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SPECIAL ARTICLE COVID-19

The COVID-19 Pandemic and Planetary Health. A Critical Review of Epidemiology, Prevention, Clinical Characteristics and Treatments for Oral, Head and Neck Health Professionals. Do We Have a Roadmap?

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Abstract

Introduction Coronavirus disease 19 (COVID-19) is potentially the greatest global public health crisis of this century. This disease emerged as an outbreak of pneumonia of unknown cause in Wuhan, the capital city of the Hubei province in China, in December 2019. Otolaryngologists, head and neck surgeons and dentists are at an increased risk of occupational disease.

Objective The present review summarizes currently published evidence of Covid-19 epidemiology, clinical characteristics, treatment and prevention. No proven effective treatments for this disease currently exist.

Data Synthesis COVID-19 started from a zoonotic transmission event associated with a large seafood market that also traded in live wild animals, and it soon became clear that efficient person-to-person transmission was also occurring. Symptoms are varied, and not all patients develop all of them.

Conclusion Social distancing seems to have been successful in several places in the world. However, this recommendation alone is not enough to contain the disease, and it is not a long-term solution. Large-scale testing by health professionals of representative samples of the population may give an estimate of the progression of the disease. Different treatments are under test and bring hope of a cure to the population. However, no current treatments (April 27, 2020) have been proven to be the key to success in the treatment of patients with COVID-19. Planetary health is a useful concept to understand the current drivers of this pandemic and to draw a roadmap for science and healthcare that may guide actions to fight economic depression and ensure a healthy recovery.

Keywords
- COVID-19
- planetary health
- epidemiology
- prevention
- clinical characteristics
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Introduction

The coronavirus disease 2019 (COVID-19) outbreak in Wuhan, China, has spread rapidly, and there are confirmed cases in multiple countries currently. Although many details, such as the source of the virus and its ability to spread between individuals, remain unknown; there is a rising number of cases for which human-to-human transmission has been confirmed.[1,2] The disease can be spread from person to person through moisture from the nose or mouth, which is passed on when an infected person coughs or sneezes. Viral particles emitted from the respiratory tract of an infected individual land on a surface. Then, another person touches that object, then touches their nose, mouth or eyes. The virus then sneaks into the body via the mucous membranes, infecting the second person.

Exiting COVID-19 lockdowns may be a dangerous trial and error process. However, what is the right exit strategy? "We've managed to get to the life raft," says epidemiologist Marc Lipsitch of the Harvard T.H. Chan School of Public Health (HSPH). "But I'm really unclear how we will get to the shore."[3]

Our objective is to summarize current findings about the epidemiology, clinical characteristics, treatment and prevention of COVID-19 of interest for oral, head and neck health professionals. According to current evidence, there is no proven effective treatments for this disease.

Critical Review

From the discovery of the disease to this date (May 21, 2020), more than 5,010,000 COVID-19 cases and 328,000 deaths have been reported globally in the 213 countries, areas and territories with confirmed cases.[4] The World Health Organization (WHO) declared COVID-19 a pandemic on March 12, 2020.

Residents of nursing homes, hospices and elderly homes are more susceptible to this viral infection and, because of age and comorbidities, are a vulnerable group for severe infection.[5]

Health care workers are another susceptible group. They provide care to patients with severe infections and who may likely have high viral loads, and stand close to patients during procedures, such as examination, transport, blood sampling, intubation and bronchoscopy. Reports from China show that 3,300 health care professionals have been infected, and numbers in Italy indicate that 20% of all health care workers might also have contracted the infection.[6]

Schools, restaurants and bars seem to be far from a safe re-opening. In the most diverse regions of the planet, each city, state and country will have to define how to implement the cautious re-opening of different institutions, based on epidemiological data, the actual health status of the population and the knowledge that this decision may have to be reversed at any time. Habits and traditions will certainly no longer be the same. The days of sharing drinks with friends using the same straw are over.

Among healthcare workers, dental professionals seem to be at a high risk of infection because of their exposure to saliva, blood, aerosols and droplets produced during most dental procedures.[7] The spreading potential of SARS-CoV-2 is great, as one person may infect two or three others. Such potential is associated with its mode of transmission, which occurs through respiratory droplets in sneezing, coughing or secretions and the direct contact with infected people. Moreover, this virus has the ability to multiply and survive in the environment and on surfaces.[7,8]

SARS-CoV-2 may spread through particles in aerosols generated by dental devices. The nose filters air particles larger than 10 microns. When smaller than that, particles may enter the respiratory system, and, when smaller than 2.5 microns, the alveoli. Sars-Cov-2 particles are smaller than 0.1 micron and may enter the bloodstream and target organs, such as the heart and brain. Most transmissions occur through large respiratory droplets, rather than small aerosols. Droplets are often heavy enough and do not travel very far; instead, they fall after traveling up to six feet in the air. However, viral particles may be aerosolized in cough, sneeze, or during dental care, and may travel up to 20 feet. Aerosolized droplet nuclei may remain in the air long after the infected person leaves. The virus has been shown to survive up to 72 hours on plastic and stainless steel surfaces, up to 24 hours on cardboard surfaces, up to 9 hours on copper surfaces, and up to 3 hours as suspended aerosols.[8] Dental practices produce aerosols, which raises concerns regarding the safety of dentists, dental assistants and patients.

Most dental procedures that use instrumentation produce airborne particles in the site where the instrument is used. Dental handpieces, ultrasonic scalers, air polishers and air abrasion units produce the most visible aerosols. Each of these instruments removes material from the operative site, and this material becomes aerosolized by the action of rotary instruments, ultrasonic vibrations or the combined action of water sprays and compressed air. Water spray, usually the portion of the aerosol most visible to the naked eye, may be noticed by both the patient and dental personnel.[9]

Sars-Cov-2 may be detected in saliva before lung lesions appear, at a positive rate of up to 91.7%, and saliva samples can grow the virus. This suggests that COVID-19 may be transmitted by asymptomatic patients through infected saliva.[9]

Infection control measures should be taken to prevent the virus from further spreading and to help control this epidemic situation. The risk of cross infection between patients and dental practitioners may be high because of the characteristics of dental settings. Strict and effective infection control protocols are urgently needed for dental practices and hospitals in areas that are or may be affected by COVID-19.

Discussion

The COVID-19 pandemic has placed an extraordinary demand on the World Healthcare System. Many institutions have cancelled elective and nonurgent procedures to save resources and limit exposure. While operational definitions of elective and urgent procedures do exist, there is a degree of surgeon judgment in each decision. In the present commentary, we provide a framework to define the priority of head and neck surgery during the pandemic. Unique considerations for the head and neck patient are examined, including risk to the oncology patient, outcomes following delay in head and neck cancer treatment and risk of transmission during

otolaryngologic surgery. Our priority criteria define four categories: urgent – proceed with surgery; less urgent – consider postponing < 30 days; less urgent – consider postponing between 30 and 90 days; and case-by-case analysis. Finally, we discuss our preoperative clinical pathway for transmission mitigation, including defining low-risk and high-risk surgery for transmission and the role of preoperative COVID-19 testing.[10]

The world is experiencing an unprecedented challenge during the COVID-19 pandemic. Lessons learned include: the need to "flatten the curve" and prevent spread in the community; increased risks of transmission to otolaryngologists, oral maxillofacial surgeons, dentists, and anesthesiologists; and tactics to limit the risk of spread. Rigorous adherence to infection control measures and attention to rapidly changing policies and procedures are essential to mitigate the spread of this disease. New challenges are emerging, and one of them is the provision of care for patients that need urgent attention because of time-sensitive conditions, such as head and neck cancer, at a time when our healthcare systems are running at full operating capacity or are already overwhelmed. We must learn from one another as the disease crosses the globe, and we must integrate these lessons into practice before too many patients and their caregivers succumb to the pandemic. System- and hospital-based decision-making procedures should be in place to support healthcare teams, which are composed of dedicated but vulnerable individuals.[11] Some patients may agree with delaying procedures, but others may not, and health professionals should maintain a delicate balance when making decisions. Ultimately, surgeons are responsible for acting proactively and having detailed conversations with their patients in the context and emotional climate of COVID- 19. This may often be achieved by pursuing avenues not often used in health care, such as telemedicine.[12]

Although recommended for a variety of domains, such as patient education, diagnosis, and treatment, and specifically planned for disaster scenarios, telemedicine has been severely underutilized, even in such rare circumstances.[13]

Clinical studies have been inconclusive about the effectiveness of N95 respirators and medical masks in preventing health care personnel (HCP) from acquiring workplace viral respiratory infections. A cluster randomized pragmatic effectiveness study was conducted at 137 outpatient sites at 7 US medical centers between September 2011 and May 2015, with final follow-up in June 2016. Each year, for 4 years, during the 12-week period of peak viral respiratory illness, pairs of outpatient sites (clusters) within each center were matched and randomly assigned to the N95 respirator or medical mask groups. Overall, 1,993 participants in 189 clusters were randomly assigned to wear N95 respirators (2,512 HCP-seasons of observation) and 2,058 in 191 clusters were randomly assigned to wear medical masks (2,668 HCP-seasons) when near patients with a respiratory illness. The authors concluded that among outpatient HCP, wearing N95 respirators or medical masks in this trial resulted in no significant differences in the incidence of laboratory-confirmed influenza.[14]

During the COVID-19 outbreak, no consensus has been reached about the provision of dental services, but recommendations for patient triage, patient entrance into the dental practice, dental treatment and after-treatment management have been made by several health authorities and dental associations in different countries.[15]

In dental practices, several measures should be taken before the appointment. Patient communication is pivotal. Patients should be reassured by explaining the precautions put in place, such as the use of personal protective equipment (PPE) and sterilization. Appointments should be booked at large intervals. Chair use time should be reduced to allow for thorough sterilization and to reduce interpatient contact. Patients may undergo an initial screening for COVID-19 by phone. Quick questions should be asked to determine whether consultation with an infectious diseases specialist is necessary before the patient comes to the office: Are you experiencing severe difficulty breathing (struggling for each breath, can only speak in single words) or severe chest pain (constant tightness or crushing sensation)? Are you feeling confused or unsure of where you are? Have you been losing consciousness? Other symptoms, such as fever, chills, new or worsening cough, shortness of breath, sore throat, difficulty swallowing, runny or congested nose, loss of sense of taste or smell, conjunctivitis, headache, digestive symptoms (nausea, vomiting, diarrhea, stomach pain), muscle aches and unusual exhaustion (fatigue, lack of energy), are all signs of alert that may demand proper medical consultation before the dental visit.[16]

A longer time between appointments should be planned to allow for exit, cleaning and sterilization. Patients should avoid spending time in the waiting room. Reception staff must wear appropriate PPE: procedure or surgical mask, gloves and eye protection or face shield. Physical barriers (shields) in the reception room may be helpful. Magazines or toys should be removed from waiting rooms to avoid contamination. The person accompanying the patient should wait outside the office (e.g., in their car), unless their presence is absolutely necessary, such as a parent accompanying a young child or a patient who requires accommodation. Ideally, accompanying individuals should live in the same household as the patient.[16]

Patients should be screened for COVID-19 by measuring and recording their temperature before they are allowed to enter the dental practice. Be aware that COVID-19 patients may present with symptoms of taste abnormalities, which may precede respiratory symptoms. Each patient should perform hand hygiene using 70–90% alcohol-based hand rub (ABHR) or soap and running water immediately after entering the dental practice. Shoe soles should be sprayed, or shoe covers provided. Ensure that general housekeeping, including cleaning and disinfection of high-touch surfaces, is performed twice a day. Remove nonessential items, such as stored nonclinical items, dental display models, flyers, brochures, night guard samples and implant displays. Supply deliveries must be accepted outside and sanitized. Public areas and appliances should be frequently cleaned and disinfected, including door handles, chairs and desks. Elevators should be disinfected as well, and people using them should wear masks and avoid direct contact with buttons and other objects.[17]

Before arriving at the dental practice for work, each staff member should conduct their own self-assessment for COVID-19 and report results. No facial hair should be allowed. According to CDC, this prevents the effectiveness of some filters. Nails should be trimmed, and jewelry removed. Although PPE should ideally be standardized for all procedures, it may be necessary to separate PPE for critical and noncritical procedures. Critical: clinical treatments by dentist, assistant, hygienist. Noncritical: cleaning the operatory, sterilizing, bringing materials to and from the operatory, etc. A face shield and protective glasses, gown and fit-tested N-95 mask should be worn whenever an aerosol is produced. Noncritical tasks, such as cleaning the operatory and greeting the patient, require only protective glasses. Personal protective equipment (PPE) should be cleaned with soap whenever visibly soiled, and disinfection between patients is obligatory.[17]

The patient should be accompanied into the operatory by a staff member wearing clean PPE. Patient contact with all surfaces, such as door handles, should be minimal, and dental staff should open and close all doors. The contents of all operatories where aerosol-generating procedures are performed, including unnecessary equipment, supplies, plants and artwork, should be reduced to a minimum. Complimentary pens should be provided for the signature of consents or other forms. No paper material of any kind should be in the operatory once a procedure starts.[16]

All aerosol-generating procedures must be performed in an operatory with floor-to-ceiling walls and, ideally, a door, which must remain closed during and after the procedure. Staff should not leave the room until treatment is completed. If necessary, PPE should be removed. Other members of staff may bring in materials or instruments, with no need to change PPE.[17]

Pre-rinsing the oral cavity with a disinfecting solution, such as 1% hydrogen peroxide, for 30 seconds before examination reduces the risk of virus contamination.[18] Intraoral radiographs should be reduced to the necessary minimum, and dentists should consider using extraoral radiographs instead, whenever possible. The use of rubber dams associated with a high-volume evacuator (HVE) minimizes aerosols and possible exposure to infectious agents. For operators working without assistants, HVE devices that attach to the operating instrument improve aerosol reduction.[16]

The most frequently reported signs and symptoms of patients admitted to hospitals are fever (77–98%), cough (46–82%), myalgia or fatigue (11–52%), and shortness of breath (3–31%) at the onset of the illness.[19–22] In a group of 1,099 hospitalized COVID-19 patients, 44% had a fever at hospital admission, and 88% developed it during hospitalization.[1] However, some physicians working in affected areas have found that some patients diagnosed with COVID-19 do not show typical respiratory symptoms, such as fever and coughing. Some infected patients have neurological symptoms only at presentation: (1) headache, exhaustion, unstable gait and malaise, which may be assigned to nonspecific manifestations of COVID-19–the proportion of such initial presentations needs to be further explored; (2) cerebral hemorrhage; (3) cerebral infarction; and (4) other neurological disorders. In a recent study of 214 patients with COVID-19, 78 (36.4%) had neurological manifestations, such as headaches, dizziness, acute cerebrovascular diseases and impaired consciousness.[23] Of the 214 patients, 40 (18.7%) required intensive care unit (ICU) interventions because of severe neurological involvement.[23] There is already sound evidence from South Korea, China and Italy that significant numbers of patients with proven COVID-19 infection develop anosmia or hyposmia. In Germany, more than two thirds of confirmed cases had anosmia. In South Korea, where testing has been widespread, 30% of patients with a positive result had anosmia as their major presenting symptom in otherwise mild cases.[24]

Oral and facial manifestations may occur in Covid-19 infection. Vesicular facial skin eruptions may also appear in the skin of the head and neck. They are red and elevated, or large spots of various sizes. Pityriasis rosea-like, a maculopapular eruption, and perifollicular eruptions are also found in some confirmed cases of Covid-19. Purpuric eruptions may occur in the ear of children. Enanthem is the most common finding in the oral mucosa, which has red spots especially in the palate, lips and gingiva. A red collar may be seen along all of the gingival margin.[25] The information summarized above indicates that clinical evidence and common sense should prevail in decision making.[26]

In cancer cases, especially in patients with carcinomas of the upper airways and digestive tract, for which the treatment of choice is surgical, COVID-19 infection should be investigated at between 24 and 48 hours before surgery.[27]

Lei et al conducted a study with 34 surgery patients, 20 (58.5%) of whom were women and whose median age was 55 years old (interquartile range [IQR], 43–63 years old). All patients developed COVID-19 pneumonia shortly after surgery with abnormal findings on chest CT scans. Common symptoms were fever (31 [91.2%]), fatigue (25 [73.5%]) and dry cough (18 [52.9%]). Fifteen (44.1%) required admission to the ICU during disease progression, and 7 (20.5%) of them died. Compared with other patients, ICU patients were older and more likely to have underlying comorbidities, underwent surgeries that are more difficult and had more severe laboratory abnormalities, such as hyperleukocytemia and lymphopenia. The most common complications in nonsurvivors included acute respiratory distress syndrome (ARDS), shock, arrhythmia and acute cardiac injury.[28]

The pathogenetic mechanisms underlying central nervous system (CNS) invasion may be understood in the future, but there is a current urgent need to distinguish between neurologically affected COVID-19 patients and those who do not have signs and symptoms of CNS involvement. SARS-CoV-2 seems to reach the brain via a hematogenous route, but other routes to the CNS, such as the one across the cribriform plate of the ethmoid bone in the area of the olfactory bulb,[29] should be taken into consideration in patients with early-phase COVID-19 who present with loss of smell and taste and neurological manifestations. Studies suggest that SARS-CoV may directly infect the human CNS in some patients.[30]

Currently, many cases of patients with COVID-19 complicated by neurological diseases have already been reported.

It is important to mention that neurological signs and symptoms of some patients with COVID-19 may be a manifestation of hypoxia, respiratory and metabolic acidosis at an advanced stage of the disease. A differential diagnosis of these cases should be made, as a correct diagnosis may be lifesaving. This diagnosis also appears to be important from the vantage point of selecting a treatment regimen, as management of patients with COVID-19 and neurological involvement may require more specific and aggressive treatments than those given to patients without it.[31]

As the COVID 19 pandemic propagates throughout the United States, otolaryngologists will be faced with difficult questions on how to balance the safety of their patients, their families and the community as a whole. Otolaryngologists have an important role as healthcare providers who may see patients with signs and symptoms of COVID-19. They are, therefore, at a significantly higher risk of infection because of the nature of their specialty. Practices and recommendations will evolve based on new data and the availability of testing and resources. The present document should serve as a template for otolaryngologists to structure their practices in the face of the COVID-19 outbreak and to advocate for changes within their hospital systems.[32]

Telemedicine has brought great advances to remote patient care, as well as to the different approaches that may be adopted using technology. Telemedicine is certainly not a substitute for a physician or the empathy developed in a face-to-face consultation. However, in times of crisis, it is an important resource and should be used, always cautiously and within its limits. Keeping a physical distance has been an important "preventive tool" in reducing exposure to COVID-19.

Vaccine development and research into medical treatments for COVID-19 are under way, but results are many months away. Meanwhile, the pressure on the global healthcare workforce continues to intensify. This pressure takes two forms: the first is the potentially overwhelming burden of illnesses that stresses the capacity of health systems, and the second is the adverse effects on healthcare workers, including the risk of infection.[33] On April 9, the journal Nature reported that 78 vaccine projects had been launched around the globe, with a further 37 under development. Of the projects that are underway, one is a vaccine program that is now in its phase-one trial at Oxford University, two are being conducted by US biotechnology corporations, and three by Chinese scientific groups. Many other vaccine developers say that they plan to start human testing this year. The global COVID-19 vaccine R&D landscape already has 115 vaccine candidates, 78 of which are confirmed as active, whereas 37 are unconfirmed, and their development cannot be determined from publicly available or proprietary information sources. Of the 78 confirmed active projects, 73 are currently at exploratory or preclinical stages. The most advanced candidates have recently moved into clinical development: mRNA-1273 from Moderna, Ad5-nCoV from CanSino Biologicals, INO-4800 from Inovio and LV-SMENP-DC and pathogen-specific aAPC from the Shenzhen Geno-Immune Medical Institute.[34] Presently, there is no standardized treatment or vaccine available for COVID-19.[35] Clinical and serologic studies will be needed to confirm which populations remain at highest risk once vaccines are available.

Chloroquine inhibited the dengue virus in some cell cultures,[36] but failed to shorten the illness in a randomized study of 37 patients.[37] Although laboratory studies suggested activity against the influenza virus, chloroquine did not prevent infection in a large randomized trial.[38] Chloroquine and hydroxychloroquine have a long-standing history in the prevention and treatment of malaria and in the treatment of chronic inflammatory diseases, such as systemic lupus erythematosus (SLE) and rheumatoid arthritis (RA).[39] The chloroquine dose to treat COVID-19 is 500 mg orally once or twice daily.[40,41] Hydroxychloroquine dosing recommendations for SLE generally are 400 mg orally daily.[42] However, a physiologically based pharmacokinetic modeling study recommended that the optimal dosing regimen for hydroxychloroquine in the treatment of COVID-19 is a loading dose of 400 mg twice daily for 1 day followed by 200 mg twice daily.[43] In contrast, alternative recommendations are made for 600 mg total daily dose based on safety and clinical experience with Whipple disease.[40] Two recent studies of hydroxychloroquine in hospitalized patients did not find any significant benefits.

Several studies evaluated the use of the antiretroviral drugs Lopinavir/Ritonavir and Ribavirin and found no significant evidence of any benefits of the use of these drugs in the treatment of patients with COVID-19.[44–50] Oseltamivir, a neuraminidase inhibitor approved for the treatment of influenza, has no documented in vitro activity against SARSCoV-2. The COVID-19 outbreak in China started during the peak influenza season, and large proportions of patients received empirical oseltamivir treatment until the discovery of SARS-CoV-2 as the cause of COVID-19.[19] Several of the current clinical trials include oseltamivir in comparison groups, but not as a main treatment intervention.[51]

Interferon-α and -β have been studied for nCoVs, and interferon-β had activity against the middle east respiratory syndrome (MERS).[52] Current Chinese guidelines list interferons as an alternative drug for combination therapy.[41] Several other immunomodulatory agents traditionally used for noninfectious diseases were found to have in vitro activity or mechanisms to inhibit SARS-CoV-2, including, but not limited to, baricitinib, imatinib, dasatinib, and cyclosporine.[53–57] However, no animal or human data exist to recommend their use for COVID-19, and it remains to be seen whether they confer protection for patients already taking them for other indications.[58]

We need better, properly powered, randomized controlled trials of chloroquine or hydroxychloroquine. For now, except for supportive measures, infection with SARS-CoV-2 is "essentially untreatable"[59].

The potential risk factors of older age, high sequential organ failure assessment (SOFA) score, and d-dimer > 1 µg/L may help clinicians identify patients with a poor prognosis at an early stage. Prolonged viral shedding provides the rationale for a strategy of isolation of infected patients and optimal antiviral interventions in the future.[60]

The vast majority of infected patients ($> 80\%$) do not get significantly ill and do not require hospitalization. Among

hospitalized patients, between 10 and 20% are admitted to the ICU, between 3 and 10% of those require intubation and between 2 and 5% of them die.[61,62]

This disease and its treatments are currently a moving target and some management choices may change in the coming weeks. However, at the helm of all management is prevention of spread to other contacts, which seems to be the best way to slow down this pandemic.[35]

Despite the variety of drug options identified so far, scientific evidence is still preliminary and of low methodological quality. In addition, there are dozens of clinical studies underway evaluating the efficacy and safety of drugs worldwide. Frequent updating is recommended to monitor scientific evidence as it becomes available.

Planetary Health is concerned with the interdependencies between Earth's natural systems and human health, focusing on how ecological systems affect humans and how humans affect the environment. The COVID-19 pandemic is very likely the result of a zoonotic spillover, a process that seems to be accelerating as the human ecological footprint increases. Despite worldwide unpreparedness, the larger planetary health scientific community had already been intensively researching this issue and discussing how to better prevent and tackle it.[63] There is a current understanding that there may be other pandemics in the making.[64] Therefore, health workers have to become familiar with planetary health and advocate for our civilization to foster a roadmap that is both pragmatic and harmonious with natural systems to reduce the risks of a new zoonotic spillover.

There is a widespread perception that the world is entering a new economic depression due to the COVID-19 pandemic. This current human tragedy is much like what will come from climate change, which is expected to accelerate the occurrence of natural disasters and disruptions to the economy along with massive morbidity and mortality. Health providers must strive for climate actions to safeguard humanity.[65] Health professionals and their corresponding scientific associations should alert the population and world leaders of the need for a healthy recovery and a safer economic paradigm, instead of simply providing financial rescue to the hyper-consumerist disruptive production model that is associated with zoonotic spillovers and other interconnected ecological catastrophes. The proposed European Green Deal may be a good model to emulate,[66] as significant cobenefits to economy, jobs, and health may be achieved by aiming at carbon neutrality.

Social distancing and the avoidance of crowded places may have important consequences for mental health in the population. Social distancing is associated with depression, as human beings are not prepared to live away from other individuals. In addition, avoiding crowded spaces may give rise to a long-term phobic behavior when life returns to normal. Physical contact is an important form of showing affection between people. The distance between individuals may have a greater impact on human relationships, especially in certain cultures. Technology has maintained communications between people over the internet, but this type of interaction may not replace conventional physical contacts between humans.

The use of masks against COVID-19 is highly recommended for an indefinite time. In addition to social distancing and hygiene of hands and environments, the mask provides effective protection for oneself and others. Handmade masks should be 100% cotton and have a double layer. Health professionals should wear surgical masks or, in risk areas, N95 or FFP2 masks.

A 77-year-old obese man with a history of hypertension, splenectomy and 6 days of fever and chills died. He tested positive for SARS-CoV-2 on postmortem nasopharyngeal and lung parenchymal swabs. Autopsy revealed diffuse alveolar damage, chronic inflammation and edema in the bronchial mucosa. A 42-year-old obese man with a history of myotonic dystrophy developed abdominal pain followed by fever, shortness of breath, and cough. Postmortem nasopharyngeal swab was positive for SARS-CoV-2; lung parenchymal swabs were negative. Autopsy showed acute bronchopneumonia with evidence of aspiration. Neither autopsy revealed viral inclusions, mucus plugging in airways, eosinophils, or myocarditis.[67]

The analysis of lung tissues of patients with COVID-19 may help understand the pathogenesis and clinical outcomes in this life-threatening respiratory illness. A study was conducted with lung tissues of 38 patients who died of COVID-19 in two hospitals of Northern Italy. Hematoxylin-eosin staining, immunohistochemistry for the inflammatory infiltrate and cellular components, and electron microscopy were used for a systematic analysis. Results revealed features of the exudative and proliferative phases of diffuse alveolar disease (DAD): capillary congestion, pneumocyte necrosis, hyaline membrane, interstitial edema, pneumocyte hyperplasia, reactive atypia and platelet-fibrin thrombi. The inflammatory infiltrate was composed of macrophages in alveolar lumens and lymphocytes mainly in the interstice. Electron microscopy revealed viral particles in the cytoplasm of pneumocytes. The authors concluded that the predominant pattern of lung lesions in COVID-19 patients is DAD, as described for the other two coronaviruses that infect humans, SARS-CoV and MERS-CoV. Hyaline membrane formation and pneumocyte atypical hyperplasia are frequently found in these cases. The main relevant finding was the presence of platelet-fibrin thrombi in small arteries; this important finding fits into the clinical context of coagulopathy, which is prevalent in these patients and which should be one of the main targets of treatment.[68]

Final Comments and the Post-COVID-19 Era

The COVID-19 pandemic has huge proportions. Its scope cannot be determined today, because it is still under its full development cycle in most regions of the planet. Studies in the literature suggest that pulmonary impairment is the major event to be elucidated and managed. The measures adopted by health agencies in many countries were based on WHO data, which suggest the isolation of people in high-risk groups for an indefinite time and mass social distancing. These measures have to be under constant review, because this disease

progresses in different ways, even when similar treatments are used. In addition to gene mutations and comorbidities that patients may have, patient responses to the same treatments differ. The world will certainly be different after this pandemic, as other habits, behaviors and greetings will be adopted around the world. Finally, health professionals will be a clear voice in the definition of how economic depression remedies may benefit from science and health expertise.

Conflict of Interests

The authors have no conflict of interests to declare.

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