of PPE required; 3) lack of clarity about how to obtain PPE in urgent or emergent settings; and 4) the desire for more widespread training on PAPR use.

4. Discussion

To our knowledge, this is the only study to survey US otolaryngologists about their practices and challenges in PPE usage during the COVID-19 pandemic. Reassuringly, the majority of participants described routine access to full PPE when performing AGPs and pAGPs in all patients, regardless of COVID-19 status. In addition, the majority of participants reported that they always had adequate PPE to safely perform procedures during the pandemic, and that they felt confident that they would be provided adequate PPE to safely provide care as demand for care peaks. The majority of participants also reported adequate fitting and training in PPE usage. However, evaluating the quantitative and qualitative survey data together also highlights areas for potential improvement in PPE usage. These include suboptimal availability of full PPE for AGPs in patients without confirmed or suspected COVID-19, as well the need for wider recognition of common otolaryngologic procedures as high risk for aerosolization and deserving of PPE prioritization.

While the majority of participants reported routine access to full PPE for AGPs in patients without confirmed or suspected COVID-19, nearly one third of participants did not have routine access to full PPE in this scenario. Due to the possibility of asymptomatic infection and a wide-ranging incubation period from two to 14 days, performing AGPs in the asymptomatic patient carries some degree of risk [5]. Furthermore, concern has been raised about the possibility of false negative SARS-CoV-2 reverse transcription-polymerase chain reaction (RT-PCR) results. Li et al. reported a high false negative rate of RT-PCR testing among 610 hospitalized patients in Wuhan clinically diagnosed with COVID-19 [6]. In light of possible asymptomatic presentation and concern about the sensitivity of RT-PCR testing, the availability of full PPE for AGPs in patients without confirmed or suspected COVID-19 is suboptimal. Acknowledging current variability in testing, AAO-HNS’s “Guidance for Return to Practice for Otolaryngology-Head and Neck Surgery” recommends use of N95 or PAPR, eye protection, and gloves for any procedure using potential aerosol generating or thermal instrumentation, regardless of COVID-19 status.

Another concern raised by participants was the discordance between otolaryngologists and institutional leadership regarding what procedures are considered AGPs and pAGPs and thus deserving of full PPE. Indeed, the list of AGPs published by the CDC remains limited and,
as of September 7, 2020, included: open suctioning of airways, sputum induction, cardiopulmonary resuscitation, endotracheal intubation and extubation, non-invasive ventilation, bronchoscopy, and manual ventilation [2]. While common otolaryngology procedures such as flexible laryngoscopy may not in themselves constitute AGPs, there is potential for aerosolization with any triggered cough, gag, or sneeze [3]. Furthermore, recent human subject simulations by Workman et al. have demonstrated that nasal endoscopy can generate detectable 1–10 μm aerosols [7]. As evidence surrounding the aerosol-generating potential of common otolaryngologic procedures continues to evolve, ensuring institutional and infection control leadership’s familiarity with such procedures and their risk for aerosol generation will be critical in making PPE recommendations that balance safety and limited resource availability.

Our study has several limitations. The small sample size and predominance of academic otolaryngologists in urban settings, likely due to our recruitment methods, limit the generalizability of results. In addition, given region-specific variations in disease curves, responses may reflect different time points during the pandemic. Finally, while our results indicate a high rate of N95 reuse, our survey did not specifically inquire about methods about N95 decontamination, which may offer a viable way to safely reuse high-demand N95 masks if performed without negatively impacting respirator performance [8].

In summary, this study offers insight into success and challenges in PPE usage based on a survey of a selection of US otolaryngologists. As states reopen and elective surgeries and procedures resume, these insights can serve to inform guidance on PPE use. Future surveys will be needed to assess changes in practice and attitudes towards PPE use as the pandemic continues to evolve.

5. Conclusion

In a survey of a selection of US otolaryngologists, the majority reported availability of full PPE, including N95 or PAPR, when performing AGPs or pAGPs in all patients, regardless of COVID-19 status. In addition, the majority of participants reported high perception of safety and adequate PPE fitting and education. Areas for improvement include optimizing access to PPE for AGPs performed in patients without confirmed or suspected COVID-19, as well as increasing recognition of common otolaryngologic procedures and their risk of aerosolization among institutional leadership.

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CRediT authorship contribution statement

Karina Yu: Methodology, Formal analysis, Data curation, Writing - original draft. Alan G. Micco: Methodology, Data curation, Writing - review & editing. Elisabeth Ference: Data curation, Writing - review & editing. Joshua M. Levy: Data curation, Writing - review & editing. Stephanie Shintani Smith: Conceptualization, Methodology, Data curation, Writing - review & editing.

Declaration of competing interest

The authors have no financial or otherwise conflicts of interest to disclose.

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