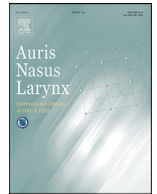




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Review of practical recommendations for otolaryngologists and head and neck surgeons during the COVID-19 pandemic

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ABSTRACT

Introduction: Otolaryngologists are at very high risk of COVID-19 infection while performing examination or surgery. Strict guidelines for these specialists have not already been provided, while currently available recommendations could presumably change in course of COVID-19 pandemic as the new data increases.

Objectives: This study aimed to synthesize evidence concerning otolaryngology during COVID-19 pandemic. It presents a review of currently existing guidelines and recommendations concerning otolaryngological procedures and surgeries during COVID-19 pandemic, and provides a collective summary of all crucial information for otolaryngologists. It summarizes data concerning COVID-19 transmission, diagnosis, and clinical presentation highlighting the information significant for otolaryngologists.

Methods: The Medline and Web of Science databases were searched without time limit using terms “COVID-19”, “SARS-CoV-2” in conjunction with “head and neck surgery”, “otorhinolaryngological manifestations”.

Results: Patients in stable condition should be consulted using telemedicine options. Only emergency consultations and procedures should be performed during COVID-19 pandemic. Mucosa-involving otolaryngologic procedures are considered high risk procedures and should be performed using enhanced PPE (N95 respirator and full face shield or powered air-purifying respirator, disposable gloves, surgical cap, gown, shoe covers). Urgent surgeries for which there is not enough time for SARS-CoV-2 screening are also considered high risk procedures. These operations should be performed in a negative pressure operating room with high-efficiency particulate air filtration. Less urgent cases should be tested for COVID-19 twice, 48 h preoperatively in 24 h interval.

Conclusions: This review serves as a collection of current recommendations for otolaryngologists for how to deal with their patients during COVID-19 pandemic.

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1. Introduction

At the end of 2019 in Wuhan, China, a novel coronavirus, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) led to a rapidly spreading respiratory disease [1]. The new disease induced by SARS-CoV-2 was named “COVID-19” by World Health Organization (WHO) on 11 February 2020 [1].

The high contagiousness of SARS-CoV-2 resulted in its rapid spread throughout China and subsequently throughout the world, resulting in global pandemic [1]. Currently, COVID-19 disease is considered a major public health crisis threatening humanity.

Because of the high virulence and rapid spread of SARS-CoV-2 via aerosol or droplet transmissions, until May 12, 2020, a total of 4 058 252 confirmed cases of COVID-19 and 281 736 deaths worldwide have been reported by WHO [1].

2. Aim of the study

The main aim of this review was to synthesize existing scientific evidence concerning otolaryngology during the COVID-19 pandemic. The study analyzed disease transmission, diagnosis, and clinical presentation extracting the information significant for otolaryngologists/head and neck surgeons. The study summarizes the currently existing practice guidelines and recommendations concerning otolaryngological procedures and surgeries during COVID-19 pandemic and provides a collective summary of all crucial information for ear, nose, and throat (ENT) specialist.

3. Methods

The Medline and Web of Science databases were searched without time limit but focusing on the newest reports, using the terms “COVID-19”, “SARS-CoV-2”, “novel coronavirus”, and “coronavirus from Wuhan” in conjunction with “ENT surgery”, “otolaryngological surgery”, “head and neck surgery”, “otorhinolaryngological manifestation”, “ENT”, “upper respiratory tract”, “head and neck oncology”, “olfaction”, “smell”, “taste”, “ear”, “nose”, “throat”, “oral cavity”, “pharynx”, and “larynx”. Boolean operators (NOT, AND, OR) were also used in succession to narrow and broaden the search. Auto alerts in Medline were also considered, and the reference lists of original articles and review articles were searched for further eligible sources. Opinions of medical societies were also included if applicable. The search included articles without language limitations.

A total of 227 articles were originally identified using our search criteria. 170 articles were excluded after abstract or full-text analysis because they did not exactly address the topic. Therefore, the total number of 57 studies were finally chosen to prepare this manuscript. This article was prepared on studies conducted on both, large cohorts and small cohorts, as a great majority of reports included sparse cohorts of patients.

According to the fact that COVID-19 is a novel disease, randomized controlled studies and precise evidence-based recommendations for COVID-19 management are not available yet. A number of otolaryngologic societies worldwide are currently working on preparing recommendations for ENT specialists/head and neck surgeons.

4. Results

4.1. Transmission of SARS-CoV-2 and COVID-19 induction

Despite the initially suggested animal to human transmission of SARS-CoV-2, human to human transmission is currently believed to be the main source of the virus transmission [1]. SARS-CoV-2 spreads directly through small aerosol particles (less than 5 μm in size) or droplets (bigger than 20 μm in size) while a COVID-19 positive individual is coughing, sneezing or speaking in a distance less than 2 m from another person [2]. Aerosolization, a process during which small particles are generated and dispersed in the air, is an essential source of SARS-CoV-2 infection for ENT specialists. Unlike droplets, aerosolized SARS-CoV-2 particles do not require direct contact with the infected individual [2]. Additionally, aerosolized SARS-CoV-2 particles were considered to remain viable in the air for at least three hours [3]. Hands' contact with the surfaces contaminated with the live virus followed by touching one's nostrils, mouth or eyes could also result in contagion, as SARS-CoV-2 could stay viable on some surfaces for up to 24–72 h [2,4]. Nasolacrimal duct, a structure through which tears are transported to the nasal cavity, could potentially explain why eyes contaminated with SARS-CoV-2 led to COVID-19 development [4].

The estimated incubation period for COVID-19 ranged between 0 and 14 days after exposure, while the mean incubation period reported by various authors ranged between 4.4 and 6.9 days [5]. Importantly, COVID-19 positive patients within the first days after exposure and before developing symptomatic disease could be an important source of further virus transmission [5]. Additionally, approximately 7–13% of individuals with COVID-19 could remain asymptomatic or oligosymptomatic throughout the whole disease duration [6].

Interestingly, Zou et al. implied that viral loads in nasal and throat swabs were similar in symptomatic and asymptomatic individuals with COVID-19 emphasizing the role of asymptomatic patients in transmitting the virus prior to the development of the symptoms [7].

The SARS-Cov-2 ability to invade human organism and to induce COVID-19 is based on the presence of spike (S) glycoprotein on the virus' surface and its interaction with host cells' proteins, namely angiotensin-converting enzyme 2 (ACE2) and transmembrane protease serine 2 (TMPRSS2) [8]. Viral S protein binds to host ACE2 after initially being primed by a cell surface protease TMPRSS2 [8]. Subsequently, viral RNA could be incorporated into the genetic material of the infected host cell [8].

The presence of ACE2 and TMPRSS2 in the epithelium covering the structures of the upper respiratory tract (URT),

including oral cavity, pharynx, larynx or nasal cavity, enables the invasion of SARS-CoV-2 into the host cells via URT and could explain the high concentration of the virus in these areas [8]. It was suggested that differences in the population susceptibility to COVID-19 might be related to the modulation of ACE2 and TMPRSS2 levels in URT induced by air pollution or chronic inflammatory respiratory diseases, such as asthma, chronic obstructive pulmonary disease or atopy [4].

4.2. Diagnosis

COVID-19 diagnosis is currently based on SARS-CoV-2 detection using real-time a reverse transcriptase-polymerase chain reaction (RT-PCR) test. Nevertheless, the sensitivity of RT-PCR to detect SARS-CoV-2 does not reach 100%. RT-PCR could give false-negative results, as, according to various authors, the reported sensitivity of this molecular test ranged between 60 and 90% [9]. The most commonly recommended samples for SARS-CoV-2 evaluation are nasopharyngeal and oropharyngeal swabs, however, sputum, bronchoalveolar lavage (BAL) or endotracheal aspirates could also be obtained for examination [9]. The analysis of nasopharyngeal swabs, that should be taken from the posterior nasopharyngeal tonsil region, was recommended mostly, as nasopharynx harbors high viral loads [10]. Testing tracheal aspirates could be of great importance in patients after laryngectomy as the primary airflow in these individuals is via the tracheostomy [11]. Testing BAL was considered to be the most sensitive in analyzing SARS-CoV-2 in intubated patients [12].

Chest computed tomography (CT) has a sensitivity of 97% and, according to observational studies, could be even more precise tool than RP-PCR in detecting COVID-19 in particular cases, if revealing infiltrates, ground-glass opacities, and bronchovascular thickening consolidations [13].

Laboratory examination in COVID-19 positive patients usually revealed leukopenia and lymphopenia, elevated levels of C-reactive protein, D-dimer, lactate dehydrogenase, aminotransferases, and serum creatinine [9]. Procalcitonin tended to remain in the normal range in the majority of COVID-19 positive individuals [9].

Currently, the criteria for confirmed and suspected COVID-19 cases proposed by WHO were presented in Table 1.

4.3. Otorhinolaryngological symptoms of COVID-19

The majority of patients infected with SARS-CoV-2 suffer from fever, dry cough, muscle pain and fatigue [14].

Otorhinolaryngological symptoms are not the most common manifestations of COVID-19.

Among all otolaryngological organs, the sinonasal cavity is considered to be the main site of the infection induced by SARS-CoV-2, as approximately 90% of the inhaled air goes through the sinonasal cavity [4]. Importance of the sinonasal cavity in COVID-19 development could also result from the high concentration of the genes predisposing to SARS-CoV-2 infection, namely genes encoding ACE2 and TMPRSS2 [4].

Individuals with COVID-19 may experience sore throat or swelling of the pharyngeal lymphoid tissue, runny nose, nasal congestion or edema, sudden loss of smell that sometimes accompanied by dysgeusia, cough that is mainly unproductive, dyspnea, hoarseness or cervical lymphadenopathy [15]. Laryngitis and laryngeal edema are other COVID-19-induced symptoms that ENT specialists and anesthesiologists must be aware of, especially while intubating and extubating tracheas of critically ill individuals [16]. Parathyroid glands and salivary ducts may also be affected, nevertheless, these are a rare manifestations of COVID-19 [17]. Isolated URT symptoms were usually reported in patients with a mild or moderate form of the disease. However, they might also precede the conversion to the severe form of COVID-19 [15]. Additionally, younger individuals were more prone to present URT manifestations of COVID-19 than older patients [15].

Sudden smell/taste disorders (STD) occurred especially in younger individuals (below 60 years old) and appeared as the initial symptom of COVID-19 in the majority of studied patients [18]. STD was mainly reported in individuals without other coexisting symptoms of COVID-19 or in those with mild ones and was considered to be an especially useful tool in detecting SARS-CoV-2 infection in young subjects [18,19].

The meta-analysis conducted by Tong et al. revealed that the prevalence of olfactory dysfunction reached 52.73%, ranging between 5.14% and 98.33%, while gustatory dysfunction was demonstrated by 43.93% (range 5.61%–92.65%) of COVID-19 positive patients [20].

Because of the fact that gustation is significantly linked to olfaction, it was implied that COVID-19-induced dysgeusia was mainly related to the primary failure in the sense of smell [20]. It could explain the frequent co-occurrence of these two symptoms.

Beltra-Corbellini et al. reported that in 35.5% of patients with COVID-19, olfactory or gustatory dysfunction was the initial symptom of the disease, and the onset of STD was acute in the vast majority of cases (70.95%) [18]. The complete return to normal smell and taste was observed in 40% of patients after 7.4 ± 2.3 days, while the partial recovery was reported in 16.7% after approximately 9 days [18].

Because in several COVID-19 cases olfactory function returned to normal or improved after a relatively short period, it was proposed that olfactory dysfunction resulted from an inflammatory response in the nasal cavity that transitionally disrupted odorants from reaching the olfactory neurons [18]. Nevertheless, it is currently unknown whether SARS-CoV-2 is able to permanently damage olfactory neurons or just to induce temporary dysfunction [18].

The occurrence of sudden onset loss of smell, not accompanied by nasal obstruction, was considered to be highly predictive of COVID-19 [4]. It was reported that in the cohort of 55 individuals with sudden anosmia, not accompanied by nasal obstruction, 94% tested positive for COVID-19 within 7 days of the anosmia onset [4]. In several patients, the return of the sense of smell tended to start after 5–10 days, nevertheless the duration to complete recovery remained unknown [4].

Table 1

The criteria for confirmed and suspected COVID-19 cases proposed by WHO [1].

Confirmed COVID-19 case	Suspected COVID-19 case
positive validated SARS-CoV-2 specific nucleic acid examination (PR-PCR)	presence of acute respiratory tract infection (sudden onset of at least one of the following symptoms: cough, fever, dyspnea) + no other etiology could fully explain the symptoms + a history of travel or living in an area with confirmed COVID-19 cases within 14 days prior to the onset of the symptoms;
OR SARS-CoV-2 identification by electron microscopy or viral culture, irrespective of clinical signs and symptoms	OR acute respiratory tract infection + close contact with an individual positive/suspected for COVID-19 within 14 days prior to the onset of the symptoms; OR severe acute respiratory tract infection (fever and at least one symptom of respiratory infection including cough or dyspnea) requiring hospitalization + no other etiology fully explaining patient's condition

Similarly, Beltran-Corbellini et al. reported that subjects suffering from STD did not present nasal obstruction [18]. Therefore, the authors concluded that SARS-CoV-2 expressed a high affinity to olfactory epithelium [18]. It was implied that anosmia could occur in patients affected by SARS-CoV-2 as a result of the infection of the sustentacular cells located in the nasal cavity [21]. Sustentacular cells are responsible for the support, protection and nourishment of the sensory nerves, to which these cells are adjacent to [21]. The high expression of ACE2 and TMPRSS2 proteins that are responsible for virus invasion was found in sustentacular cells [21]. It implied that the infection of these non-neural cells and not the sensory nerves, might be responsible for the loss of smell in patients with COVID-19 [21].

Educating the society that sudden loss of smell/taste may suggest COVID-19 could help in the early implementation of self-isolation, which subsequently could prevent further spread of the disease [18]. For otolaryngologists, sudden STD could be a symptom strongly suggesting COVID-19 [18]. It was suggested that anosmia/hyposmia/dysgeusia should be incorporated into the list of screening tools for potential SARS-CoV-2-induced infection [22]. According to various authors, sudden anosmia in the absence of other manifestations was strongly related to COVID-19 infection [20].

European Rhinologic Society recommended against prescribing nasal or systemic corticosteroids in patients with sudden anosmia and it was consistent with other reports [23]. Corticosteroids use for the sudden loss of smell could escalate COVID-19 infection and should be avoided [24]. So far, any medical treatment for sudden COVID-19-related anosmia had been given a strong recommendation [19]. Because of the lack of proven pharmacotherapy for COVID-19-related anosmia, olfactory training was suggested as a main form of treatment in these cases [19].

ENT UK recommended that adults with sudden anosmia not accompanied by other symptoms should isolate themselves for 7 days. Decreasing the number of otherwise asymp-

tomatic patients, who act as vectors, could significantly reduce the transmission of SARS-CoV-2 [24].

In contrast to anosmia, rhinorrhea, nasal congestions or edema are considered to be less frequent symptoms of COVID-19 [4]. Nasal congestion and rhinorrhea were rarely reported in COVID-19 positive individuals (approximately 4–5%) [25].

According to the meta-analysis conducted by Rodriguez-Morales et al. the mean prevalence of sore throat reached 11% (ranging between 6.4% and 46%) [26].

Pharyngodynia should not be considered as a specific COVID-19 symptom, as it could result from intensive coughing [27]. Nevertheless, in a number of individuals, sore throat was not accompanied by cough [15]. Nasal and pharyngeal symptoms appeared mainly in patients with mild form of the disease [25].

The estimated prevalence of cough in COVID-19 patients ranged between 60 and 82%, while the prevalence of dyspnea ranged between 9% and 37% [25]. Both symptoms were more commonly observed in individuals with a severe form of COVID-19 [25].

Otolaryngologists should be highly suspicious of COVID-19 infection in individuals with mild URT symptoms especially in afebrile ones, as, in the majority of cases, they are first specialists to be contacted by these patients [28].

4.4. Otolaryngologists during COVID-19 pandemic

It was reported that the rate of work-related SARS-CoV-2 infection was higher in ENT specialists than in other specialties [28]. ENT specialists are exposed to SARS-CoV-2 infection as they examine URT, and, as they perform procedures that generate aerosolized secretions and bleeding [7]. ENT-related procedures that result in inducing aerosolization include tracheotomy, repeated endotracheal tube exchange, bronchial tree suctioning, endoscopy, sinus surgery, mastoid drilling, cauterization, positive pressure ventilation, nebulizer

usage or oxygen supplementation [3]. Additionally, many ENT operations, especially oncologic ones, require general anesthesia that involves a number of aerosol-generating procedures (AGPs), such as intubation, bag-valve mask ventilation, post-extubation cough, cuff leakage or accidental disconnection of the ventilatory closed-circuit [6]. Currently, less is known about the risk of SARS-CoV-2 infection for ENT surgeons while performing not AGPs such as parotidectomies or neck dissections [6].

Laryngectomy patients and individuals after tracheotomy with COVID-19 carry a particularly high risk of infecting ENT specialists and other members of medical staff as the way of breathing in these individuals is modified and enables the easy spread of SARS-CoV-2 containing aerosolized tracheal secretions [11]. Additionally, tracheostomy generates a greater aerosol volume than the respiration through a physiological way [11].

In accordance with such high risk of infection, only emergency consultations and procedures should be performed by ENT specialists in times of COVID-19 pandemic in areas with confirmed SARS-CoV-2 cases [23,28].

Patients in stable condition, those with properly managed chronic ENT diseases, and others not requiring urgent in person visit should be consulted using telemedicine options [23,28]. In person appointments should be postponed [28].

Individuals necessitating in person ENT assessment must undergo preappointment screening that comprises body temperature measurement, symptoms-adjusted triaging and obtaining the recent travel history [23].

Full Personal Protective Equipment (PPE) must be used by an ENT specialist while consulting a patient. PPE should consist of a fluid-resistant FFP3/N95 mask, eye protection, disposable and fluid-resistant gloves, and gown, head and shoe covers [2]. Additionally, during performing surgical procedures double-gloving was recommended for ENT surgeons [2].

ENT specialist should be equipped with enhanced PPE that comprise N95 respirator and full face shield or a powered air-purifying respirator (PAPR), disposable gloves, surgical cap, gown, and shoe covers, while performing procedures on positive or suspected COVID-19 patients [3].

In cases of urgent surgery for which there is not enough time for SARS-CoV-2 screening, the clinical staff must be limited to the essential personnel equipped with enhanced PPE [29]. These operations should be performed in a negative pressure operating room with high-efficiency particulate air (HEPA) filtration [29].

American Academy of Otolaryngology-Head and Neck Surgery (AAO-HNS) recommended that all otolaryngologic procedures should be postponed unless really necessary or until reliable preoperative testing for SARS-CoV-2 presence can be done [22].

American Head and Neck Society, AAO-HNS, and the American Colleges of Surgeons, recommended that preoperative testing for SARS-CoV-2 presence should be performed in all individuals undergoing high-risk procedures [22,30]. Nevertheless, precise guidelines for preoperative SARS-CoV-2 testing including establishing the best time to perform the

SARS-CoV-2 detection test in relation to the operation date, and the required number of negative tests to consider patients as COVID-19 negative, are currently not available.

According to Topf et al. procedures not involving mucosa (thyroidectomy and parathyroidectomy, neck dissection, parotidectomy, local resection of skin cancers, and branchial cleft excision) should be considered low-risk procedures, while trans-mucosal (all transoral surgeries such as glossectomy, buccal resection or transoral robotic surgery, laryngeal surgeries and direct laryngoscopy, tonsillectomy, intranasal surgery, maxillectomy or mandible resection) – the high-risk ones [31]. The high-risk procedures must be performed using enhanced PPE [31].

The algorithm for proceeding with ENT patients requiring surgery during the COVID-19 pandemic was presented in Fig. 1.

Interestingly, Mady et al. proposed a novel strategy for the intranasal and intraoral preoperative use of povidone-iodine (PVP-I), a potentially virucidal agent, in both, patients and ENT surgeons, to reduce the risk of virus aerosolization and transmission [32]. The recommendations of PVP-I administration were presented in Table 2.

4.5. Rhinology/Rhinologic procedures

Rhinologic surgeries, including endoscopic or open sinus and skull base surgery, carry an extremely high risk SARS-CoV-2 infection for ENT surgeons and should be postponed in all non-acute cases [10,23].

The high risk of infecting ENT providers is mainly related to the high concentration of the virus in the sinonasal cavity, and the formation of aerosols induced by surgical instruments commonly used during endoscopic procedures, such as a drill, microdebrider, balloons or suction electrocautery [7,10]. Saline irrigation used for sinuses washing or for cleaning the endoscope also carries a risk of virus aerosolization [10]. In general, all actions induced on URT mucosa by high-speed flow, even administration of the anesthetic sprays to the nasal cavity, led to aerosolization of the mucosa [10].

According to recommendations, performing endoscopic sinus/skull base surgery should be done after a patient tested negative for SARS-CoV-2 within 48 h prior to the operation [10]. Because of the relatively high level of false negative results, two tests should be performed if possible [33].

Interestingly, Zhu et al. reported that an endonasal pituitary surgery for pituitary adenoma performed on a single individual who was diagnosed with COVID-19 several days postoperatively when he developed fever, cough, dyspnea, bilateral opacities in chest CT, and reduced oxygen saturation requiring non-invasive ventilation, resulted in postoperative COVID-19 infection in 14 medical staff members, none of whom participated in the surgery [34]. The COVID-19 infection developed in 4 nurses, not wearing protective equipment, who took care of the patient directly before the quarantine was incorporated, and in 10 more members of the medical staff from the department who did not have contact with the affected patient [34].



Fig. 1. Algorithm for proceeding with ENT patients requiring surgery during the COVID-19 pandemic.

enhanced PPE includes N95 respirator and full face shield/a powered air-purifying respirator (PAPR), disposable gloves and double-gloving, surgical cap, fluid-resistant gown, and shoe covers.

**PAPR rather than N95 respirator and full face shield is preferred in high-risk procedures.

***High-risk procedures (involving mucosa): all transoral surgeries such as glossectomy, buccal resection or transoral robotic surgery, laryngeal surgeries and direct laryngoscopy, tonsillectomy, intranasal surgery, maxillectomy or mandible resection; Low-risk procedures (not involving mucosa): thyroidectomy and parathyroidectomy, neck dissection, parotidectomy, local resection of skin cancers, and branchial cleft excision [31].

HEPA - high-efficiency particulate air filtration; CT-computed tomography; OR-operating room.

A position statement from the European Academy of Allergy and Clinical Immunology (EAACI) and Allergic Rhinitis and its Impact on Asthma (ARIA) recommended that COVID-19 positive patients with allergic rhinitis should continue therapy based on intranasal corticosteroid (including sprays) at the previous dose [35]. Treatment cessation should be avoided, as topical corticosteroid-induced suppression of the immune system in these patients had not been reported [35].

4.6. Head and neck oncology/head and neck cancer (HNC) surgery

4.6.1. Patients categorization

Strict guidelines concerning head and neck oncology management during the COVID-19 pandemic have not been developed yet. AAO-HNS suggested classifying oncologic cases as “time-sensitive” or “emergent” [22]. All “emergent” surgeries should be performed within 48 h, while “time-sensitive”

Table 2

A novel strategy for the intranasal and intraoral preoperative use of povidone-iodine (PVP-I) in patients and ENT surgeons, to reduce the risk of virus aerosolization and transmission according to Mady et al. [32].

	Positive/suspected COVID-19 cases undergoing ENT surgery	ENT surgeon performing procedure in COVID-19 positive/suspected case
Recommended method of PVP-I administration	nasal irrigation with 240 mL of 0.4% PVP-I solution (dilution of 10 mL of 10% aqueous PVP-I into 240 mL of normal saline in a sinus rinse delivery bottle) OR oral/oropharyngeal wash with 10 mL of 0.5% aqueous PVP-I solution (1:20 dilution in sterile or distilled water)	nasal irrigation with 240 mL of 0.4% PVP-I solution (dilution of 10 mL of 10% aqueous PVP-I into 240 mL of normal saline in a sinus rinse delivery bottle) OR oral/oropharyngeal wash with 10 mL of 0.5% aqueous PVP-I solution (1:20 dilution in sterile or distilled water)
PVP-I administration schedule	nasal or oral cavity/oropharyngeal application every 2–3 h, up to 4 times a day	nasal or oral cavity/oropharyngeal application every 2–3 h, up to 4 times a day in the following situations: after or before the contact with a positive/suspected COVID-19 case OR while performing high risk procedure in this case OR if enhanced PPE* is lacking
Additional information	Optionally, PVP-I could be used in asymptomatic patients requiring high risk procedures	–

* enhanced PPE includes N95 respirator and full face shield/a powered air-purifying respirator (PAPR), disposable gloves and double-gloving, surgical cap, fluid-resistant gown, and shoe covers.

but not urgent operations ought to be postponed for a “few weeks” [6].

Managing oncologic patients is very challenging during the COVID-19 pandemic as these individuals are at higher risk of becoming infected or developing severe COVID-19-induced complications than average society members [31]. It was recently reported that individuals with cancer were at 3.5 times higher risk of requiring mechanical ventilation, intensive care unit (ICU) hospitalization or death than individuals without the oncologic disease [36].

As head and neck squamous cell carcinoma (HNSCC) may progress and deteriorate the patient's condition if treatment initiation is delayed, establishing the “potentially safe” postponement duration before treatment incorporation is needed [31]. According to Centers for Medicare & Medicaid Services (CMS) Adult Elective Surgery and Procedures Recommendations, oncologic surgeries were classified as Tier 3a procedures and should not be delayed [37].

According to the French consensus, patients requiring surgical management of HNC during the COVID-19 pandemic should be assigned to one of the three following groups (Group A, B or C) depending on the urgency of treatment [38]. These recommendations were presented in Table 3.

Authors from the United States of America proposed categorizing patients requiring ENT surgeries into one of four groups: urgent (surgery should be performed without delay), less urgent (postponing surgery for more than 30 days should be considered), less urgent (postponing surgery for 30–90 days should be considered), and case-by case basis [31]. Precise information concerning the classification of cer-

tain diseases into one of the four groups was presented in Table 4.

It was strongly recommended that SARS-CoV-2 positive patients without the need for urgent ENT surgery must initially undergo COVID-19 treatment [38].

4.6.2. Evaluation and follow-up in oncologic patients

The follow-up in patients with a history of oncologic surgery, except for those requiring first post-surgical evaluation, those with post-surgical complications, those with tracheoesophageal prosthesis (TEP) complications, and symptomatic ones, should be performed using telemedicine with video options [38]. Individuals with deterioration or the presence of symptoms suggesting potential disease relapse that were identified during teleconsultation, as well as potential new oncologic cases, should be examined in person by an ENT specialist [38]. Prescriptions ought to be provided using telemedicine.

4.6.3. Potential technical problems during head and neck oncological surgeries

Certain ENT procedures for oropharyngeal, hypopharyngeal or laryngeal cancers could be technically difficult or even impossible to perform while wearing enhanced PPE [6]. The usage of the DaVinci console during transoral robotic surgery (TORS) is one of them [6]. Using PAPR or eye protection with loupes or microscope for transoral laser microsurgery or microvascular anastomosis could be difficult [6]. Enhanced PPE-induced inconveniences may force the surgeon to perform open surgery rather than less invasive surgical methods that subsequently could worsen the surgical outcomes [6].

Table 3

The French consensus recommendations for classification and management in oncologic patients requiring surgical management of head and neck cancer during the COVID-19 pandemic [38].

	Group A	Group B	Group C
Disease/condition	life-threatening conditions: -bleeding -dyspnea	-HNSCC, - aggressive salivary glands, -aggressive skin cancers	-slowly enlarging salivary glands carcinomas, - atypical masses localized in the salivary glands not clinically classified as malignant, -laryngeal leukoplakia, -well-differentiated cancers of the thyroid gland
Urgency of the surgery	immediate treatment is needed	delaying treatment for more than 4 weeks could negatively influence patients' prognosis	delaying treatment for 1.5–2 months or more is considered not to have a negative influence on patients' prognosis
Proceeding	nasopharyngeal swabs for SARS-CoV-2 detection using RT-PCR + chest CT should be performed within 24 h prior to the operation	After the postponement duration: nasopharyngeal swabs for SARS-CoV-2 detection using RT-PCR + chest CT should be performed within 24 h prior to the operation	After the postponement duration subjects should be evaluated to detect a possible rapid disease progression
Additional information	If RT-PCR and chest CT are not available, patient should be considered COVID-19 positive and further management of this individual must be adjusted for SARS-CoV-2 positive cases Patients who tested negative for SARS-CoV-2 must be managed with caution as the test may give false-negative result if performed on samples that did not comprise a sufficient amount of intact viral RNA	Diagnostic imaging and pre-radiotherapy dental treatment, if required, should be done in a one-day hospitalization Urgent tracheostomy should be performed if absolutely necessary, in all other cases non-surgical alternative treatment was advised.	

HNSCC- head and neck squamous cell carcinoma.

SARS-CoV-2 - Severe Acute Respiratory Syndrome Coronavirus 2.

RT-PCT - real-time a reverse transcriptase-polymerase chain reaction.

CT – computed tomography.

RNA – ribonucleic acid.

4.6.4. Laryngectomy patients/patients with tracheostomy

It was recommended that laryngectomy patients with positive or unknown status of COVID-19 should always be examined using enhanced PPE [11]. Cases with confirmed negativity for COVID-19 may be cautiously evaluated using standard PPE, as described by the Occupational Health and Safety Administration [39].

Specialists performing high-risk procedures should use PAPR rather than N95 respirator and full face shield [11]. PAPR was also recommended for all procedures involving manipulation within the airway [11].

If a patient requires an in-office visit, tracheostomy ought to be equipped with a heat moisture exchanger (HME) that filters viral or bacterial particles, and adhesive baseplates [11]. HME attached to the stoma using a baseplate was strongly encouraged in individuals after laryngectomy [11]. Cuffed tracheostomy tubes were recommended for COVID-19 positive individuals as they could reduce the risk of local leakage around HME and tracheostomy tube [3]. Tracheostomy must additionally be covered by a surgical mask or at least by scarf [11]. The surgical mask should also cover the patient's mouth and nose [11].

Laryngectomy patients with positive or unknown status for COVID-19 who must be hospitalized require special care, as they cannot be oxygenated, bag-masked, or intubated via URT in order to prevent the spread of aerosolized particles [11]. Individuals with a lot of tracheal secretions and cough should be supplied with tracheostomy tubes with an attached HEPA filter and closed-line suction. Interestingly, using a closed-circuit system like a mechanical ventilator, even if positive-pressure ventilation is not needed, was considered to be effective in reducing the amount of aerosolized viral particles [11]. The closed-circuit system should always be accompanied by the use of cuffed tracheostomy tubes to reduce leaks in the circuit [3]. Patients with tracheostomy should perform bronchial tree toilets including suctioning, on their own. Nebulizer usage ought to be avoided or used carefully as it carries a high risk of virus aerosolization [3]. Additionally, ENT specialist should educate patients not to touch their tracheostomy needlessly, and to wash their hands every time they have a contact with the stoma [11].

The minimal number of necessary medical stuff should be present during patients' examination, medical procedures, and

Table 4

Patients' classification according to the surgery urgency by Topf et al. [31].

Type of group according to urgency degree	Urgent	Less urgent	Less urgent	Case-by case basis	Cases not fitting urgent/less urgent/case-by case basis group
Proceeding	surgery should be performed without delay	postponing surgery for more than 30 days should be considered	postponing surgery for 30–90 days should be considered	individual approach	Patient-adjusted approach, management should be based on the decision of the head and neck department team/multidisciplinary head and neck cancer board
Type of the disease/procedure	-Mucosal HNSCC , especially HPV-negative -Recurrent HNSCC -High-risk thyroid cancers: anaplastic thyroid carcinoma, medullary thyroid carcinoma, metastatic papillary thyroid carcinoma, locally aggressive PTC, revision PTC with disease progression, and greater than 4 cm follicular lesions -Skin cancers: Melanoma greater than 1 mm thick, Merkel cell carcinoma, advanced high-risk cutaneous SCC and BCC located close to critical areas - High-grade salivary tumors: salivary duct carcinoma, mucoepidermoid carcinoma, adenoid cystic carcinoma, carcinoma ex pleomorphic adenoma, acinic cell carcinoma, adenocarcinoma - Skull base malignancy - Cases with deteriorating kidney function	- Low-risk PTC without metastasis - Low-grade salivary cancers	-Benign thyroid disease: goiter, benign thyroid nodules, thyroiditis - Parathyroidectomy with stable kidney function - Benign salivary lesions - Low-risk non-melanoma skin cancers	- Diagnostic procedures: laryngeal directoscopy with biopsy uncommon diseases with uncertain prognosis	–
Additional information	postponing treatment may worsen oncologic outcomes	Analyzing the natural course and prognosis of these diseases, postponing the surgery for more than 30 days is considered not to worsen patient's prognosis	–	–	–

HPV-human papilloma virus.

HNSCC- head and neck squamous cell carcinoma.

PTC - papillary thyroid carcinoma.

SCC- squamous cell carcinoma.

BCC – basal cell carcinoma.

surgeries [11]. Nasopharyngo- and tracheoscopies, if not absolutely required, ought to be postponed. In cases in whom nasopharyngo- or tracheoscopy is necessary, lidocaine anesthesia was recommended to prevent mucosal irritation and subsequent coughing induction [11]. Local anesthesia based on lidocaine-soaked pledgets rather than spray distribution of the drug was advised [11]. Decongestants should also be used similarly [11]. Patients' self-suctioning during nasopharyngo- or tracheoscopy was encouraged [11].

In individuals with possibly dislocated TEP, radiographic imaging rather than broncho- or tracheoscopy was recommended [11]. TEP present in the respiratory tract is an indication for urgent intervention irrespective of the patient's

COVID-19 status [11]. To avoid the closure of the fistula or potential food/liquid aspiration rubber catheter should be placed into the fistula [11]. For patients with the leakage around TEP, non-permanent plug and thickened liquids should be applied [3].

4.6.5. Surgical vs. non-surgical treatment in head and neck oncology during COVID-19 pandemic

Because of the fact that surgery and non-surgical treatment could both be used as first-line therapy for the majority of mucosal SCCs, it was recommended that the non-surgical way of treatment should be preferred during COVID-19 pandemic [6]. In patients with cancers for which the treatment

of choice is surgery, the decision whether to perform an operation during COVID-19 pandemic or not should be made after analyzing all potential pros and cons in the context of oncologic outcome [6].

For patients with T1/T2 laryngeal cancer requiring undelayed treatment, definitive radiotherapy rather than microsurgery using potassium titanyl phosphate (KTP)/carbon dioxide laser (CO₂) was suggested to be a better treatment option, as the laryngeal microsurgery carries a high risk of SARS-CoV-2 infection for ENT surgeon [29].

Nevertheless, oncologic individuals referred to radiotherapy with or without chemotherapy will be exposed to radiotherapy +/- chemotherapy-related consequences including frequent visits in the radiotherapy center or chemotherapy-induced immunosuppression [6].

In contrast, individuals with T1aN0 glottic/T1N0 tonsil SCC could undergo a single, definitive surgery [6]. This therapeutic option, on the one hand, carries a high intraoperative risk of SARS-CoV-2 transmission to ENT surgeon, but on the other hand, protects the patient from the repeated visits to the radiotherapy center, and the consequences of radiation treatment [6].

Managing patients with advanced cancers of the upper aerodigestive tract is more challenging, as these individuals usually require long post-operative hospitalization and intensive medical care [6]. Primary radiation with or without chemotherapy could be considered for individuals with T4a laryngeal, oral cavity or advanced sinonasal SCC [6].

During COVID-19 pandemic neoadjuvant chemotherapy with or without cetuximab or neoadjuvant chemotherapy with or without immunotherapy could be considered in some cases. Besides not being normally used in cases of primary or recurrent mucosal SCC referred to surgery, neoadjuvant chemotherapy could reduce symptoms and subsequently delay the need for operation in these patients [6]. However, chemotherapy-induced toxicity could lead to serious complications if a patient during chemotherapy turns out to be COVID-19 positive [6]. Neoadjuvant immunotherapy alone is currently not recommended because of the lack of sufficient data on its side effects during the COVID-19 pandemic [6]. Initiating or continuing adjuvant therapy in individuals with solid tumors in whom adjuvant therapy could potentially be curative, should not be delayed [3].

Postponed surgical intervention for individuals with surgically low-grade salivary carcinomas and well-differentiated papillary thyroid carcinomas is unlikely to worsen the patient's oncologic outcome [6].

It was recommended that decisions concerning establishing treatment strategies for oncologic patients should be based on a multidisciplinary evaluation of every individual patient [29].

4.7. Airway endoscopies

Endoscopic procedures may aerosolize SARS-CoV-2 and, if possible, should be avoided in both, outpatients and inpatients [29].

Nasal- and laryngoscopies, as well as oropharyngeal examination could easily induce sneezing or coughing subsequently

leading to the dispersion of the virus containing aerosol particles. It was established that both, nasal cavity and nasopharynx, exhibit high viral loads, thus all not urgent nasal- and laryngoscopies should be postponed to reduce the risk of virus transmission to ENT specialist [29,38].

Nasal endoscopy should be postponed except for cases of unilateral symptoms, rhinosinusitis complications, failed previous appropriate therapy, evaluation in immunocompromised patients, and individuals in whom malignancy is highly suspected [33]. In not urgent cases CT rather than nasal endoscopy should be considered [33].

According to American Laryngology Community, indications for flexible laryngoscopy comprise hemoptysis, odynophagia impeding hydration and nutrition, and airway obstruction mainly secondary to infection or malignancy [40]. In other conditions, CT or ultrasound, rather than laryngoscopy were advised [40]. Prior to the URT endoscopy, testing for COVID-19 should be performed [40].

If the endoscopic examination is needed, e.g. for patients with airway obstruction or malignancy, disposable nasal pledges soaked with local anesthetic and decongestants were recommended [29]. Using the smallest diameter scope was advised to reduce the chance of inducing sneezing or coughing [10]. ENT specialist should be equipped with PPE while performing URT endoscopies. Observers should not be attending the procedure to reduce potential exposures, and to save PPE [10,40]. Various methods of endoscopes sterilization including automated reprocessing, gas sterilization with ethylene oxide, and chemical reprocessing with isopropyl alcohol, glutaraldehyde, chlorine dioxide, or ortho-phthalaldehyde could be used, except for except 70% isopropyl alcohol [40].

High level disinfection (2–3% hydrogen peroxide, 2 to 5 g/L chlorine disinfectant, or 75% alcohol) should be used for cleaning rooms, in which the procedure was performed [10,40].

4.8. Tracheotomy

Patients with acute airway obstruction requiring tracheotomy should be considered as COVID-19 positive, as there is no time for SARS-CoV-2 testing in case of such urgent surgery [29]. High-flow nasal cannulas in individuals with airway obstruction and positive or unknown COVID-19 status should not be used, as they carry a high risk of virus aerosolization [29]. The patient ought to be preoxygenated and subsequently rapidly intubated, preferably using video laryngoscopes, to reduce the viral aerosolization [29]. The use of disposable laryngoscopes could reduce the risk of virus spread [29]. If necessary, second-generation laryngeal mask airways rather than first-generation devices should be used, as they are less likely to provide leakage [29]. Extra-corporeal membrane oxygenation (ECMO) was recommended over the emergent surgical opening of the airway in a “can't intubate, can't ventilate” scenario, to prevent virus particles aerosolization [29]. Intubation in COVID-19 positive or suspected cases is supposed to be performed by a specialist equipped with PAPR gear [10]. During the COVID-19 pandemic, surgical tracheotomy rather than ECMO should be performed in indi-

viduals with obstructive laryngeal tumors, profuse oropharyngeal hemorrhage, trismus precluding the opening of the oral cavity and intubation, and in other cases that will potentially require long-lasting protection of airway patency [29].

Tracheostomy should be performed in a negative pressure operating theater equipped with HEPA filtration and by an ENT surgeon wearing enhanced PPE [29]. If PAPR gear is not available, FFP3/N95 masks could be covered by a surgical mask to provide multilayer protection [41]. If negative pressure operating room is not available, an aerial-isolated room should be used to perform the surgery [41]. In patients hospitalized in ICU tracheostomy should be performed in ICU rather than in the operating room to avoid transport-related procedures, including disconnection of the circuit for transfer or manual ventilation [42]. Besides the surgeon, other members of medical staff attending the procedure should also wear enhanced PPE [29]. The patient is supposed to be completely paralyzed using neuromuscular blockade to prevent coughing and swallowing [10]. Propofol and rocuronium bromide administration prior to the tracheal intubation was recommended to avoid coughing and droplet production. The use of glycopyrrolate could be considered to reduce secretions [12]. Intraoperatively, electrocautery usage should be avoided, while suction use should be limited. Oxygenation must be accomplished with positive end-expiratory pressure (PEEP) [41]. Opening the anterior tracheal wall must be done extremely gently to prevent perforating the cuff and to maintain a closed circuit [29]. The mechanic ventilation should be stopped while incising the tracheal wall and inserting a cuffed, non-fenestrated tracheostomy tube into the trachea [43]. Heat and moisture exchanger (HME) must be immediately combined with the tracheostomy tube to prevent the virus particles from spreading [43]. After tracheostomy tube insertion, end tidal CO₂ and tidal volumes must be confirmed [42]. A closed circuit gear, the same as used for individuals connected to a mechanical ventilator, could be used after tracheostomy [44]. Ventilation with lower ventilator settings (40–50% FiO₂, PEEP <12) for more than 21 days was recommended [42].

Weaning patients from a ventilator should be performed with the cuff inflated, because its deflation during this procedure would lead to aerosol generation [42].

Tracheostomy care differs from typically used. After the surgery, the tracheostomy tube should not be changed or manipulated as long as the patient's COVID-19 status remains positive or unknown [43]. It was suggested that the tube should not be exchanged for at least 7–10 days after the surgery [45]. Further tube change should be postponed for 30 days [41]. Dressing around the tube should be left unchanged unless there is evidence of local infection [41]. Additionally, only closed in-line suction and closed circuit maintenance were recommended the British Association of Otorhinolaryngology – Head and Neck Surgery (ENT UK) [43]. The humidified wet circuit must be avoided to prevent the risk of the room contamination in case of unexpected circuit disconnection [43]. Percutaneous dilation tracheostomy was not recommended, as it exposes ENT surgeon for the contact with the open tracheostomy for a longer period of time [29]. As awake patient tracheostomy or percutaneous cricothy-

rotomy are procedures during which air-flow suspension cannot be achieved, surgical tracheostomy performed on an intubated or sedated individual is the preferred procedure to reduce the viral aerosolization [41].

Besides the fact that tracheostomy performed within the first 7 days after intubation was associated with a decrease in the length of mechanical ventilation, mortality rate and duration of stay in ICU in a systematic review conducted in 2018 [46], currently, there are no clear recommendations regarding the timing of tracheostomy in individuals with COVID-19-induced acute respiratory distress syndrome (ARDS) [47]. Similarly, no recommendation for performing tracheostomy within 7 days in COVID-19 patients with ARDS has been proposed [47]. No data indicating improvement of these patients' clinical conditions after tracheostomy is currently available [47]. New York Head and Neck Society recommended that, in the majority of cases, approximately 21 days' delay prior to consideration of tracheostomy after intubation was reasonable [12]. According to this Society, in individuals with high mortality risk tracheostomy should not be performed [12]. It should also be avoided in patients with respiratory instability [42]. New York Head and Neck Society recommended that all intubated patients should have cuff pressure of approximately 30mm Hg to prevent tracheal/laryngeal necrosis and subsequent stenosis, as well as to sustain appropriate seal to avoid aerosolization [12]. Nevertheless, with the use of modern low-pressure cuffs, the prevalence of symptomatic stenosis is 1–2% [12]. The cuff pressure should be checked every 4 h [12].

Vukkadala et al. suggested that COVID-19 is improbable to induce the need for prolonged ventilation requiring tracheostomy, as individuals in a critical condition either recover or decease [10].

4.9. Otolaryngologic surgeries

Otologic surgeries are considered high risk procedures for ENT surgeons because of intraoperatively generated virus aerosolization [48]. Virus aerosolization could, on the one hand, result from the middle ear connection with the nasopharynx via Eustachian tube, and on the other hand, from the use of high-speed drills during transmastoid procedures [48]. Nevertheless, data on the viral loads in the middle ear and mastoid cavity are limited [48]. Because of the fact that the transconjunctival spread of SARS-CoV-2 was reported, drilling-induced dust generation that enters eyes intraoperatively could potentially transmit the virus [48]. Operation using a rigid otoscope with a camera instead of a microscope may be performed if wearing PPE disturbs effortless microscopic surgery [24].

As for all high risk procedures, enhanced PPE with PAPR was recommended while performing otologic operations [48]. While the majority of otologic procedures are not urgent ones, some of them require emergency intervention [48]. A classification of otologic conditions depending on the urgency of surgical intervention and the proposed surgical recommendations were presented in Table 5.

Table 5

Recommendations for otologic interventions during COVID-19 pandemic according to Saadi et al. [48].

Type of surgery/procedure	Recommendation
Urgent/emergent surgery: -TTP for acute convalescent mastoiditis -complicated mastoiditis -complicated otitis media -mastoidectomy for acute convalescent mastoiditis or complicated mastoiditis	-should be performed as soon as possible, treatment should be initiated within 24–48 h - patient must be considered COVID-19 positive to avoid delaying surgery while waiting for the results - number of medical personnel should be limited to the minimum, enhanced PPE required for all staff members - bag mask ventilation should be avoided for TTP, instead laryngeal mask airway or intubation should be used -enhanced PPE including PAPR should be used during mastoidectomy -high-speed drill should only be used in managing complicated mastoiditis - TTP should be performed with the use of endotracheal intubation to minimize the risk of virus aerosolization
Semiurgent surgery: -facial nerve decompression in case of its acute paralysis -closure of high-flow cerebrospinal fluid leak -tympanomastoidectomy in case of complicated cholesteatoma -postmeningitic cochlear implantation -brainstem decompression for intracranial tumors -temporal bone malignancy	-should be performed as soon as possible, more than 48 h delay is acceptable in some cases - within 48 h preoperatively test for SARS-CoV-2 presence, quarantine while waiting for results, another test for SARS-CoV-2 presence on the day of operation. If results are not quickly available – patient must be considered COVID-19 positive - number of medical personnel should be limited to the minimum (no residents, no students), enhanced PPE required for all staff members, surgery performed in a negative pressure operating theater equipped with HEPA filtration
Semielective surgery: -tympanomastoidectomy in case of cholesteatoma with persistent infection or progression -cochlear implantation in children -bilateral otitis media with effusion in children -closure of low-flow cerebrospinal fluid leakage -excision of growing vestibular schwannoma	-should be performed within 3–6 months -within 48 h preoperatively test for SARS-CoV-2 presence, quarantine while waiting for results, another test for SARS-CoV-2 presence on the day of operation
Elective surgery: -stapedotomy/stapedectomy -ossicular chain reconstruction -tympanoplasty for dry or stable tympanic membrane perforation -adult cochlear or boneanchored hearing aid implantation	-all elective surgical cases (quality-of-life-related hearing rehabilitation) should be postponed (indefinite time delay, preferably until COVID-19 resolution)
Examination: - otoscopy - binocular microscopy - cerumen removal	-evaluation of COVID-19 positive/unknown demanding close contact (less than 1 m) should be performed in enhanced PPE ^{a/b}

TTP-tympanostomy tube placement.

^a enhanced PPE includes N95 respirator and full face shield/a powered air-purifying respirator (PAPR)[†], disposable gloves and double-gloving, surgical cap, fluid-resistant gown, and shoe covers.

^b PAPR rather than N95 respirator and full face shield is preferred in high-risk procedures.

ENT UK recommended against the use of high dose oral steroids for Meniere's Disease or Sudden Sensorineural Hearing Loss (SSNHL) [24]. Instead, therapy based on intra-tympanic steroid injection should be preferred in managing these diseases [24].

Idiopathic facial nerve palsy in COVID-19 positive/unknown patients should not be treated with systemic steroids [24]. COVID-19 should not affect the standard treatment of necrotizing otitis externa, however, the patient should be discharged from the hospital immediately after improvement [24].

4.10. Emergency procedures

Emergency procedures including nasal bleeding management, peritonsillar abscess drainage or facial wound repair

should be considered high risk procedures and performed by ENT specialists wearing enhanced PPE [24,29,49].

Treatment of nasal bleeding should be initially based on compression [49]. Tranexamic acid and local decongestion using soaked pledgets instead of spray were also advised [49]. Silver nitrate cautery could be used if bleeding continues. Nasal packing should be performed in case of unsuccessful non-invasive management or potentially life-threatening bleeding [49]. Resorbable nasal packing was strongly advised to prevent the need for the next visit [49]. In cases of resorbable nasal packing failure, non-resorbable packing was recommended [24]. Management of posterior nasal bleeding requiring sphenopalatine artery ligation should be preceded by COVID-19 testing [49]. While managing epistaxis, the suction system should be used within a closed system with a viral filter [49].

Individuals with maxillofacial trauma and its subsequent complications such as rectus muscle entrapment, retrobulbar hemorrhage, massive hemorrhage, and exposed brain should immediately be operated. Surgeries in this area are considered high risk ones [29]. Maxillofacial traumas require emergency procedures in the majority of cases. Therefore all patients, even asymptomatic ones should be considered COVID-19 positive, as there is usually not enough time to perform SARS-CoV-2 testing [29]. In these cases enhanced PPE must be used by all staff members [29], and the preoperative use of chlorhexidine gluconate or povidone-iodine to swish and spit was advised [50].

According to the Stanford University guidelines, those with less urgent maxillofacial injuries should be tested for COVID-19 twice, 48 h preoperatively in 24 h interval, and should be kept in quarantine until the results are obtained [29,50]. In cases of at least one positive result surgery should be performed with the use of PAPR [29].

Patients with skull base injury and cerebrospinal fluid (CSF) leak should be initially not-surgically treated and closely monitored [50]. In cases of persistent leakage after 7 days, surgery preceded by COVID-19 testing should be performed to reduce the risk of meningitis [50].

4.11. Pediatric otolaryngology

COVID-19 in children is less common than in adults. It was reported that children constituted approximately 5% of all confirmed COVID-19 cases [51]. Children, except for those under 12 months of age, were more prone to develop an asymptomatic or relatively milder form of COVID-19 than adults [10].

4.11.1. Airway endoscopy

Recommendations for flexible nasal endoscopy in children are similar to those proposed for adults [51]. Endoscopy should be considered in cases of the strong probability of foreign body presence in the airways. In children without definitive symptoms suggesting the presence of the foreign body in the respiratory tract, CT scan should be performed initially, and followed by endoscopy in those with suspicious CT results. Endoscopy should also be performed in cases of button battery or caustic agent ingestion [51].

4.11.2. Newborn hearing evaluation

Newborn hearing evaluation could be done if the child's mother does not present COVID-19 symptoms and if a procedure is performed by personnel not working directly with COVID-19 individuals [51].

4.11.3. Pharmacologic treatment

Saline nasal irrigation could be used only to reduce the nasal obstruction, mainly in infants [51]. Corticosteroids for polyposis, infectious sinusitis and anosmia were not recommended during the COVID-19 pandemic [51]. In contrast, short corticosteroid treatment could be used in cases of severe forms of acute facial paralysis (grades 5 and 6 of the House Brackmann classification) and SSNHL [51].

4.11.4. Surgical treatment

According to the French Association of Pediatric Otorhinolaryngology and French Society of Otorhinolaryngology, the only surgeries that should be performed during COVID-19 pandemic are those that cannot be delayed for more than 2 months, and those for which surgery is the only therapeutic option [51]. These guidelines implied that tonsillectomies should be postponed [51]. Endonasal surgeries, except for operation for bilateral choanal atresia and poorly tolerated congenital piriform aperture stenosis, should also be delayed [51]. Tympanostomy tube placement and tympanoplasties for cholesteatoma or retraction pockets should be postponed unless complications such as meningeal exposure, labyrinthine fistula or facial nerve paralysis occur [51]. Indications for tracheotomy must be discussed on a case-by-case basis [51].

Preoperative COVID-19 testing within 48 h was recommended for children similarly to recommended for adults [51]. Performing procedures on COVID-19 positive or suspected children requires the same precautions as for adults [51].

5. Conclusion

ENT specialists are at a very high risk of COVID-19 infection while performing examination or surgery because of the nature of this specialty. Strict guidelines for otolaryngologists/head and neck surgeons have not already been provided, and currently available recommendations could presumably change in course of COVID-19 pandemic as the new data increases. We hope that this review will serve as a collection of current recommendations for ENT specialists for how to deal with their patients during the COVID-19 epidemic, and will constitute a valuable hint in their clinical practice.

Authors' contribution

JK: Substantial contribution to the design of the manuscript, literature search, data analysis and interpretation. Preparing the main paper.

WK: Substantial contribution to literature search and data analysis.

KZ: Substantial contribution to literature search

TZ: Drafting the manuscript and revising it critically for important intellectual content. Final approval of the manuscript.

All authors read and approved the final manuscript.

All listed authors have approved the manuscript before submission, including the names and order of authors.

Ethical statement

Compliance with Ethical Standards: All the research included in this manuscript meet the ethical guidelines, including adherence to the legal requirements of the study country. The study protocol complied with the 1964 Helsinki declaration and its later amendments. I confirm that the manuscript has not been published or submitted for publication to any other journal.

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Ethical approval

All the research included in this manuscript meet the ethical guidelines, including adherence to the legal requirements of the study country. The study protocol complied with the 1964 Helsinki declaration and its later amendments.

Informed consent

Not applicable.

Declaration of Competing Interest

The authors declare that they have no conflicts of interests.

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