

# Impact of COVID-19 pandemic on otolaryngology, ophthalmology and dental clinical activity and future perspectives

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**Abstract. – OBJECTIVE:** Since the COVID-19 outbreak, otolaryngologists, ophthalmologists and dentists have been severely affected, both for the transmission routes and for the diagnostic and therapeutic procedures typical of these disciplines.

**MATERIALS AND METHODS:** In this article, we discuss the transmission routes, the potential risk of contagion for patients and healthcare providers during procedures, and comment on the changes that will affect head and neck clinical practice in the future of outpatient and surgical activities.

**RESULTS:** Otolaryngologists, ophthalmologists and dentists are at high risk for infection contagion and spread because they perform diagnostic and therapeutic procedures that generate aerosol and droplets thus facilitating virus transmission. Furthermore, examination involves close doctor-patient contact and otolaryngologists and dentists have to remove patient's protective devices during the visit.

**CONCLUSIONS:** Special attention to prevention protocols for diagnostic and therapeutic procedures and the use of protective equipment is of utmost importance to limit contagion and prevent a new virus spread in the near future.

*Key Words:*

SARS-CoV-2, COVID-19, Otolaryngology Head and Neck Surgery, Ophthalmology, Dentist.

## Introduction

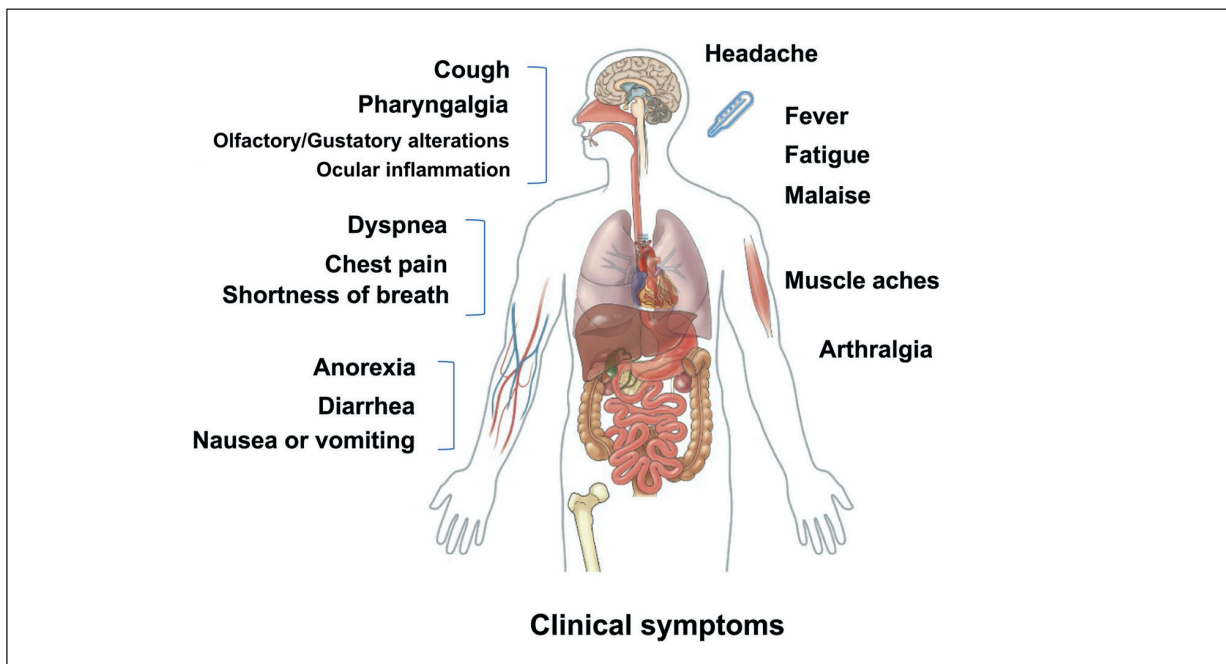
On January 8, 2020, a novel Coronavirus disease (COVID-19) caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) was officially announced<sup>1</sup>. The contagion started last December in Wuhan, China, and became a health emergency in many countries

worldwide<sup>1-3</sup>. On January 30, 2020, the World Health Organization (WHO) announced that the COVID-19 outbreak constitutes a public health emergency of international concern<sup>4</sup>. Most patients affected by COVID-19 experienced dry cough and fever, while some patients also complained fatigue, shortness of breath, and other atypical symptoms, such as muscle pain, confusion, sore throat, pharyngalgia, headache, vomiting, diarrhea, olfactory, and gustatory dysfunctions and, more rarely, ocular inflammation such as kerato-conjunctivitis<sup>1,5-9</sup> (Figure 1).

Healthcare providers involved with diagnostic and therapeutic procedures in the head and neck region, such as otolaryngologists, ophthalmologists and dentists, have a higher risk of contracting and spreading the infection. The present article aims at evaluating the impact of COVID-19 disease in otolaryngology, ophthalmology and dental clinical activity with special attention on routes of contagion, at-risk procedures and future effects on head and neck clinical practice.

## Routes of Transmission

The person-to-person transmission routes of SARS-CoV-2 include direct transmission through cough, sneeze and droplet, and contact transmission, such as the contact with oral, nasal, and eye mucous membranes<sup>1</sup>. The fecal-oral route also represents a potential person-to-person transmission route<sup>10</sup>. Although the main environmental transmission route of SARS-CoV-2 is through droplets and direct/indirect contact, there is a possible risk of spreading the virus through smaller aerosols during specific surgical and medical procedures<sup>11-14</sup>. The transmission of the infection can occur both through airborne and droplet. Airborne transmission occurs through small inspira-



**Figure 1.** Clinical symptoms of patients with 2019 coronavirus disease. Modified from Li J, Fan JG. Characteristics and Mechanism of Liver Injury in 2019 Coronavirus Disease. *J Clin Transl Hepatol* 2020; 8: 13-17<sup>9</sup>.

ble aerosols (<5-10  $\mu\text{m}$ ) even over long distances; while droplet transmission indicates the passage of larger aerosol infection directly from the infected person to the susceptible person over short distances<sup>14,15</sup> (Figure 2).

### Ocular Transmission

Li Wenliang, an ophthalmologist, was one of the first physicians to warn about the spread of coronavirus in Chinese patients; Dr. Li contracted the disease and died after visiting a patient suffering from conjunctivitis<sup>16,17</sup>. Reports of deaths of other ophthalmologists due to COVID-19 also raised concern about ocular transmission. As known from the literature, the virus can cause conjunctivitis and can be transmitted by aerosol contact with the conjunctiva. The mechanism of SARS-CoV-2 infection *via* conjunctiva is that respiratory droplets can be drained into the nasolacrimal duct and then into the respiratory tract with tears. However, the viral load in tears may not be sufficiently high for infection transmission. Because of the close distance between patients and doctors during most ophthalmic, dental and otolaryngology exams, even the slightest risk is unbearable. Therefore, appropriate protective devices and the use of the safe procedure in a sanitized environment are necessary<sup>18-20</sup>.

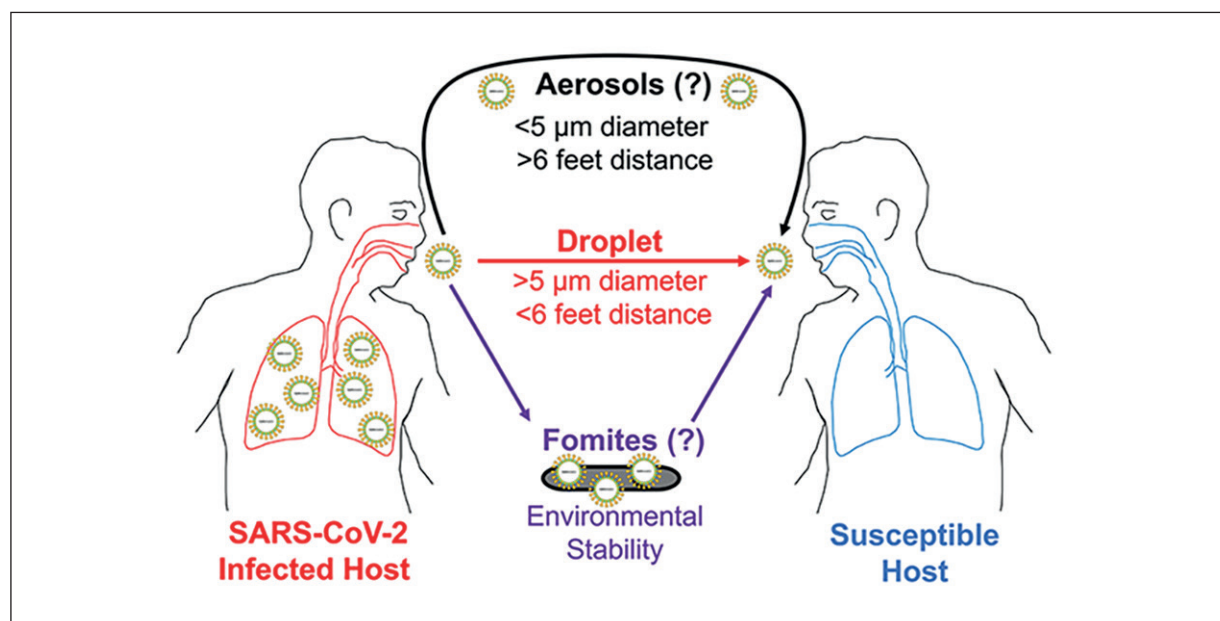
### Respiratory Transmission

Several studies reported that nasopharynx and nose are the major reservoirs of the virus<sup>21</sup>. Aerosols and droplets are considered the main spread routes of SARS-CoV-2. The main transmission modality is direct spread from an infected patient's cough and/or sneeze to other subjects that inhale droplets and aerosol containing the virus. It is also described the transmission *via* contact with virus-contaminated surfaces and consequent contact with the oral, nasal, or conjunctival mucous membranes. Since aerosol droplet spread is considered the main route of transmission for the infection, healthcare providers that perform procedures in the head and neck region, have a higher risk of contracting infection<sup>22</sup>.

### Medical Procedures Exposing to Contagion

#### Otolaryngology Procedures

As demonstrated by international literature, otolaryngologists and head & neck surgeons are among the healthcare providers at higher risk of contracting the virus during upper airway diagnostic and therapeutic procedures<sup>15</sup>. Many procedures performed by the otolaryngologist generate



**Figure 2.** COVID-19 potential modes of transmission. This illustration shows three potential ways SARS-CoV-2 can spread from an infected host to a susceptible host. First, it is transmitted person to person through respiratory droplets that can travel for distances 6 feet or less in air. Second, SARS-CoV-2 is likely transmitted through fomites for the duration it is viable on environmental surfaces. Third, it is also likely transmitted through aerosols for distances longer than 6 feet in the air. From Galbadage T, Peterson BM, Gunasekera RS. Does COVID-19 Spread Through Droplets Alone? *Front Public Health* 2020; 8: 163<sup>14</sup>.

aerosols from viral spreading areas, such as the nasal and oropharyngeal cavity<sup>23,24</sup>. Furthermore, during procedures the patient should remove facial mask exposing himself and physician to contagion. The procedures with a high risk of viral transmission are nasal endoscopy, nasal packing for epistaxis treatment, nasal surgery, endoscopic functional sinus surgery, CO<sub>2</sub> laser ablation of pharyngeal and laryngeal tissues, electrocautery, tracheotomy, endotracheal suctioning, oropharyngeal surgery, head and neck reconstruction surgery, mastoid surgery, the use of nebulizer/atomizer, microdebrider and micro driller<sup>15</sup>. Moreover, patients with COVID-19-related respiratory distress often require prolonged intubation and tracheostomy. Accumulating evidence has focused on the danger of some aerosol-generating procedures, such as endotracheal tracheostomy, intubation and extubation, that play an important role in virus diffusion.

### **Ophthalmology Procedures**

The ocular surface is a potential target tissue for SARS-CoV-2 invasion<sup>17</sup>. Despite conjunctivitis is not among the most common symptoms of COVID-19, the ophthalmologists have to respect some recommendations to prevent virus trans-

mission. In fact, ophthalmologists work in close contact with patients' eyes and are at risk of infection. High risk procedures include Goldmann application tonometry, contact lens frames and spectacle frames<sup>25</sup>.

### **Dental Procedures**

The dental practice exposes odontologists to tremendous risk of SARS-CoV-2 infection due to the face-to-face communication and the exposure to saliva, blood, and other body fluids, and the handling of sharp instrument<sup>26</sup>. Dental patients who sneeze, cough or receive dental treatment including the use of ultrasonic instruments or high-speed handpiece make their secretions, blood or saliva aerosolize to the surroundings environment<sup>27</sup>. During dental procedures, large amount of aerosol and droplets mixed with the patient's saliva and blood are generated. Particles of aerosols and droplets are small enough to stay airborne for an extended period before settling on surfaces or enter the respiratory tract. Thus, SARS-CoV-2 has the potential to spread through droplets and aerosols from infected individuals in dental clinics<sup>10</sup>. Furthermore, during dental procedures, the patient is asked to remove protective mask exposing himself and dentist to contagion.

## Protection From Contagion

### Protection Devices

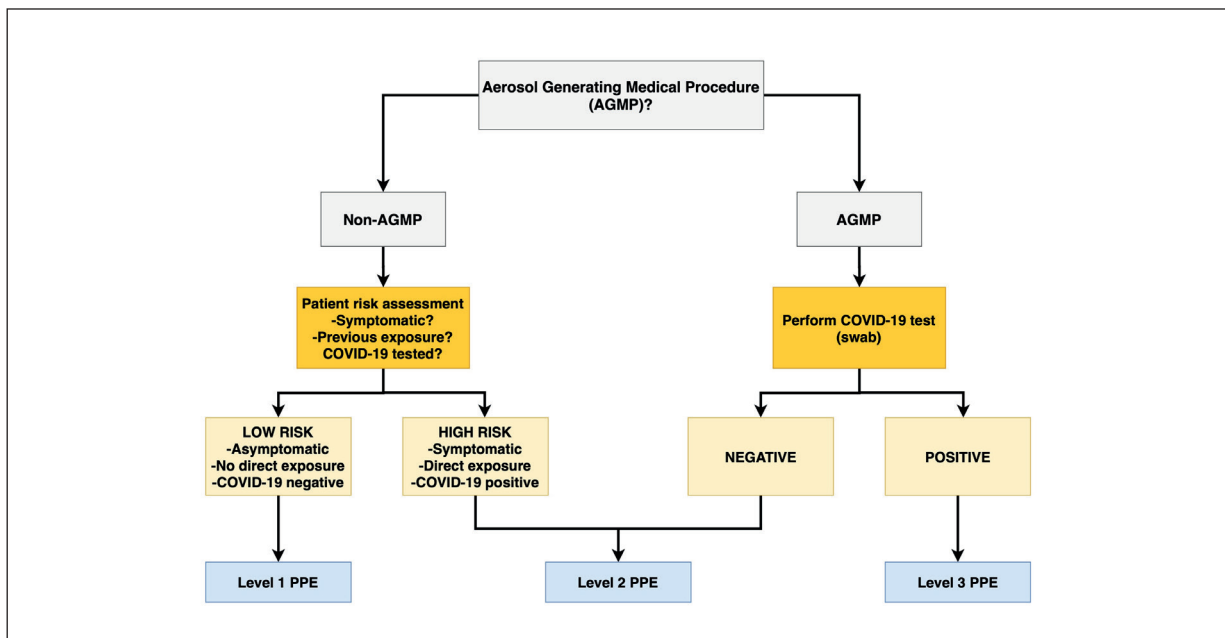
The protection of healthcare personnel is of paramount importance to limit infection spread. The literature recommends the use of full personal protective equipment (PPE) for all aerosol-generating procedures including FFP2 or FFP3 masks, glasses, masks, caps and face shields mask, eye protection, fluid-repellent disposable surgical gown and gloves<sup>28</sup>. Proper protocols for doffing and disposal of PPE are also important<sup>21</sup>.

Workers who come in close contact with the upper aerodigestive tract during diagnostic and therapeutic procedures are particularly at risk, and the use of telephone, video, or telemedicine should be considered to maintain relationships with patients and to support assessments that can be made without in-person physical examination. Only patients who need a thorough head and neck examination should be seen in person, and only the necessary personnel should be present. It will be of paramount importance to ensure minimal exposure of hospital staff to the virus and the correct use of PPE for patient and healthcare providers.

The Canadian Society of Otolaryngology Head and Neck Surgery developed guidelines for Health Care Workers Performing Aerosol Generating Medical Procedures during the COVID-19 pandemic. These guidelines apply to otolaryngologists, ophthalmologists and dentists, defining the level of protection based on specific parameters (Figure 3).

### Management of Diagnostic and Therapeutic Activities

The literature reports that approximately 80% of patients are asymptomatic; therefore, during the COVID-19 pandemic is mandatory a risk stratification throughout outpatient visits and hospitalization. Head and neck professionals should be familiar with SARS-CoV-2 clinical manifestations, in order to safely manage suspected cases. In Italy, a telephone triage protocol to investigate the presence of COVID-19 symptoms and possible high-risk contacts has been adopted by public and private hospitals and clinics<sup>29</sup>. Before the visit, the measurement of body temperature of staff and patients must be performed as a routine procedure using a contact-free forehead thermometer. Furthermore, only the necessary personnel should be present during the examination and correctly wear PPE<sup>21</sup>.



**Figure 3.** Guidelines for Health Care Workers Performing Aerosol Generating Medical Procedures during the COVID-19 Pandemic developed by the Canadian Society of Otolaryngology Head and Neck Surgery (modified). 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; Level 3 PPE: Negative pressure room with minimum personnel + N95 mask with second surgical mask and attached face shield or goggles + double fluid repellent gown + head cover including neck protection + double gloves.



During the pandemic, most countries decreased the surgical activity postponing elective procedures<sup>30-32</sup>; only emergency and oncologic procedures were guaranteed. Patients who underwent emergency surgery were tested with a nasopharyngeal swab before hospital admission, and the swab was repeated in the postoperative period. At present, intubation and extubation procedures, as well as endoscopy, airway suctioning, and tracheotomy, are considered aerosol-generating procedures (AGPs). The use of high-speed tools like piezoelectric devices and drills are also considered AGPs, due to the amount of blood and saliva aerosolized. For these reasons, all of these techniques are considered high-risk procedures and should be performed with a high level of protection for the healthcare providers.

### **Future Perspectives**

We are currently experiencing a new phase of the COVID-19 pandemic and the national and international health systems are gradually changing the level of care. Outpatient visits and elective surgical procedures are being gradually restored in some countries, especially in Europe and Asia, although the lockdown has caused a reduction of elective procedures with a potential decrease of early diagnosis of many conditions<sup>33</sup>.

The healthcare systems should maintain precautionary measures for patients who had symptoms belonging to the head and neck region, as in some cases these symptoms may be indicators of asymptomatic or paucisymptomatic cases.

Another important issue for some countries, including Italy, is the lack of serological tests which does not allow SARS-CoV-2 research in the whole population.

Over time, outpatient activity will resume also for non-urgent diseases. However, the challenge will be to create secure areas for patients and to avoid overloading hospitals to limit contagion and new virus spread. For this reason, everyone must respect social distancing in the waiting rooms and people should feel safe when going to the hospital. Protecting healthcare workers from high-risk infection hazards is also vital to ensuring their safety while delivering care and to avoid a healthcare system collapse.

### **Conclusions**

Otolaryngologists, ophthalmologists and dentists are at high risk for infection contagion

and spread because they perform diagnostic and therapeutic procedures that generate aerosol and droplets thus facilitating virus transmission. Furthermore, examination involves close doctor-patient contact and otolaryngologists and dentists have to remove patient's protective devices (face mask) during the visit. For these reasons, these specialists must pay the utmost attention while carrying out diagnostic and therapeutic procedures wearing proper PPE. Serological tests should be extensively performed in the general population and healthcare providers. As virus is still circulating, these professionals must make sure that they are not virus carriers themselves. Social distancing in the waiting room, a correct patient history collection, the measurement of body temperature and the use of disposable devices in a sanitized environment are the elements to move forward with the utmost caution to limit contagion and prevent a new virus spread in the near future.

### **Conflict of Interest**

The Authors declare that they have no conflict of interests.

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### **References**

- 1) HUANG C, WANG Y, LI X, REN L, ZHAO J, HU Y, ZHANG L, FAN G, XU J, GU X, CHENG Z, YU T, XIA J, WEI Y, WU W, XIE X, YIN W, LI H, LIU M, XIAO Y, GAO H, GUO L, XIE J, WANG G, JIANG R, GAO Z, JIN Q, WANG J, CAO B. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020; 395: 497-506.
- 2) TIAN S, HU N, LOU J, CHEN K, KANG X, XIANG Z, CHEN H, WANG D, LIU N, LIU D, CHEN G, ZHANG Y, LI D, LI J, LIAN H, NIU S, ZHANG L, ZHANG J. Characteristics of COVID-19 infection in Beijing. *J Infect* 2020; 80: 401-406.
- 3) ZHENG F, TANG W, LI H, HUANG YX, XIE YL, ZHOU ZG. Clinical characteristics of 161 cases of corona virus disease 2019 (COVID-19) in Changsha. *Eur Rev Med Pharmacol Sci* 2020; 24: 3404-3410.
- 4) MAHASE E. Coronavirus covid-19 has killed more people than SARS and MERS combined, despite lower case fatality rate. *BMJ* 2020; 368: m641.
- 5) LECHEN JR, CHIESA-ESTOMBA CM, DE SIATI DR, HOROI M, LE BON SD, RODRIGUEZ A, DEQUANTER D, BLECIC S, EL AFIA F, DISTINGUIN L, CHEKKOURY-IDRISSI Y, HANS S, DELGADO IL, CALVO-HENRIQUEZ C, LAVIGNE P, FA-

- LANGA C, BARILLARI MR, CAMMAROTO G, KHALIFE M, LEICH P, SOUCHAY C, ROSSI C, JOURNE F, HSIEH J, EDJALI M, CARLIER R, RIS L, LOVATO A, DE FILIPPIS C, COPPEE F, FAKHRY N, AYAD T, SAUSSEZ S. Olfactory and gustatory dysfunctions as a clinical presentation of mild-to-moderate forms of the coronavirus disease (COVID-19): a multicenter European study. *Eur Arch Otorhinolaryngol* 2020; 277: 2251-2261.
- 6) WANG D, HU B, HU C, ZHU F, LIU X, ZHANG J, WANG B, XIANG H, CHENG Z, XIONG Y, ZHAO Y, LI Y, WANG X, PENG Z. Clinical characteristics of 138 hospitalized patients with 2019 Novel Coronavirus-infected pneumonia in Wuhan, China. *JAMA* 2020; 323: 1061-1069.
  - 7) RALLI M, DI STADIO A, GRECO A, DE VINCENTIIS M, POLIMENI A. Defining the burden of olfactory dysfunction in COVID-19 patients. *Eur Rev Med Pharmacol Sci* 2020; 24: 3440-3441.
  - 8) KANNAN S, SHAIK SYED ALI P, SHEEZA A, HEMALATHA K. COVID-19 (Novel Coronavirus 2019) - recent trends. *Eur Rev Med Pharmacol Sci* 2020; 24: 2006-2011.
  - 9) LI J, FAN JG. Characteristics and mechanism of liver injury in 2019 Coronavirus disease. *J Clin Transl Hepatol* 2020; 8: 13-17.
  - 10) PENG X, XU X, LI Y, CHENG L, ZHOU X, REN B. Transmission routes of 2019-nCoV and controls in dental practice. *Int J Oral Sci* 2020; 12: 9.
  - 11) BOUROUIBA L. Turbulent gas clouds and respiratory pathogen emissions: potential implications for reducing transmission of COVID-19. *JAMA* 2020; 323: 1837-1838.
  - 12) VAN DOREMALEN N, BUSHMAKER T, MORRIS DH, HOLBROOK MG, GAMBLE A, WILLIAMSON BN, TAMIN A, HARCOURT JL, THORNBURG NJ, GERBER SI, LLOYD-SMITH JO, DE WIT E, MUNSTER VJ. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *N Engl J Med* 2020; 382: 1564-1567.
  - 13) WANG W, XU Y, GAO R, LU R, HAN K, WU G, TAN W. Detection of SARS-CoV-2 in different types of clinical specimens. *JAMA* 2020; 323: 1843-1844.
  - 14) GALBADAGE T, PETERSON BM, GUNASEKERA RS. Does COVID-19 spread through droplets alone? *Front Public Health* 2020; 8: 163.
  - 15) THAMBOO A, LEA J, SOMMER DD, SOWERBY L, ABDALKHANI A, DIAMOND C, HAM J, HEFFERNAN A, CAI LONG M, PHULKA J, WU YO, YEUNG P, LAMMERS M. Clinical evidence based review and recommendations of aerosol generating medical procedures in otolaryngology - head and neck surgery during the COVID-19 pandemic. *J Otolaryngol Head Neck Surg* 2020; 49: 28.
  - 16) HU K, PATEL J, PATEL BC. Ophthalmic manifestations of Coronavirus (COVID-19). *StatPearls Treasure Island (FL)*; 2020.
  - 17) BOZKURT B, EGRILMEZ S, SENGOR T, YILDIRIM O, IRKEC M. The COVID-19 pandemic: clinical information for ophthalmologists. *Turk J Ophthalmol* 2020; 50: 59-63.
  - 18) CHEN MJ, CHANG KJ, HSU CC, LIN PY, JUI-LING LIU C. Precaution and prevention of coronavirus disease 2019 infection in the eye. *J Chin Med Assoc* 2020; 83: 648-650.
  - 19) WAN DY, LUO XY, DONG W, ZHANG ZW. Current practice and potential strategy in diagnosing COVID-19. *Eur Rev Med Pharmacol Sci* 2020; 24: 4548-4553.
  - 20) GUI D, PEPE G, MAGALINI S. Just one more hygiene practice in COVID-19. *Eur Rev Med Pharmacol Sci* 2020; 24: 3438-3439.
  - 21) GIVI B, SCHIFF BA, CHINN SB, CLAYBURGH D, IYER NG, JALISI S, MOORE MG, NATHAN CA, ORLOFF LA, O'NEILL JP, PARKER N, ZENDER C, MORRIS LGT, DAVIES L. 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.
  - 22) MAFFIA F, FONTANARI M, VELLONE V, CASCONI P, MERCURI LG. Impact of COVID-19 on maxillofacial surgery practice: a worldwide survey. *Int J Oral Maxillofac Surg* 2020; 49: 827-835.
  - 23) D'AGUANNO V, RALLI M, GRECO A, DE VINCENTIIS M. Clinical recommendations for epistaxis management during the COVID-19 pandemic. *Otolaryngol Head Neck Surg* 2020: 194599820926497.
  - 24) DE LUCA P, SCARPA A, RALLI M, DE VINCENTIIS M, CASSANDRO E, CHIARELLA G, CASSANDRO C. Nasal, pharyngeal and laryngeal endoscopy procedures during COVID-19 pandemic: available recommendations from national and international societies. *Eur Arch Otorhinolaryngol* 2020; 277: 2151-2153.
  - 25) LU CW, LIU XF, JIA ZF. 2019-nCoV transmission through the ocular surface must not be ignored. *Lancet* 2020; 395: e39.
  - 26) TO KK, TSANG OT, CHIK-YAN YIP C, CHAN KH, WU TC, CHAN JMC, LEUNG WS, CHIK TS, CHOI CY, KANDAMBY DH, LUNG DC, TAM AR, POON RW, FUNG AY, HUNG IF, CHENG VC, CHAN JF, YUEN KY. Consistent detection of 2019 novel coronavirus in saliva. *Clin Infect Dis* 2020 Feb 12: ciaa149.
  - 27) MENG L, HUA F, BIAN Z. Coronavirus disease 2019 (COVID-19): emerging and future challenges for dental and oral medicine. *J Dent Res* 2020; 99: 481-487.
  - 28) LANGE SJ, RITCHEY MD, GOODMAN AB, DIAS T, TWENTYMAN E, FULD J, SCHIEVE LA, IMPERATORE G, BENOIT SR, KITE-POWELL A, STEIN Z, PEACOCK G, DOWLING NF, BRISS PA, HACKER K, GUNDLAPALLI AV, YANG Q. Potential indirect effects of the COVID-19 pandemic on use of emergency departments for acute life-threatening conditions - United States, January-May 2020. *MMWR Morb Mortal Wkly Rep* 2020; 69: 795-800.
  - 29) ARMOCIDA B, FORMENTI B, USSAI S, PALESTRA F, MISSONI E. The Italian health system and the COVID-19 challenge. *Lancet Public Health* 2020; 5: e253.
  - 30) MINNI A, RALLI M, CANDELORI F, CIALENTE F, ERCOLI L, PARLAPIANO C, GRECO A, DE VINCENTIIS M. Lessons learned from COVID-19 pandemic in Italy. *Bosn J Basic Med Sci* 2020. doi: 10.17305/bjbm.2020.4847. Online ahead of print.

- 31) 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; 145561320923893.
- 32) RALLI M, MINNI A, CANDELORI F, CIALENTE F, GRECO A, DE VINCENTIIS M. Effects of COVID-19 pandemic on otolaryngology surgery in Italy: the experience of our university hospital. *Otolaryngol Head Neck Surg* 2020; 194599820928970.
- 33) YANG CL, QIU X, ZENG YK, JIANG M, FAN HR, ZHANG ZM. Coronavirus disease 2019: a clinical review. *Eur Rev Med Pharmacol Sci* 2020; 24: 4585-4596.