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The Anesthesiologist and COVID-19**O Anestesiologista e a COVID-19**

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In December 2019, China reported clusters of pneumonia in the city of Wuhan, epidemiologically related to transmission from animals. On December, 31, 2019, the Center for Disease Control and Prevention of China described a new coronavirus and announced the first stage of an outbreak.¹ In addition to coronavirus SARS-CoV and coronavirus MERS-CoV, the world would be facing a new virus that was named SARS-CoV-2, which could lead to a severe acute respiratory syndrome and was named by the World Health Organization Covid-19 (*Coronavirus Disease 2019*).²

The current scenario was not initially anticipated, but China began presenting numbers that grew on an exponential scale, which led to the isolation of the province in which the city of Wuhan is located. While the situation seemed isolated to China, with a few cases outside the original region, on January 31, 2020 two cases were diagnosed in Rome, Italy.³ The outbreak in Lombardy, in northern Italy, began with a 38-year-old Italian who presented to the hospital with flu-like symptoms. After this, two elderly individuals died after having been to the same hospital.⁴ At the end of February, there were already over 400 confirmed cases in Lombardy.⁵ On March 8, 2020, Italy already registered over 5,800 cases and 233 deaths.⁶ The quarantine decreed for northern Italy was soon expanded to the entire country, determining that citizens confine themselves until the beginning of April, 2020.⁷

Even with the containment measures in China and in Italy, there was a global expansion of transmission, and in mid-March, 2020 the Johns Hopkins University specialized site disclosed the confirmation of over 200 thousand cases in over 160 countries and territories, with over nine thousand deaths and 82 thousand individuals recovered.⁸ On March 11, 2020, the World Health Organization declared the Covid-19 pandemic.⁹ Italy is currently the most affected country, with over 30 thousand cases and over 3,000 deaths. WHO declared Europe the new epicenter of the Pandemic.⁸

The virus arrived officially to Brazil on February 25, 2020, along with the diagnosis of a 61-year old man, coming from Lombardy, and who tested positive for SARS-CoV-2 in the city of São Paulo.¹⁰ When this editorial was written, in Brazil there were over 600 cases and at least six deaths already.⁸ Although anyone can become ill, there is already enough evidence showing that the elderly, mainly those with chronic conditions such as cardiopathies and pneumopathies, are the most vulnerable group to the most severe forms of the disease and comprise the great majority of deaths.¹¹

The incubation period of SARS-CoV-2 seems to be four to seven days.¹² There is a spectrum of clinical manifestations related to COVID-19, from asymptomatic infection to severe respiratory failure. The main symptoms described are fever, myalgia, fatigue, dry cough and dyspnea.¹³ Uncommon symptoms, also described, include purulent sputum, headache, hemoptysis

and diarrhea. Clinical presentations can be classified as mild, moderate or severe, according to the presence and severity of symptoms, as described in Table 1.

The mean progression period of the disease, between onset of symptoms and beginning of dyspnea, is eight days, and for mechanical ventilation to be required 10.5 days. Common laboratory findings include leucopenia and lymphopenia. Other findings may include increased lactic deshidrogenase and creatinophosphokinase, in addition to increased liver enzymes. Hematological alterations can be related to bone marrow suppression, sequestration of lymphocytes or apoptosis.¹⁴

Most patients present mild symptoms, although 15% can progress to respiratory distress syndrome, renal or heart failure, or multiple organ failure between 7 and 10 days after hospitalization.

Another presentation that can occur is development with abdominal symptoms, probably related to expression of the angiotensin II receptor in the small bowel. These patients can play an important role in the spread of the disease, because they do not present the symptoms most commonly associated with COVID-19, and eventually are not considered as at risk and are not tested, and can thus, extensively infect healthcare teams.¹⁵

Lung changes are found in practically all inpatients. The radiological pattern frequently observed is bilateral and peripheral frosted glass opacity. With the progression of the disease, the radiological pattern becomes a “reversed halo”.

There still are no specific recommendations for mechanical ventilation for COVID-19 patients. The recommendations are the same protective pulmonary measures used for patients with acute respiratory distress syndrome (ARDS), such as tidal volume ≤ 6 mL/kg of predicted weight, respiratory rate ≤ 35 per minute, plateau pressure ≤ 30 cmH₂O and PEEP ≥ 5 cmH₂O.¹⁶ Physiological targets include PaO₂ between 55 and 80 mmHg, with SpO₂ between 88 and 95% and permissive hypercapnia. There is no recommendation for a specific ventilation mode, putting the patient in the prone position is recommended, but use of ECMO still presents conflicting data.¹⁷⁻¹⁹ The systematic use of corticoids has shown increased mortality, and routine use of β 2-agonists is not recommended.²⁰ Still along the line of following protective ventilation recommendations, more conservative volume replenishment management and recruitment maneuvers are indicated.¹⁹

We still do not know all transmission mechanisms of COVID-19, which make social prevention measures and measures among health professionals difficult to be implemented. Health professionals cannot isolate themselves at home, nor practice strict interpersonal distancing, and are at the front line in treating and guiding the exposed or infected population. In this scenario, anesthesiologists are essential parts in the care chain of these patients.

The virus is known to spread by aerosol of respiratory secretions, mainly of symptomatic patients, in which the viral load tends to be higher. Professionals who work in sectors in which there are critical patients or where they handle the airway of virus carriers certainly are those most exposed inside the hospital, and anesthesiologists are considered as part of this group.^{21,22} It is known from previous experience from other coronavirus epidemics and from the 2009 influenza A pandemic that procedures that involve airways, such as tracheal intubation, tracheal extubation, tracheal suction, bronchoscopy and disconnecting mechanical ventilators, have a higher risk of transmission by respiratory aerosols.²³

Health professionals, mainly those who deal with critical patients or those who handle airways of infected patients or with suspected infection, should be stringently protected. Critical care units should be prepared for patients who will develop signs of severity, and measures have already been implemented and learned during the SARS-CoV and MERS-CoV epidemics.^{24,25}

Wong et al. recently published in the *Canadian Journal of Anesthesia* the experience of a major hospital in Singapore on the response of the Anesthesiology team to this new coronavirus epidemic.²⁶ Recommendations included decrease in elective surgeries as a way of increasing total hospital capacity, in addition to preserving the workforce of physicians. Measures to decrease unnecessary personnel circulating in the hospital and appropriate triage of employees and patients with signs and symptoms of COVID-19 were implemented. Measures to enhance communication among physicians and other health professionals were also implemented, in addition to material and a direct channel to care for professionals who reported anxiety or presented signs of COVID-19 epidemic-related burnout.^{26,27}

The major challenge to anesthesiologists is the care for patients with a suspected or confirmed diagnosis of COVID-19. All anesthesiology services should have well defined flows and processes for the care of these patients and to protect professionals involved. Although, in times of pandemic all patients may pose a risk of being virus carriers, a dedicated operation room is recommended for the care of critical patients, mainly if negative pressure rooms, ideal for these scenarios, are not possible. As the entire routine of the surgical block will be changed, if there are suspected or confirmed patients, appropriate training, systematic checking, accessible checklists and dedicated areas for gowning and ungowning should be implemented.^{28,29}

Given several Brazilian states have already confirmed community transmission of SARS-CoV-2, the adoption of measures to prevent contact with aerosols is recommended. The Brazilian Society of Anesthesiology published recommendations for the use of personal protection equipment (PPE) that are in compliance with international recommendations.³⁰ During airway handling which can generate aerosols, wearing masks appropriate to the risk of the patient, protection goggles, disposable gowns and gloves are recommended. Basic PPE for the care of

patients with suspected or confirmed infection include N95 masks, protection goggles (or complete helmet), caps, gowns and gloves, and wearing two gloves can be considered.^{26,29,31} It is recommended that the entire team undergo retraining of gowning and ungowning.

In order to prepare an operation room to receive a suspected or infected patient, only what is essential should stay in the room, therefore few items will need to be disinfected, reprocessed or disposed of at the end of the procedure.³² Disposable materials should be used whenever possible and any equipment touched by many individuals should be covered by plastic – including monitors, anesthesia equipment, ultrasound devices and computers – with terminal disinfection after the end of the procedure.^{26,27}

In order to avoid unnecessary transportation of patients with suspected or confirmed infection and of professionals involved in anesthetic-surgical care, patients should be assessed and recovered inside the operation room dedicated toward that end.^{31,33} Several publications recommend that the respiratory circuit and soda lime be disposed of after the procedure.³⁴⁻³⁶ All professionals who are in contact with the patient should take a bath and change scrubs.

Only urgent and emergency surgeries should be performed during the critical period of the pandemic. Urgent heart and oncology surgeries on patients with suspected infection can be postponed for some hours to wait for a confirmation PCR test for SARS-CoV-2.³² In Brazil, the Federal Council of Medicine, the National Supplementary Health Agency and the Brazilian Society of Anesthesiology, in agreement with the Brazilian College of Surgeons and the Brazilian Medical Association, recommend that surgeries, diagnostic procedures and elective outpatient care be temporarily interrupted.^{30,37,38}

During anesthesia, all measures to keep patient safety and prevent the spread of the infection should be taken. As it is known that handling the airway of patients with suspected or confirmed infection can generate aerosols, any unnecessary handling, positive pressure ventilation with facial mask, open circuit suction and patient coughing during tracheal intubation or extubation should be avoided. If regional anesthesia is possible, the patient should be kept with a surgical mask during the procedure. Given awake intubation and atomization of airways can generate many aerosols,³⁹ such procedures should be avoided. If supplementary oxygenation is indicated for non-intubated patients, a simple nasal catheter under a surgical mask should be used, and high-flow catheters or non-invasive ventilation are counter-indicated.^{32,34,39}

Using HEPA (*high efficiency particulate air*) type filters between facial masks and the Y respiratory circuit is recommended, in addition to another filter between the expiratory limb and the anesthesia machine.²⁶ Tracheal intubation, preferably with a video laryngoscope, is the technique of choice to control airways, and more experienced anesthesiologists should perform the intubation. All circuit extensors should be placed before intubation to avoid unnecessary

disconnections. Pre-oxygenation should be performed with an appropriate seal between the patient's face and the mask, and intubation should be fast sequence to avoid positive pressure ventilation under a facial mask. Patients should be intubated to a deep plane and with an appropriate neuromuscular blockade to avoid coughing.^{26,34} During extubation, care should be taken to avoid coughing and spread of aerosols. Anti-emetics to minimize risk of vomiting and consequent coughing during anesthetic recovery is recommended. Intravenous lidocaine immediately before extubation can also contribute to minimizing the occurrence of coughing.⁴⁰ Oropharyngeal suction should be performed with a rigid suction tube to avoid contamination of part of the face by the flexible suction tube. Post-anesthesia recovery should be done in the operation room, and if transportation of the intubated patient to the intensive care unit is required, closed circuit ventilation should be used and unnecessary disconnections avoided.²⁶

Anesthesiologists are experts in airway management and are on the front line of treatment of many patients with COVID-19; that is why they have to be prepared to protect themselves during airway handling. An analysis of over 70 thousand cases in China showed that 3.8% of individuals infected were health professionals, 14.8% of which considered severe, with five deaths reported.⁴¹ Many lessons were learned with previous coronavirus epidemics and with recent experience with the SARS-CoV-2 pandemic in China and Italy. Given they are the most well-trained individuals to approach airways, anesthesiologists should also protect themselves appropriately while handling patients with COVID-19.

Since the first coronavirus epidemic, science has never been so globally connected. During the first coronavirus outbreak, SARS-CoV, there had already been five deaths when China told the world. In the current pandemic, no patients had died yet when China reported to the World Health Organization. The SARS-CoV-2 virus was identified one week after the new outbreak was reported.⁴¹ In Brazil, only 48 hours after the first infection was reported in the city of São Paulo, Professor Ester Sabino's team, from the School of Medicine of São Paulo University, sequenced the SARS-CoV-2 genome, helping to understand the proliferation of the virus and its mutations, in addition to helping global science to fight the disease.⁴²

Health professionals will be greatly affected by this pandemic, and this has been observed in previous scenarios. There already were over 100 health professionals infected in a single institution and in quarantine due to COVID-19. Telemedicine can contribute to minimizing the risk, and the current sanitary crisis can contribute to speeding up the adoption of video consultations in our environment. Many American hospitals already have telemedicine triage systems at emergency rooms, which can be performed by physicians and other professionals in quarantine, leaving other professionals to care for critical patients.⁴³

Coordinating and preparing for a pandemic is not simple. Recommendations should come from the higher level of governance and be coordinated in hierarchal way. The Ministry of Health is playing a major role in this coordination, but every hospital and Anesthesiology service should implement their own protocols following recommendations from the higher levels. Surgical block teams are considered complex and high performance, and the knowledge of contamination prevention measures, ongoing surveillance, appropriate use of PPE and appropriate gowning and ungowning training and retraining should be implemented, and are extremely important.

Investments in public health and in science should continue, including basic science, and translational to clinical research. Several research groups are pursuing a vaccine capable of curbing the ongoing expansion of the disease and rapidly decreasing related mortality. Adequate investments can contribute to the coordination, cooperation and creation of international research networks to attain an appropriate response to outbreaks and pandemics. There are still countless questions without answers, given research and treatment results are being developed as the pandemic spreads. Although we are still facing the unknown, some general recommendations, in addition to technical recommendations, have already been well established: social isolation and protection of the most vulnerable individuals are mandatory, and the health of anesthesiologists is the most precious good at this time of crisis, due to their role in the frontline to face COVID-19.

Appropriate communication and quality information are essential throughout the pandemic process. Incorrect and fake information are frequently disclosed, and disinformation is dangerous and can weaken the correct collaboration of society and the global outcome of the crisis. In order to contribute to better information in times of pandemics, following, we list the main links of scientific journals and domestic and global organizations that are making correct COVID-19-related information available, in an ongoing and updated flow, and with free access.

Links of interest

JAMA – <https://jamanetwork.com/journals/jama/pages/coronavirus-alert>

NEJM – <https://www.nejm.org/coronavirus>

WHO – <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>

The Lancet – <https://www.thelancet.com/coronavirus>

CDC – <https://www.cdc.gov/coronavirus/2019-ncov/index.html>

SBA – <https://www.sbahq.org/ebook/>

ANESTHESIOLOGY – <https://anesthesiology.pubs.asahq.org/ss/coronavirus.aspx>

University of Toronto – <https://www.anesthesia.utoronto.ca/news/coronavirus-and-safety-precautions>

WFSA – <https://www.wfsahq.org/resources/coronavirus>

UpToDate – <https://www.uptodate.com/contents/coronavirus-disease-2019-covid-19>

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Table 1 – COVID-19 associated clinical symptoms

Clinical presentation	Symptoms
Mild	No pneumonia or mild pneumonia
Moderate	Dyspnea, respiratory rate ≥ 30 /min Oxygen saturation $\leq 93\%$ Ratio of arterial oxygen partial pressure to fractional inspired oxygen < 300 and/or Lung infiltrate $> 50\%$ within 24 to 48 hours
Critical	Respiratory failure, septic shock and/or multiple organ dysfunction or failure

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