Pediatric otolaryngology in the coronavirus disease 2019 pandemic: what have we learned?

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Purpose of review

Coronavirus disease 2019 (COVID-19) has changed the face of healthcare. The current review is to discuss the major aspects that have changed in pediatric otolaryngology, from surgical operations management, to clinic workflow, to procedural precautions.

Recent findings

There have been many studies over the past year describing different ways to improve the safety of healthcare delivery in pediatric otolaryngology amidst a global pandemic, as well as ways to improve clinic and surgical logistics along with guidelines for telehealth of a surgical specialty.

Summary

COVID-19 has forever altered how healthcare is viewed and practiced, and pediatric otolaryngology was not exempt. With an increased focus on provider safety, as well as novel ways of utilizing changes in methods of communication, the practice of pediatric otolaryngology has evolved with the rest of healthcare to take on the new challenges brought on by this global pandemic.

Keywords

coronavirus disease 2019, pediatric otolaryngology, telemedicine

INTRODUCTION

On March 13, 2020 a state of emergency was declared due to the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) also known as coronavirus disease 2019 (COVID-19). This was the date that transformed not only day-to-day life, but also the way medicine was delivered [1]. The daily effort of enforcing physical distancing and limiting the face-to-face interpersonal interactions has challenged healthcare providers to adhere to these precautions while continuing to deliver high-quality healthcare. Furthermore, all elective cases were cancelled, and hospitals were gearing up for an influx of patients with COVID-19. We watched with disbelief as other countries were facing shortages of hospital beds, ventilators, and other necessary equipment, having to make difficult ethical decisions regarding the best way to ration care.

As the pandemic progressed it was apparent that in most cases children were less frequently impacted by the novel virus [2]. Although children may not have directly been impacted by COVID-19, they can still be asymptomatic carriers and spread the virus, thus safety precautions must be taken. Otolaryngologists taking care of pediatric patients have had to adapt to the changes that have occurred due to the

onset of this pandemic. In this article, we will highlight how daily and systemic practices have evolved throughout the pandemic in the field of pediatric otolaryngology. Practitioners have been faced with providing necessary care while simultaneously ensuring the safety of themselves and their healthcare team, while protocols and guidelines have evolved throughout the course of the pandemic.

DISCUSSION

Coronavirus disease 2019 in children

A majority of pediatric patients do not have the severe manifestations reported in adults, however,

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KEY POINTS

- The COVID-19 pandemic completely halted all healthcare, and significantly changed the landscape of pediatric otolaryngology.
- Thought to be due to social distancing and universal masking, incidence of pediatric otitis and tonsillitis has significantly decreased, thereby diminishing the surgical case volume.
- Due to widespread internet access and financial support starting with the CARES Act, telemedicine has become widely utilized in pediatric otolaryngology clinics.

they can perpetuate the pandemic as asymptomatic carriers. Based on the recent American Academy of Pediatrics report summarizing cumulative data from the United States, 14.2% of children have been diagnosed with COVID-19 since the start of the pandemic, with only 0.1–1.9% hospitalized and 0–0.22% of all COVID-19 deaths [3]. Furthermore, given the higher incidence of asymptomatic infection in children, we may not be capturing a portion of children with COVID-19. Frequently children may present with cough (33%) or sore throat (8%), which are symptoms of many other conditions and therefore not pathognomonic for COVID-19 [4].

Multisystem inflammatory syndrome in children

As early as April of 2020, there were reports of severe systemic hyperinflammatory disease in children, initially thought to be Kawasaki disease, with the onset 2–4 weeks after the initial infection phase [5]. This was eventually found to be a separate entity called multisystem inflammatory syndrome in children (MIS-C) [6]. MIS-C can have a wide range of symptoms, including mucocutaneous inflammation, with frequent cardiovascular involvement and hemodynamic instability [7]. Treatment involves close monitoring of hemodynamics as well as intravenous immunoglobulins and steroids.

Although otolaryngologists may not directly be involved in managing children with MIS-C, they may play a vital role in the initial diagnosis. A recent case series of 539 MIS-C patients showed that 67% presented with mucocutaneous inflammation, including inflamed oral and pharyngeal mucosa, and a third of patients had upper respiratory symptoms on presentation [8[¶]]. More than 89% of patients reported dysphagia and dysphonia at presentation after initial symptomatic resolution [9[¶]].

In addition, cases have been reported of retropharyngeal edema without bacterial cause as a presenting factor in children with MIS-C [10]. Given that severe hemodynamic instability is frequently not the initial presenting factor, and often times upper airway and mucosal symptoms are prevalent in these patients otolaryngologist should be familiar with this condition.

Clinical management

Clinic workflow

Although practices began to plan for resuming clinical volume, many designed detailed workflows and algorithms for triaging and prioritizing patients [11[¶],12]. As it became commonplace knowledge that COVID-19 was spread through aerosolized particles [13,14], ‘aerosol-generating procedure’ (AGP) became a household name among otolaryngologists. Although the highest risk of aerosolization comes from powered operative instruments (shavers, drills, CO₂ laser, suction electrocautery) [15[¶]], nasal endoscopy and nasal exams can cause aerosolization as well. Even further, topical anesthetic sprays have additional aerosolization potential, increasing the risk to personnel.

Because COVID-19 viral concentrations were known to be highest in the nasopharynx and oropharynx, even the basic head and neck exam was considered high risk for transmission in the untested, unvaccinated child [16]. Extra precautions were taken early in the pandemic for AGPs, and many otolaryngology clinics have adapted a clinical flow with the consideration of AGPs and their management [12,17]. Many clinics in addition have added extra screening prior to the patient and family presenting to clinic. In this previsit screen, the clinic personnel can review the guidelines for social distancing as well as screen for any signs or symptoms of COVID.

In both the outpatient and inpatient setting, flexible nasopharyngolaryngoscopy (NPL) is used to evaluate children with airway or breathing complaints. Early in the pandemic, flexible NPL was viewed as a very high-risk procedure and was recommended to be deferred if possible [18]. Most authors consider the NPL an AGP and recommend the expanded precautions of n95 mask and face shield during the procedure [15[¶]]. Hoffman *et al.* [19] described a negative pressure face shield with instrumentation ports and a side port for suctioning which had excellent tolerance in the adult population, but this would provide a challenge in a child. Some institutions reported only performing NPL

when the findings would have a significant impact on patient management [20]. As an outpatient, NPLs were performed in a negative pressure room with all providers wearing full personal protective equipment (PPE). Later in the pandemic, flexible NPLs have returned to the previous guidelines for use. For all inpatient consults, patients are tested for COVID-19 on admission, so COVID status is known at the time of the NPL. For outpatients, if an NPL is expected then the patient is tested 48–72 h prior to the clinic visit for COVID-19. If COVID status is unknown, the exam is performed in an isolated exam room with full precautions. Although these are the testing precautions taken at our institution, others may forgo testing and simply recommend expanded PPE. Given that NPLs are AGP we do recommend vigilance prior to performing this procedure, whether it be COVID screening questions, testing, and/or expanded PPE.

Telemedicine

Perhaps one of the biggest practice changes in clinical medicine was the sudden need to maximize patient interaction while minimizing physical contact and in-person evaluations to only those necessary. The natural solution was telemedicine – which was used sparingly prepandemic. From a logistical and business standpoint, telemedicine became economically feasible through support by the CARES Act, which set the precedent for requiring insurances and Medicare to reimburse telemedicine clinic visits [21]. Since, many state-regulated insurances and private payers have removed limitations on telehealth utilization [22]. These changes along with increased accessibility of video conferencing services have allowed most practices to be able to support a robust telemedicine practice during the age of social distancing.

Pediatric otolaryngology provides a unique challenge to effective telemedicine implementation, given the difficulty with examination of young children and the need for ancillary devices to complete the exam. Although through use of parental guides we have instructed families on taking pictures of the oral cavity/oropharynx, this can be difficult in young children. In cases where the examination was inadequate or a procedure was required, patients had subsequent in-person visits. Despite these limitations telemedicine has been shown to be very effective in the pediatric setting [23]. Telemedicine has proved useful in assessing the need for surgical intervention in children [24,25] and can serve as an easy mode of postoperative follow-up and management of simple complications [26].

Although we have learned much about the implementation of a telemedicine practice during

the pandemic, there is still much room for improvement – perhaps the most in improving technical difficulties and families' educational materials prior to the appointment [27]. In addition, in 2019 an estimated 10% of the population in the United States did not have Internet access or a smartphone [28]. Going forward, expanding our practices' telemedicine access will require an in-depth assessment of each institution's technical capabilities as well as a strong technical support team to decrease further challenges in telehealth applications. For our practice, we will continue to offer telemedicine in the immediate future as an option whenever an in-person visit is not feasible or strictly necessary, such as a new patient visit that would require a prolonged travel time, or simple uncomplicated follow ups. In addition, the flexibility to be able to 'see' patients when not physically present in clinic adds an accessible additional option to check in with patients at their and the providers convenience.

Surgical operations management

The onset of the pandemic significantly impacted pediatric otolaryngologist, with initially postponing all elective procedures and cumulating evidence regarding high concentrations of viral particles in the upper respiratory tract and the impact of particle aerosolization. For pediatric-specific otolaryngology interventions, Chorney *et al.* [11[■]] proposed an algorithm-based approach at the onset of the pandemic for triaging surgical cases and procedures focused on risk–benefit analysis and prioritizing urgent procedures while balancing the safety of the healthcare team. Similarly, Bann *et al.* [16] proposed best practice recommendations categorizing surgical cases as elective, semielective, semiurgent, or urgent/emergent with timeframes to surgery suggested for each category. Fortunately, as the pandemic progressed and pediatric hospitals were not overwhelmed, surgical cases and scheduling resumed, albeit to a 'new normal'.

At our institution, any patient going to the operating room or being admitted to the hospital undergoes a PCR COVID-19 laboratory test 48 h before the procedure. Similarly, Parikh *et al.* [20] published their management protocol where every operating room case was tested for COVID-19 with a 24-h turnaround time. However, this standard is not universal amongst all pediatric hospitals and may be cost-prohibitive or not logistically feasible universally. In addition to testing, the patient and family is asked to follow social distancing guidelines and self-quarantine if possible in the interim between testing and the procedure. Any patient that has a positive COVID-19 test that is not emergent has their

procedure or intervention rescheduled 3-weeks after the positive test. The child can be rescheduled within 3 months of the positive test, without requiring a repeat test if they have no symptoms. In contrast to universal testing, Campiti *et al.* [29] has forgone routine preoperative testing after symptomatic screening proved negative for patients undergoing myringotomy and tube placement.

Considering patients who have tested negative for COVID-19, most providers and institutions are forgoing extended PPE use (n95 or powered air purifying respirator [PAPR]) and only utilizing intraoperative universal masking, eye protection, and strict hand hygiene – also known as ‘standard precautions’. For known COVID-19-positive patients who need urgent or semiurgent procedures, or for those where there is not time to get a COVID test performed, ‘expanded precautions’ are used including n95 or PAPR, face shield, as well as a negative pressure room and proper ‘donning/doffing’ protocols [30]. Some protocols required expanded precautions for all nasal, sinus, or throat related surgery even when the patient had tested negatively preoperatively [17].

Procedures

Sinus surgery

The nasal cavity and nasopharynx have been shown to be reservoirs of COVID-19 viral particles [31], as such initially all sinus and nasal surgeries, including adenoidectomy, functional endoscopic sinus surgery, inferior turbinate reductions, and endonasal skull-base surgery were postponed until preoperative testing was available. To mitigate AGP transmission operative techniques focused on the use of cold steel techniques when possible and avoiding balloons, drills, shavers, and suction electrocautery [16]. In cases where powered instruments or electrocautery were necessary, most suggested using a second suction near the surgical site, such as at the contralateral nostril or oropharynx to minimize risk from aerosolized particles [15[¶]].

Otologic surgery

Perhaps the biggest persistent change related to COVID in pediatric ear nose and throat is the decrease in pediatric acute and chronic otitis media, and subsequently a decrease in the myringotomy and tympanostomy tube placement (MTT) procedure. Prior to the pandemic, MTT was the most common ambulatory surgery [32]. There was a sharp decline of MTT that has persisted even after surgery restrictions have been lifted [33]. Although the exact cause is unknown,

the prevailing theory is that masking, along with decreased social interactions and increased social distancing amongst children has prevented many children from being exposed to the pathogens that cause upper respiratory infections. Although this could be viewed as a potential treatment or preventive option for at-risk children, the logistics and feasibility of social distancing and universal masking, not to mention the political implications, would make this an unrealistic universal method of treatment. In addition, utilizing these methods on a case-by-case basis may not yield the decreased risk of chronic ear infections that was seen when the vast majority of the population practiced them.

From a surgical precautions standpoint, MTT has been shown to have no more aerosolization than the induction of anesthesia [29]. The biggest consideration is the airway management, where mask ventilation has a higher risk of aerosolization than a supraglottic airway device (laryngeal mask airway) [34]. Respiratory viruses have been isolated from middle ear effusions that correlate with nasopharyngeal specimens [35], and as such at the onset most otologic procedures were deferred due to non-urgent nature. However, a recent review article only found Grade D moderate evidence that the aerosolization of bone dust during mastoid surgery generates clinically significant aerosols, yet the authors concluded that mastoid surgery should still be considered an AGP [15[¶]]. Markey *et al.* [36] simulated mastoid drilling and assessed bone dust contamination during mastoid surgery, and propose utilizing the microscope for all drilling as a protective barrier from bone dust, using small size drill burs where possible, and marking a ‘safe zone’ 150 cm away from the drilling where bone dust should not propagate.

Tonsillectomy and oropharyngeal surgery

Adenotonsillar surgery is the second most common surgery in children, after MTT [32,37]. Similar to otitis media, data has shown that masking and social distancing may have decreased episodes of tonsillitis in children with recurrent tonsillitis [38]. Initially, all tonsillectomy procedures save those for severe OSA or concern for malignancy, were recommended to be postponed [16]. In addition to the resource utilization concerns (need for admission, risk of readmission or reoperation), there is strong evidence that using electrocautery in the oropharynx is a droplet forming AGP [39], and appropriate consideration was needed [15[¶]].

There has been much discussion and research into the utilization of povidone–iodine solution (Betadine; Aviro Health L.P., Stamford, Connecticut, USA) as an oral prep prior to oropharyngeal

procedures as a precaution against COVID-19. A review by our group early in the pandemic showed that while it was deemed safe in children, insufficient evidence existed to make a formal recommendation [40]. Since, a randomized controlled trial showed that povidone-iodine mouthwash decreased salivary SARS-COV-2 concentrations in known positive participants [41]. Although not universally utilized or officially recommended, many surgeons are using a quick oral rinse with povidone-iodine at the beginning of the procedure as prophylaxis [42], or admixed with the operative irrigation in place of normal saline [43].

Airway procedures

For COVID-positive patients, airway intervention procedures have a high risk of exposure to healthcare workers. Microlaryngoscopy and rigid bronchoscopy should be considered very high risk due to both aerosol generation and prolonged gas flow [44]. As such, airway circuits should remain closed for as long as feasible and minimal instrumentation and suctioning should be employed [45]. Francom *et al.* [46] proposed a novel disposable surgical tent with an ultrafiltration smoke evacuator for use during endoscopic airway interventions to decrease aerosolization and reduce exposure of operating room staff.

Tracheotomy is considered a high-risk AGP due to high air flow within the airway [47]. Several practical steps to minimize aerosolization intraoperatively have been described, including using a nonfenestrated cuffed tracheostomy tube, advancement of the endotracheal tube prior to entering the airway, minimizing cuff leak, and limiting postoperative tube changes [44]. In addition to operative precautions, considerations must be made postoperatively regarding trach care in a COVID positive or unknown patient. Among these, recommendation include using appropriate signage to notify healthcare workers of the presence of a tracheostomy along with COVID status, minimizing disconnections of the closed-circuit vent, utilizing in-line suctioning, as well as immediate placement of an heat moisture exchanger when off of the vent or circuit [48].

At the onset, planned open airway reconstruction procedures were avoided due to the resources required (ICU stays, readmission, reoperation) [16]. With elective surgeries resuming, airway reconstructions resumed with preoperative testing and expanded precautions intraoperatively.

CONCLUSION/PRACTICE IMPLICATIONS

The COVID-19 pandemic has changed the face of healthcare, and pediatric otolaryngology is no

exception. This pandemic has tested our ability to adapt to new modes of healthcare delivery and management to increase safety for patients, healthcare providers, and ancillary staff. For our field, perhaps the biggest changes are the standardization and widespread use of telemedicine and certain safety measures incorporated for both in-office and operating room procedures. With the advent of vaccinations against the novel coronavirus and positive cases decreasing, we are hopeful for a return to some semblance of normalcy.

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Conflicts of interest

There are no conflicts of interest.

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- of special interest
- of outstanding interest

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