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Risk of SARS-CoV-2 contagion in otolaryngology specialists

Il rischio di contagio da SARS-CoV-2 tra gli specialisti in otorinolaringoiatria

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SUMMARY

COVID-19 has rapidly spread in the past two years with a profound impact on otolaryngological activities, which has undergone radical transformation to guarantee diagnostic and therapeutic procedures mainly in oncology and urgent patients, while ensuring protection for healthcare personnel and patients. During the initial phases of the pandemic, scheduled visits and elective surgeries were postponed leading to a delay in the diagnosis and treatment of several diseases, including head and neck cancer, with a shift toward more advanced cancer stages and more aggressive treatments. Aerosol and droplets are the main routes of transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), thus leading to a high risk of contagion during otolaryngology visits and surgery. Therefore, the correct use of personal protective equipment (PPE) and attention to procedure-specific risks and measures to avoid contagion are of utmost importance for healthcare professionals, and especially for those dealing with otolaryngology diseases. This narrative review highlights that otolaryngological activity implies a high risk of contagion during outpatient visit, surgery, or urgent conditions. The correct use of PPE, evaluation of procedure-specific risks and reduction of non-urgent procedures are considered the main strategies to limit contagion.

KEY WORDS: COVID-19, SARS-CoV-2, otolaryngology, infection control measures, head and neck surgery

RIASSUNTO

La malattia da COVID-19 si è rapidamente diffusa negli ultimi due anni con un forte impatto sull'attività otorinolaringoiatrica, che ha subito una radicale trasformazione per garantire assistenza principalmente a pazienti oncologici e urgenti, e assicurare protezione al personale sanitario e ai pazienti. Durante le fasi iniziali della pandemia, le visite programmate e gli interventi chirurgici elettivi sono stati posticipati, spesso causando un ritardo nella diagnosi e nel trattamento di diverse condizioni, anche oncologiche, con diagnosi in fasi di malattia avanzata e trattamenti più aggressivi. L'aerosol e le goccioline di saliva sono la principale via di trasmissione del virus SARS-CoV-2. Pertanto, l'uso corretto dei dispositivi di protezione individuale (DPI) e l'attenzione ai rischi e alle misure di protezione specifiche per ogni procedura otorinolaringoiatrica sono della massima importanza. In conclusione, questa review evidenzia che l'attività otorinolaringoiatrica implica un alto rischio di contagio in occasione di visite, interventi chirurgici o trattamento di condizioni urgenti. Il corretto utilizzo dei DPI, la valutazione dei rischi specifici di ogni procedura e la riduzione di visite e interventi non urgenti sono considerate le principali strategie per limitare il contagio.

PAROLE CHIAVE: *COVID-19, SARS-CoV-2, otorinolaringoiatria, controllo dell'infezione, chirurgia testa-collo*

Introduction

In January 2020, a novel coronavirus disease (COVID-19) was officially announced by the World Health Organization (WHO), which rapidly developed into a worldwide public health emergency [1,2].

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COVID-19 is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The human coronaviruses (HCoVs) are members of the coronaviruses family, and responsible for multiple respiratory conditions including the common cold, bronchiolitis and pneumonia [3]. HCoVs periodically appear in different places around the world and have been linked with epidemic or pandemic human pneumonia since the beginning of the 21st century [4]; they include the severe acute respiratory syndrome coronavirus (SARS-CoV), in November 2002, and the Middle East respiratory syndrome coronavirus (MERS-CoV) in June 2012 [5].

SARS-CoV-2 characteristics

Generally, HCoVs are composed of some viral proteins: spike, membrane, envelope, nucleocapsid proteins and hemagglutinin. Spike, membrane and envelope proteins are inserted into the viral envelop, while nucleocapsid protein protects the viral RNA genome located in core of virus [6]. In particular, the spike protein is a glycosylated protein containing the receptor binding domain, which mediates viral entry into host cells [7].

Clinical aspects (symptomatic and asymptomatic infection)

Several studies have documented the clinical severity of COVID-19. In most cases, the incubation period (initial infection to symptoms) varies between 0 to 24 days after exposure, with an average of 5-7 days [8]. Interestingly, COVID-19 positive patients may be an important source of viral transmission before developing symptomatic disease [9].

The most common symptoms are fever, dry cough, pharyngeal pain, headache and myalgia. Some patients complain of fatigue, shortness of breath, muscle pain, confusion, sore throat, headache, vomiting, diarrhoea, olfactory and gustatory dysfunctions and, more rarely, ocular inflammation such as kerato-conjunctivitis [10,11] (Fig. 1).

Patients with severe disease typically present with fever, dry cough, dyspnoea, and interstitial pulmonary infiltrates on thorax imaging. Complications of COVID-19 include acute respiratory distress syndrome (ARDS), respiratory failure, liver injury, acute myocardial injury, acute kidney injury, septic shock and even multiple organ failure. In the case of severe complications, patients require invasive mechanical ventilation (IMV); the case-fatality rate varies between 36 and 52% [12].

The risk factors for disease progression are old age, male sex and presence of comorbidities like chronic obstructive pulmonary disease, hypertension, diabetes, coronary atherosclerotic heart disease and hepatitis B or liver cirrhosis [13]. In the literature, several studies confirm that one or more underlying diseases are correlated with worse prognosis [14]. Many cases of COVID-19 are asymptomatic, with positive detection of nucleic acid of SARS-CoV-2, but with no typical clinical symptoms or signs [15]. In these cases, the key point to control COVID-19 diffusion is the early recogni-

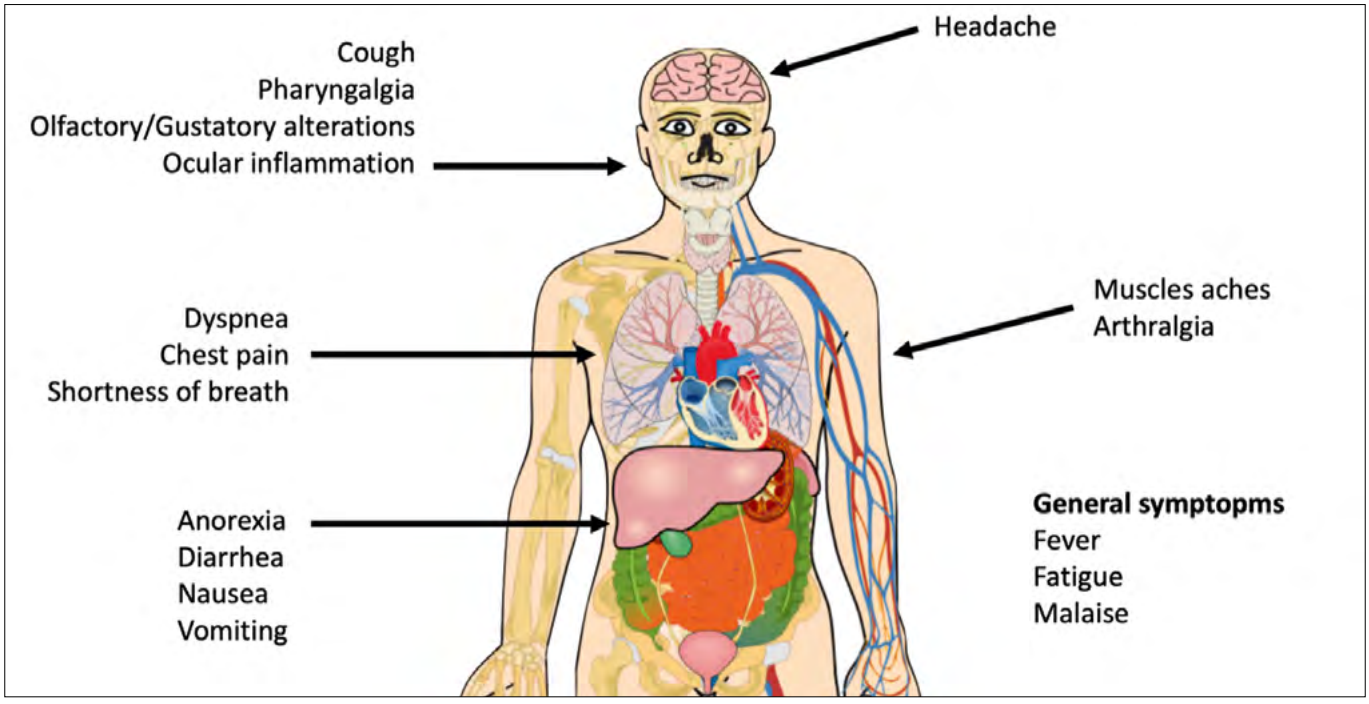

Figure 1. Main clinical symptoms of patients with COVID-19.

tion of an infected person, but most persons with asymptomatic infection do not seek medical assistance, thus contributing to the rapid spread of SARS-CoV-2 [16].

Routes of virus transmission

The main routes of virus transmission include direct transmission through cough, sneezing and contact with oral, nasal and eye mucous membranes [17]. The transmission of infection can occur through both aerosol and droplets. Airborne transmission occurs through small inspirable aerosols (< 5-10 um) even over long distances, while droplet transmission occurs through passage of larger aerosols (> 5-10 um) directly from the infected person to the new host over short distances [18].

Impact of COVID-19 on otolaryngological activity

Reorganization of otolaryngology services

As a consequence of the outbreak of SARS-CoV-2, national health care systems around the world underwent profound changes. The activity of otolaryngological services has undergone radical transformation to guarantee diagnostic and therapeutic procedures mainly to oncology and urgent patients.

A survey from the COVID-19 Task Force of the Young Otolaryngologists of the Italian Society of Otolaryngology Head and Neck Surgery [19,20] reported dramatic changes in ordinary clinical and surgical activity of otolaryngology units in Italy. Non-urgent outpatient procedures were temporarily suspended to limit viral diffusion, and healthcare personnel were relocated to dedicated COVID-19 wards [21]. Following international recommendations [22], before entering the hospital, patients were called and queried about the onset of specific COVID-19-related symptoms in the previous two weeks or direct exposure to SARS-CoV-2, and body temperature was measured at admission; furthermore, normothermia with a negative nasopharyngeal swab for SARS- CoV-2 were required before entering the operating room.

Impact on otolaryngology procedures (elective, emergency, oncology)

Urgent otolaryngology conditions are mainly represented by respiratory distress, epistaxis, sudden sensorineural hearing loss, peritonsillar and neck abscesses, haemorrhage of upper aerodigestive tract, foreign bodies, complicated otomastoiditis and traums. These are situations for which otolaryngology examination cannot be postponed and may require an upper airway endoscopy and/or an auditory evaluation.

Focusing on emergency department activity, in the literature a significant reduction of the number of visits has been described in comparison with the same period of previous years (62-68%) [23]. However, the most dramatic data is the reduction of the number of urgent services during the COVID-19 outbreak [24]. The reasons for the reduction of emergency otolaryngology interventions can be explained by various factors, including the fear of nosocomial SARS-CoV-2 infection, social distancing and home confinement.

Head and neck cancer surgical activity during COVID-19 pandemic consisted mainly in oncology-related diagnostic biopsies (generally performed through microlaryngoscopy or endoscopy), endoscopic or open head and neck procedures and otologic and otoneurologic treatment [21,23]. Head and neck oncology multidisciplinary consultation meetings have been performed in video or teleconference to avoid delays in treating and exposing patients to the risk of infection.

Telemedicine is another important tool that quickly developed during the pandemic to ensure medical examinations; in this way, access to the hospital was reserved only to patients who needed medical or surgical treatment [25]. In addition, telemedicine allowed medical examination for patients in follow-up after cancer treatment or remote evaluation of exams prescribed in previous visits.

Effects on otolaryngology patients' health

The drastic reduction of the routine activity of otolaryngology units had a dramatic impact on the services offered to patients during the pandemic. Scheduled visits and elective surgeries were postponed; this situation, associated with the patients' fear to contract the infection inside the hospital, led to a delay in the diagnosis and treatment of several diseases, including head and neck cancer, with a dangerous shift toward more advanced cancer stages and potential upstaging of TNM classification [26,27].

Some authors report a reduction of 10-20% in outpatient and surgical services in otolaryngology units, especially during the initial phase of the pandemic. For example, an increased interval between diagnosis and successive treatment was noted [28]. Delayed surgery and difficulties in guaranteeing adjuvant therapies also resulted in reduced overall survival for oncology patients [28], tumour upstaging and need for more aggressive treatment, with extension of hospital stay, increased probability of postoperative complications and further reduction of beds.

Furthermore, scientific evidence has confirmed that head and neck oncological patients are at high risk for COVID-19-related pulmonary complications, probably due to immunosuppression, impaired respiratory and swallowing function, and increased aspiration risk [29].

Risk of contagion in otolaryngology specialists

Otolaryngology visits that favour SARS-CoV-2 transmission

Aerosol and droplets are the main route of transmission of SARS-CoV-2, thus leading to a high risk of contagion during otolaryngological visits and surgery. In fact, the viral membrane fuses with the host cell through cell-receptor angiotensin-converting enzyme 2 (ACE-2) and the mucosa of upper airway tract is rich of this receptor.

Medical and surgical procedures for head and neck pathology may favour otolaryngologist, surgeon, nurse and anaesthesiologist contamination with patients' upper airway aerosol and droplets [30-32]. During outpatient visits, the otolaryngology specialist examines the nasal cavity, the oral cavity, the pharynx (naso-, oro- and hypo-) and larynx, requiring the patient to remove their face mask and often inducing sneezing and coughing. Moreover, during most otolaryngology urgent procedures, it is impossible to exclude COVID-19. For these reasons, the correct use of personal protection equipment (PPE) is of utmost importance for healthcare professionals and especially for those dealing with otolaryngological diseases [31-33].

PPE: role in otolaryngology procedures

The protection of healthcare staff is fundamental to limit spread of infection. In the literature it is highly recommended the correct use of PPE during aerosol or droplets generating procedures. The most popular and widely used PPE are FFP2 or N95 respirator and surgical masks, goggles or face shield, glasses, caps, eye protection, fluid-repellent disposable, surgical gown and gloves [31,33].

The Canadian Society of Otolaryngology Head and Neck Surgery developed guidelines defining the level of protection for healthcare workers based on specific parameters. These include Level 1 PPE: Surgical mask + gown + gloves + eye protection; Level 2 PPE: N95 respirator + fluid repellent gown + head cover including neck protection + double gloves + eye protection; and Level 3 PPE: Negative pressure room with minimum staff + N95 mask with second surgical mask + face shield or goggles + double fluid repellent gown + head cover including neck protection + double gloves [34,35]. Figure 2 schematises the algorithms for aerosol generating medical procedures (AGMP) following the guidelines for healthcare workers during AGMP proposed by the Canadian Society of Otolaryngology Head and Neck Surgery.

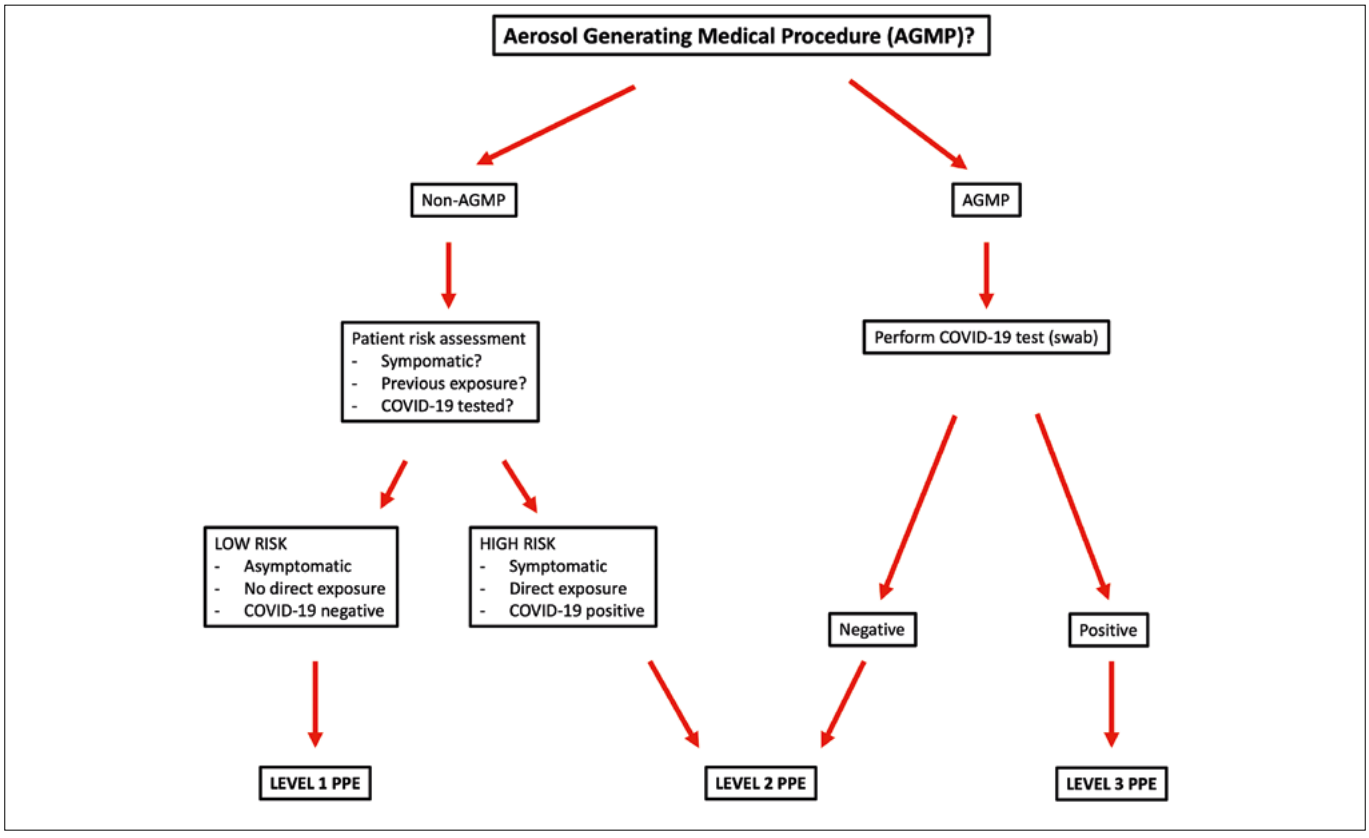

Figure 2. Guidelines for Healthcare Workers during Aerosol Generating Medical Procedures (AGMP) proposed by the Canadian Society of Otolaryngology Head and Neck Surgery.

Procedure-specific risk

Each otolaryngological surgical procedure implies a different risk of contagion. In this section, we describe the procedure-specific risk of the most frequent otolaryngology procedures and the strategy to minimise the possibility of contagion.

Endoscopy

Endoscopy of nasal, pharyngeal and laryngeal sites is routinely used in diagnostic otolaryngological activities and represents a high-risk procedure for otolaryngologists because it requires a short physical distance between patients and physicians and can induce sneezing and coughing [36]. Consequently, potential virus transmission through aerosol and direct contact can be generated, especially in cases of long exposure in closed environments [31].

National and international otolaryngology societies published several recommendations to limit contagion during endoscopy procedures. In general, the most frequent advice is to perform endoscopy with a flexible instrument in urgent cases and only if strictly necessary [36]. Another suggestion is to use topical decongestant with local anaesthetic solution during the examination [37]. In addition, during all endoscopic procedures, it is fundamental to use PPE and avoid direct contact with contaminated equipment and potentially harmful chemicals during the sterilisation procedures [38].

Epistaxis management

Epistaxis is one of the most common conditions in the general population and in some cases requires prompt treatment in an emergency department setting. Tunkel et al. [39] estimated that epistaxis accounts for about 0.5% of all emergency department visits and up to one-third of all otolaryngology procedures in the emergency department.

As a general rule, all patients must be considered COVID-19 positive and appropriate precautions should be used. In addition, healthcare personnel should inquire about contacts at risk for COVID-19 and the presence of common COVID-19 symptoms like fever, cough or alterations in taste and smell in the last two weeks. When possible, patients should wear a surgical mask minimally covering the mouth.

For proper management of epistaxis performed in the emergency department, it is important to distinguish patients who need prompt treatment from those who do not [40]. Table I summarises the clinical signs and symptoms of patients with epistaxis requiring immediate assistance.

The first approach for epistaxis is non-invasive intervention, including compression of the alar cartilages for at least 15 minutes and administration of antifibrinolytic agents. If these attempts fail, more invasive interventions should be initiated.

Ideally, invasive treatment should be performed in a negative-pressure operating room. In fact, nasal packing without anaesthesia or sedation can expose personnel to contagion because the patient is unable to control coughing and sneezing. Another recommendation is to reduce the number of personnel in the room, limiting to one otolaryngology specialist and a nurse.

The most common treatments, which include nasal packing or cautery, should be performed in case of failure of non-invasive procedures or in case of a life-threatening epistaxis [40].

Nasal endoscopy with sphenopalatine artery ligation, in case of posterior massive epistaxis, should be delayed until COVID-19 testing is performed if clinically possible [41].

The last recommendation is that the first approach to epistaxis should be performed only by an expert physician, because errors in this phase can expose other healthcare specialists to the risk of accidental contact with contaminated medical devices.

Tracheostomy

The outbreak of SARS-CoV-2 caused a high-rate admission to hospitals and intensive care units (ICU). Tracheostomy was one of the most common procedures performed in sedated ICU patients who required prolonged intubation. The best timing to perform the tracheostomy in COVID-19

Table I. Risk factors and clinical signs and symptoms of epistaxis requiring prompt treatment.

Personal risk factors	High blood pressure not on therapy Haematological disease Oncologic disease Relapsing epistaxis Anticoagulant/antithrombotic therapy
Clinical signs and symptoms	Prolonged bleeding Bleeding from both sides of the nose Bleeding from the mouth Tachycardia Syncope Hypotension Hypovolaemic/haemorrhagic shock

Table II. Factors to define tracheostomy time in ICU patients.

Factors for early tracheostomy	Factors for delay tracheostomy
Laryngeal injury, trauma or dysfunction	Requirement for prone ventilation
Ventilator-associated respiratory muscle atrophy	Multiorgan failure
Pulmonary hygiene	Potential risks to healthcare workers, patients and family
Cumulative effects of sedation	
Expedited in rehabilitation post ICU	
Ability to communicate	
Maintenance of ICU capacity	

patients is still controversial, but systematic reviews suggest executing it from 7 to 10 days after orotracheal intubation to reduce the duration of invasive ventilation, mortality rate and length of stay in ICU [42]. However, it should be considered that tracheostomy in patients with severe forms of COVID-19 can also be detrimental. In fact, data in the literature demonstrate that in COVID-19 patients who underwent an extended period of mechanical ventilation, the tracheostomy might not be beneficial, and can increase the risk of SARS-CoV-2 infection in healthcare workers [43]. Table II summarises the most important factors reported in the literature regarding the timing of tracheostomy in COVID-19 patients.

The execution of a tracheostomy can be done in sedated and intubated patient or in awake patients by local anaesthesia. It can be surgical (generally performed by otolaryngology specialists) or percutaneous (usually performed by anaesthesiologists). The latter is not preferable since airflow must be maintained during the procedure and droplet emission is higher [44]. Instead, during surgical tracheostomies it is possible to stop the airflow, although a large quantity of droplets and aerosol is usually generated after the aperture of the trachea and mechanical ventilation. In this scenario, the risk of exposure for surgeons, nurses and other healthcare personnel in operating room is very high. The procedure can be done bedside in ICU, although the most recommended setting is the operating room using negative pressure, when possible, even if this involves transfer from ICU and additional risk of exposure for medical staff.

During the procedure, healthcare personnel protection is of utmost importance; some authors also suggest adopting powered air-purifying respirators (PAPRs) in addition to the standard PPE [45,46].

The surgical kits and cannulae of different sizes must be ready before the beginning of procedure to reduce entrance of other personnel in the operating room.

During the surgical procedure, and especially before opening the trachea, it is important to perform deep muscular blockade, reduce the oxygen-percentage of the inflated air to 21%, push the tube as caudally as possible to avoid cuff breach and hyper-inflate the tube cuff to ensure lower airway isolation. Post-operative management of tracheostomy patients includes safe suction of secretions, regular cuff-pressure check and correctly planned cannula changes.

Endoscopic sinonasal and skull base surgery

Endoscopic sinus and skull base surgery are some of the most widely performed procedures in otolaryngology and are considered high-risk operations for viral spread and infection of the operator [47]. The reasons are the high viral load in the upper airways, and especially aerosol generation during endonasal instrumentation, like suctioning, drilling and use of debrider and bipolar diathermy [48].

Many cases of surgeons developing COVID-19 symptoms after endoscopic surgery in patients without clinical manifestations of infection have been reported from China, Iran, Italy and Greece [49]. Spock et al. [50] proposed a COVID-19 management algorithm to stratify urgent and non-urgent cases requiring endoscopy procedures, dividing patients into non-neoplastic and neoplastic.

During the first weeks of the pandemic, several strategies to limit aerosols produced during endoscopic sinus surgery (ESS) have been proposed. Tsagkovits et al. [47] suggested to place the surgical instruments on the thorax of patient and to wrap an otomicroscope drape around the patient in order to isolate the head and the body. According to Spock et al. [50] patients can be fitted with a rigid facial mask modified with a hole in correspondence of the nose, then placing a glove over the cutout (called 2-port VENT mask). Jones and colleagues [51] used a modified bronchoscopy mask over the face of patient; this tool, connected to a suction unit to reduce spread of aerosols and droplets, allowed the introduction of endoscopic instruments and orotracheal tube.

After these first attempts, the main recommendations reported in the literature during endoscopic surgery are the following [52]: a) Perform the procedure with a skilled surgeon, dedicated operating room team (nurse and anaesthesiologist) and set of precision instruments; b) Minimise the spread of the virus from bone drilling, cauterisation and exposure to the heat generated by light from the endoscope; c) Especially for anterior skull base pathologies, use ESS only when it constitutes the best option with regards to ex-

posure, resection and morbidity. In fact, in many cases of anterior skull base pathologies, minimally-invasive transcranial approaches may remain a better option to reduce the spread of virus during surgery.

Otologic and neurotologic surgery

During the initial phases of the pandemic, there was no clear consensus on the safety of otologic surgery and causes of contagion during it. The initial hypothesis was that mucosal lining of the Eustachian tube, middle ear and mastoid should be polluted by the virus from the upper airway and drilling the mastoid bone can produce droplets and aerosols [53]. Moreover, in animal models and cadaveric simulation it was demonstrated that drilling bony microspicules could penetrate the cornea as a possible means for viral transmission [54] and transconjunctival spread of COVID-19 [55]. The operative microscope offers protection for the eyes of surgeon, but the drilling exposes all healthcare personnel in the operating room. Otologic procedures are generally elective surgeries and should be postponed. For clinical conditions that cannot be postponed, several algorithms and classifications have been proposed to stratify otologic procedures [56]. Table III summarises the otologic and neurotologic procedures and provides a decisional algorithm.

Head and neck oncologic surgery

Oncological activity is generally considered nonelective, and diagnostic or treatment procedures should be performed as soon as possible. Most upper aerodigestive tract malignancies grow rapidly and quickly metastasise to locoregional lymph nodes. Treatment delays of 20-30 days are often associated with tumour upstaging and worse overall survival [57]. In addition, delayed treatment can result in a more aggressive tumour resection. On the other side, otolaryngology specialists are at high risk of infection due to exposure to respiratory droplets. Furthermore, in head and neck cancers alternative treatments to surgery are lacking. For example, for cancers arising from the oral cavity or advanced laryngeal cancers or human papillomavirus (HPV)-negative oropharyngeal squamous cell carcinoma (OPSCC) or salivary gland malignancies, surgery is the main treatment and there are no accepted neoadjuvant treatment options [58]. During the first phases of the pandemic, when diagnostic tests were limited and vaccines were not available, some authors suggested to favour radiation and chemotherapy for head and neck neoplasms if oncologic outcomes were comparable to surgery [59]. For these reasons, head and neck cancer management during the COVID-19 pandemic represented a challenge for surgeons and all specialists involved in the treatment of these pathologies.

To reduce the risk of missing or delayed oncological diagnosis, oncology centres began performing a selection of scheduled visits by examining the symptoms reported and previous medical history [26]. The most frequent criteria found in the literature to select patients were history of

Table III. Decisional algorithm to perform or postpone oncological surgery.

Type of urgency	Time of treatment	Pathology	Type of surgery
Urgent/emergency	Performed as soon as possible within 24-48 hours	Complicated mastoiditis (lateral sinus thrombophlebitis, neuromeningeal damage, temporomandibular arthritis) Cholesteatoma with lateral semicircular canal (LSC) fistula and associated symptoms	Surgical procedures should be performed under the presumption that patients are COVID-19 positive. Enhanced PPE is mandatory with a strong preference for use of PAPR. Clinical staff should be limited to essential personnel (i.e., senior attending anaesthesiologist, experienced attending surgeon and registered nurse) in a negative-pressure operating room with high-efficiency particulate air filtration
Semiurgent	Performed as soon as possible but may be performed in over 48 hours	Acute facial nerve paralysis Temporal bone malignancy High-volume cerebrospinal fluid leak Postmeningitic cochlear implantation	Preoperative COVID-19 test should be performed 48 hours prior surgery and repeat testing the day of surgery if rapid tests are available. However, surgical procedures should be performed under the presumption that patients are COVID-19 positive. PPE should be used
Semielective	Performed within 3-6 months	Cholesteatoma with persistent infection or progression Paediatric cochlear implantation Bilateral otitis media with effusion in children Low-flow cerebrospinal fluid leak	Semielective cases may proceed following COVID-19 testing 48 hours prior to surgery, strict quarantine pending test results, and repeat rapid test the day of surgery
Elective	Performed after 6 months	Dry/stable perforation Stapes surgery Ossicular reconstruction Adult cochlear implantation Bone anchored hearing prosthesis	Elective surgical cases should be postponed in efforts to decrease patient interaction and exposure to the contagion

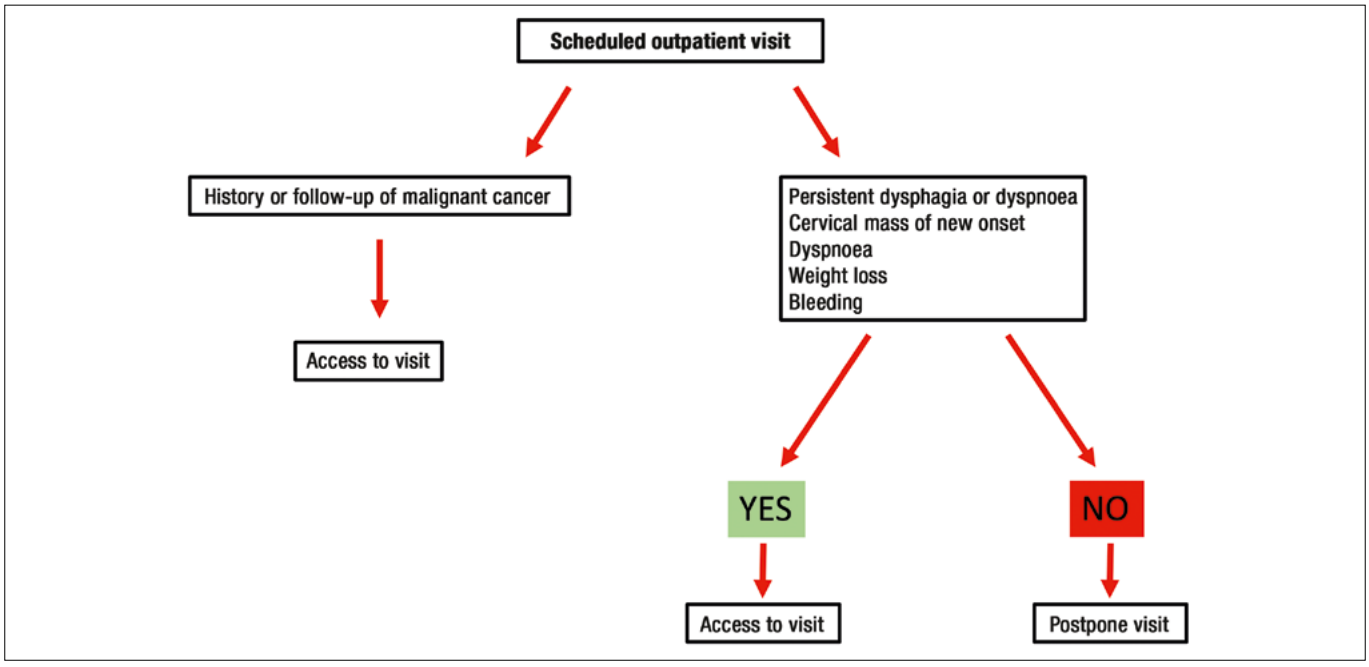

Figure 3. Flowchart for patient selection before an outpatient visit.

malignant cancer, dysphonia and persistent dysphagia, cervical masses of new onset, dyspnoea, recent body weight loss and bleeding from the upper aerodigestive tract. Figure 3 shows a suggested flowchart for patient selection. Surgery can be postponed (6-8 weeks) for only a few head and neck cancer types, including well-differentiated thyroid cancers, non-progressive skin cancers (basocellular carcinoma), slow-growing salivary gland cancers and nodules in the salivary glands not classified as malignant during preoperative assessment [25].

The COVIDSurg Collaborative group [60] evaluated 1137 consecutive patients with head and neck cancer in 26 countries and reported evidence of de-escalation of surgical treatment for oropharynx and larynx tumours. For these neoplasms, nonsurgical therapy was favoured, especially during the initial phases of the pandemic. The authors concluded that an important change has come with the advent of vaccines and improvement of infection control practices and neck surgery may be considered safe for patients during the pandemic.

Conclusions

The spread of COVID-19 in the last two years has led to profound changes in the behaviour and in the organisation of healthcare systems to guarantee medical assistance. Upper airway tract symptoms (coughing and sneezing) are the most frequent route of transmission of the virus. In this context, otolaryngology activity implies a high risk of contagion during outpatient visits, surgery or urgent conditions. The correct use of PPE and a reduction of non-urgent visits and elective surgery are considered the main strategies to limit contagion. On the other hand, the fear of contagion by patients caused a delay of treatment in urgent or oncological conditions that, in some cases, may lead to a most severe clinical situation. As of today, it is impossible to predict when the COVID-19 pandemic will end; therefore, national healthcare systems worldwide should focus on strengthening medical services to also guarantee medical care for non-urgent patients, while still limiting the risk of contagion among patients and healthcare providers.

Conflict of interest statement

The authors declare no conflict of interest.

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Authors' contributions

MR: writing original draft, supervision; AC: writing original draft; VD'A, RG and PP: literature review; AS and GR: critical revision of the manuscript; PG and PC: supervision.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

References

1 Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020;395:497-506. https://doi.org/10.1016/S0140-6736(20)30183-5

2 Mahase E. Coronavirus COVID-19 has killed more people than SARS and MERS combined, despite lower case fatality rate. BMJ 2020;368:m641. https://doi.org/10.1136/bmj.m641

3 Pene F, Merlat A, Vabret A, et al. Coronavirus 229E-related pneumonia in immunocompromised patients. Clin Infect Dis 2003;37:929-932. https://doi.org/10.1086/377612

4 Wu F, Zhao S, Yu B, et al. A new coronavirus associated with human respiratory disease in China. Nature 2020;579:265-269. https://doi.org/10.1038/s41586-020-2008-3

5 Banerjee A, Kulcsar K, Misra V, et al. Bats and coronaviruses. Viruses 2019;11:41. https://doi.org/10.3390/v11010041

6 Kirtipal N, Bharadwaj S, Kang SG. From SARS to SARS-CoV-2, insights on structure, pathogenicity and immunity aspects of pandemic human coronaviruses. Infect Genet Evol 2020;85:104502. https://doi.org/10.1016/j.meegid.2020.104502

7 Bosch BJ, van der Zee R, de Haan CAM, et al. The coronavirus spike protein is a class I virus fusion protein: structural and functional characterization of the fusion core complex. J Virol 2003;77:8801-8811. https://doi.org/10.1128/jvi.77.16.8801-8811.2003

8 Shi Y, Wang G, Cai XP, et al. An overview of COVID-19. J Zhejiang Univ Sci B 2020;21:343-360. https://doi.org/10.1631/jzus.B2000083

9 To KK-W, Tsang OT-Y, Leung W-S, et al. Temporal profiles of viral load in posterior oropharyngeal saliva samples and serum antibody responses during infection by SARS-CoV-2: an observational cohort study. Lancet Infect Dis 2020;20:565-574. https://doi.org/10.1016/S1473-3099(20)30196-1

10 Ralli M, Di Stadio A, Greco A, et al. Defining the burden of olfactory dysfunction in COVID-19 patients. Eur Rev Med Pharmacol Sci 2020;24:3440-3441. https://doi.org/10.26355/eurrev_202004_20797

11 Kannan S, Shaik Syed Ali P, Sheeza A, et al. COVID-19 (Novel Coronavirus 2019) – recent trends. Eur Rev Med Pharmacol Sci 2020;24:2006-2011. https://doi.org/10.26355/eurrev_202002_20378

12 Lim ZJ, Subramaniam A, Reddy MP, et al. Case fatality rates for patients with COVID-19 requiring invasive mechanical ventilation. A meta-analysis. Am J Respir Crit Care Med 2021;203:54-66. https://doi.org/10.1164/rccm.202006-2405OC

13 Tian S, Hu N, Lou J, et al. Characteristics of COVID-19 infection in Beijing. J Infect 2020;80:401-406. https://doi.org/10.1016/j.jinf.2020.02.018

14 Yue H, Bai X, Wang J, et al. Clinical characteristics of coronavirus disease 2019 in Gansu province, China. Ann Palliat Med 2020;9:1404-1412. https://doi.org/10.21037/apm-20-887

15 To KK-W, Tsang OT-Y, Yip CC-Y, et al. Consistent detection of 2019 novel coronavirus in saliva. Clin Infect Dis 2020;71:841-843. https://doi.org/10.1093/cid/ciaa149

16 Gao Z, Xu Y, Sun C, et al. A systematic review of asymptomatic infections with COVID-19. J Microbiol Immunol Infect 2021;54:12-16. https://doi.org/10.1016/j.jmii.2020.05.001

17 Bozkurt B, Eğrilmez S, Şengör T, et al. The COVID-19 pandemic: clinical information for ophthalmologists. Turk J Ophthalmol 2020;50:59-63. https://doi.org/10.4274/tjo.galenos.2020.29805

18 Galbadage T, Peterson BM, Gunasekera RS. Does COVID-19 spread through droplets alone? Front Public Health 2020;8:163. https://doi.org/10.3389/fpubh.2020.00163

19 Ralli M, Mannelli G, Bonali M, et al. Impact of COVID-19 on otolaryngology in Italy: a commentary from the COVID-19 task force of the young otolaryngologists of the Italian Society of Otolaryngology. Eur Rev Med Pharmacol Sci 2020;24:7516-7518. https://doi.org/10.26355/eurrev_202007_21925

20 Mannelli G, Ralli M, Bonali M, et al. Impact of COVID-19 pandemic on Italian Otolaryngology Units: a Nationwide Study. Acta Otolaryngol Ital 2020;40:325-331. https://doi.org/10.14639/0392-100X-N0832

21 Ralli M, Greco A, de Vincentiis M. The effects of the COVID-19/SARS-CoV-2 pandemic outbreak on otolaryngology activity in Italy. Ear Nose Throat J 2020;99:565-566. https://doi.org/10.1177/0145561320923893

22 Shankar A, Saini D, Roy S, et al. Cancer care delivery challenges amidst Coronavirus Disease-19 (COVID-19) outbreak: specific precautions for cancer patients and cancer care providers to prevent spread. Asian Pac J Cancer Prev 2020;21:569-573. https://doi.org/10.31557/APJCP.2020.21.3.569

23 Elli F, Turri-Zanoni M, Arosio AD, et al. Changes in the use of Otorhinolaryngology Emergency Department during the COVID-19 pandemic: report from Lombardy, Italy. Eur Arch Otorhinolaryngol 2020;277:3525-3528. https://doi.org/10.1007/s00405-020-06119-z

24 Pontillo V, Iannuzzi L, Petrone P, et al. ENT surgical emergencies during the COVID-19 outbreak. Acta Otorhinolaryngol Ital 2020;40:399-404. https://doi.org/10.14639/0392-100X-N1036

25 Couloigner V, Schember S, Nicollas R, et al. COVID-19 and ENT Surgery. Eur Ann Otorhinolaryngol Head Neck Dis 2020;137:161-166. https://doi.org/10.1016/j.anorl.2020.04.012

26 Murri D, Botti C, Bassano E, et al. Reduction in healthcare services during the COVID-19 pandemic: patient screening based on symptoms is an effective strategy for avoiding delayed laryngeal cancer diagnosis. Am J Otolaryngol 2021;42:103162. https://doi.org/10.1016/j.amjoto.2021.103162

27 Werner MT, Carey RM, Albergotti WG, et al. Impact of the COVID-19 pandemic on the management of head and neck malignancies. Otolaryngol Head Neck Surg 2020;162:816-817. https://doi.org/10.1177/0194599820921413

28 Graboyes EM, Kompelli AR, Neskey DM, et al. Association of treatment delays with survival for patients with head and neck cancer: a systematic review. JAMA Otolaryngol Head Neck Surg 2019;145:166-177. https://doi.org/10.1001/jamaoto.2018.2716

29 Liang W, Guan W, Chen R, et al. Cancer patients in SARS-CoV-2 infection: a nationwide analysis in China. Lancet Oncol 2020;21:335-337. https://doi.org/10.1016/S1470-2045(20)30096-6

30 Ralli M, Candelori F, Cambria A, et al. Impact of COVID-19 pandemic on otolaryngology, ophthalmology and dental clinical activity and future perspectives. Eur Rev Med Pharmacol Sci 2020;24:9705-9711. https://doi.org/10.26355/eurrev_202009_23062

31 Wang J, Du G. COVID-19 may transmit through aerosol. Ir J Med Sci 2020;189:1143-1144. https://doi.org/10.1007/s11845-020-02218-2

32 Balakrishnan K, Scechtman S, Hogikyan ND, et al. COVID-19 pandemic: what every Otolaryngologist-Head and Neck surgeon needs to know for safe airway management. Otolaryngol Head Neck Surg 2020;162:804-808. https://doi.org/10.1177/0194599820919751

33 Givi B, Schiff BA, Chinn SB, et al. Safety recommendations for evaluation and surgery of the head and neck during the COVID-19

pandemic. JAMA Otolaryngol Head Neck Surg 2020;146:579-584. https://doi.org/10.1001/jamaoto.2020.0780

[34] Sommer DD, Engels PT, Weitzel EK, et al. Recommendations from the CSO-HNS taskforce on performance of tracheotomy during the COVID-19 pandemic. J Otolaryngol Head Neck Surg 2020;49:23. https://doi.org/10.1186/s40463-020-00414-9

[35] Chan Y, Banblawala SM, Chin CJ, et al. CSO (Canadian Society of Otolaryngology - Head & Neck Surgery) position paper on rhinologic and skull base surgery during the COVID-19 pandemic. J Otolaryngol Head Neck Surg 2020;49:81. https://doi.org/10.1186/s40463-020-00476-9

[36] De Luca P, Scarpa A, Ralli M, et al. Nasal, pharyngeal and laryngeal endoscopy procedures during COVID-19 pandemic: available recommendations from national and international societies. Eur Arch Otorhinolaryngol 2020;277:2151-2153. https://doi.org/10.1007/s00405-020-06028-1

[37] Krajewska Wojciechowska J, Kraiewski W, Zub K, et al. Review of practical recommendations for otolaryngologists and head and neck surgeons during the COVID-19 pandemic. Auris Nasus Larynx 2020;47:544-558. https://doi.org/10.1016/j.anl.2020.05.022

[38] Beilenhoff U, Biering H, Blum R, et al. Reprocessing of flexible endoscopes and endoscopic accessories used in gastrointestinal endoscopy: position statement of the European Society of Gastrointestinal Endoscopy (ESGE) and European Society of Gastroenterology Nurses and Associates (ESGENA) - update 2018. Endoscopy 2018;50:1205-1234. https://doi.org/10.1055/a-0759-1629

[39] Tunkel DE, Anne S, Payne SC, et al. Clinical practice guideline: Nosebleed (Epistaxis). Otolaryngol Head Neck Surg 2020;162(Suppl 1):S1-S38. https://doi.org/10.1177/0194599819890327

[40] D'Aguanno V, Ralli M, Greco A, et al. Clinical recommendations for epistaxis management during the COVID-19 pandemic. Otolaryngol Head Neck Surg 2020;163:75-77. https://doi.org/10.1177/0194599820926497

[41] Van Gerven L, Hellings PW, Cox T, et al. Personal protection and delivery of rhinologic and endoscopic skull base procedures during the COVID-19 outbreak. Rhinology 2020;58:289-294. https://doi.org/10.4193/Rhin20.119

[42] Adly A, Youssef TA, El-Begermy MM, et al. Timing of tracheostomy in patients with prolonged endotracheal intubation: a systematic review. Eur Arch Otorhinolaryngol 2018;275:679-690. https://doi.org/10.1007/s00405-017-4838-7

[43] McGrath BA, Brenner MJ, Warrilow SJ, et al. Tracheostomy in the COVID-19 era: global and multidisciplinary guidance. Lancet Respir Med 2020;8:717-725. https://doi.org/10.1016/S2213-2600(20)30230-7

[44] Pichi B, Mazzola F, Bonsembiante A, et al. CORONA-steps for tracheotomy in COVID-19 patients: a staff-safe method for airway management. Oral Oncol 2020;105:104682. https://doi.org/10.1016/j.oraloncology.2020.104682

[45] Tay JK, Khoo LM, Loh WS. Surgical considerations for tracheostomy during the COVID-19 pandemic: lessons learned from the Severe Acute Respiratory Syndrome outbreak. JAMA Otolaryngol Head Neck Surg 2020;146:517-518. https://doi.org/10.1001/jamaoto.2020.0764

[46] Wax RS, Christian MD. Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus (2019-nCoV) patients. Can J Anaesth 2020;67:568-576. https://doi.org/10.1007/s12630-020-01591-x

[47] Tsagkovits A, Ioannidis D, Rokade A. The microscope drape method to reduce aerosolisation during endoscopic sinus and skull base surgery in the COVID era. How I do it. Eur Arch Otorhinolaryngol 2021;278:573-576. https://doi.org/10.1007/s00405-020-06441-6

[48] Workman AD, Welling DB, Carter BS, et al. Endonasal instrumentation and aerosolization risk in the era of COVID-19: simulation, literature review, and proposed mitigation strategies. Int Forum Allergy Rhinol 2020;10:798-805. https://doi.org/10.1002/alr.22577

[49] Patel ZM, Fernandez-Miranda J, Hwang PH, et al. Letter: precautions for endoscopic transnasal skull base surgery during the COVID-19 pandemic. Neurosurgery 2020;87:E66-E67. https://doi.org/10.1093/neuros/nyaa125

[50] Spock T, Kessler R, Lerner D, et al. Endoscopic skull base surgery protocol from the frontlines: transnasal surgery during the COVID-19 pandemic. Otolaryngol Head Neck Surg 2020;163:482-490. https://doi.org/10.1177/0194599820931836

[51] Jones HAS, Salib RJ, Harries PG. Reducing aerosolized particles and droplet spread in endoscopic Ssnus surgery during COVID-19. Laryngoscope 2021;131:956-960. https://doi.org/10.1002/lary.29065

[52] Lyson T, Kisluk J, Alifier M, et al. Transnasal endoscopic skull base surgery in the COVID-19 era: recommendations for increasing the safety of the method. Adv Med Sci 2021;66:221-230. https://doi.org/10.1016/j.advms.2021.03.001

[53] Cetinkaya EA. COVID-19 pandemic and otologic surgery. J Craniofac Surg 2020;31:E651-E652. https://doi.org/10.1097/SCS.0000000000006694

[54] Chari DA, Workman AD, Chen JX, et al. Aerosol dispersion during mastoidectomy and custom mitigation strategies for otologic surgery in the COVID-19 era. Otolaryngol Head Neck Surg 2021;164:67-73. https://doi.org/10.1177/0194599820941835

[55] Xia J, Tong J, Liu M, et al. Evaluation of coronavirus in tears and conjunctival secretions of patients with SARS-CoV-2 infection. J Med Virol 2020;92:589-594. https://doi.org/10.1002/jmv.25725

[56] Saadi RA, Bann DV, Patel VA, et al. A commentary on safety precautions for otologic surgery during the COVID-19 pandemic. Otolaryngol Head Neck Surg 2020;162:797-799. https://doi.org/10.1177/0194599820919741

[57] Xing Y, Zhang J, Lin H, et al. Relation between the level of lymph node metastasis and survival in locally advanced head and neck squamous cell carcinoma. Cancer 2016;122:534-545. https://doi.org/10.1002/cncr.29780

[58] Brody RM, Albergotti WG, Shimunov D, et al. Changes in head and neck oncologic practice during the COVID-19 pandemic. Head Neck 2020;42:1448-1453. https://doi.org/10.1002/hed.26233

[59] Day AT, Sher DJ, Lee RC, et al. Head and neck oncology during the COVID-19 pandemic: reconsidering traditional treatment paradigms in light of new surgical and other multilevel risks. Oral Oncol 2020;105:104684. https://doi.org/10.1016/j.oraloncology.2020.104684

[60] CovidSurg Collaborative. Head and neck cancer surgery during the COVID-19 pandemic: an international, multicenter, observational cohort study. Cancer 2021;127:2476-2488. https://doi.org/10.1002/cncr.33320