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Management of hospitalized patients during the COVID-19 pandemic: review

Manejo de pacientes hospitalizados durante a pandemia COVID-19: revisão

Manejo de pacientes hospitalizados durante la pandemia de COVID-19: revisión

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Abstract
SARS-CoV-2 is the leading agent of the current pandemic and is the cause of severe acute respiratory syndrome. Thus, hospital procedures are considered factors of high risk of contamination, with a high possibility of causing viral spread, in addition to nosocomial contamination. This article was developed with the objective of presenting a review of the current protocols that aim to guide on the approach of patients with COVID-19, as well as the recommendations recommended in relation to aerosol-generating medical procedures. To this end, a study of narrative literature review was carried out. In order to prevent infections, as current recommendations recommend the mandatory use of masks, aprons, gloves and eye protection. Regarding orotraqueal intubation and mechanical ventilation, you should choose the most experienced doctor on the team and prefer "fast sequence intubation". In the case of a tracheostomy, it must be performed following all the steps defined in the protocols. In relation to cardiopulmonary resuscitation, there must be five health professionals with functions very well applied and reviewed, according to the practices of maintenance, ventilation, medication administration and completion of resuscitation. Within the intensive care unit, it is necessary to assess the expandability of the location, such as the increase in the multidisciplinary team. During a pandemic, it is imperative that a risk-benefit assessment is carried out before indicating surgery. Therefore, it is evident that changes in world protocols are important for minimizing aerosols, offering greater safety to all involved, whether they are professionals or patients.
Keywords: COVID-19 pandemic; 2019 Novel Coronavirus disease; SARS-CoV-2 Infection.

Resumo
O SARS-CoV-2 é o agente protagonista da pandemia atual, sendo o causador da síndrome respiratória aguda grave. Assim, os procedimentos hospitalares são considerados fatores de alto risco de contaminação, com alta possibilidade de causar propagação viral, além da contaminação nosocomial. Este artigo foi desenvolvido com o objetivo de

apresentar uma revisão dos protocolos atuais que visam orientar sobre a abordagem de pacientes com a COVID-19, bem como as recomendações recomendadas em relação aos procedimentos médicos geradores de aerossol. Para tanto foi realizado um estudo de revisão narrativa da literatura. Um fim de prevenção de infecções, como recomendações atuais preconizam o uso obrigatório de máscaras, aventais, luvas e proteção ocular. Em relação à intubação orotraqueal e à ventilação mecânica, deve escolher o médico mais experiente da equipe e preferir pela "intubação de sequência rápida". No caso de traqueostomia, ela deve ser executada seguindo todas as etapas definidas nos protocolos. Já em relação à ressuscitação cardiorrespiratória, deve-se ter cinco profissionais de saúde com funções muito bem aplicadas e revisadas, de acordo com as práticas de manutenção, ventilação, administração de medicamentos e finalização da ressuscitação. Dentro da Unidade de Terapia Intensa, é necessário avaliar a expansibilidade do local, como o aumento da equipe multiprofissional. Durante uma pandemia, é imprescindível que seja feita uma avaliação de risco-benefício antes de indicar uma cirurgia. Sendo assim, fica evidente que as alterações nos protocolos mundiais são importantes para a minimização de aerossóis, oferecendo maior segurança a todos os envolvidos, sejam eles profissionais ou pacientes.
Palavras-chave: Pandemia COVID-19; Doença pelo novo Coronavírus (2019-nCoV); Infecção por SARS-CoV-2.

Resumen
El SARS-CoV-2 es el principal agente de la pandemia actual, causando el síndrome respiratorio agudo severo. Así, los procedimientos hospitalarios se consideran factores de alto riesgo de contaminación, con una alta posibilidad de causar propagación viral, además de contaminación nosocomial. Este artículo fue desarrollado con el objetivo de presentar una revisión de los protocolos actuales dirigidos a orientar el abordaje de los pacientes con COVID-19, así como las recomendaciones recomendadas en relación con los procedimientos médicos generadores de aerosoles. Para ello, se realizó un estudio de revisión narrativa de la literatura. El fin de la prevención de infecciones, ya que las recomendaciones actuales recomiendan el uso obligatorio de mascarillas, delantales, guantes y protección ocular. Con respecto a la intubación orotraqueal y la ventilación mecánica, debe elegir al médico más experimentado del equipo y preferir la "intubación de secuencia rápida". En el caso de la traqueostomía, debe realizarse siguiendo todos los pasos definidos en los protocolos. En relación a la reanimación cardiorrespiratoria, se deben tener cinco profesionales de la salud con funciones bien aplicadas y revisadas, de acuerdo con las prácticas de mantenimiento, ventilación, administración de medicamentos y finalización de la reanimación. Dentro de la Unidad de Terapia Intensa, es necesario evaluar la expansión del sitio, como el aumento del equipo multidisciplinario. Durante una pandemia, una evaluación de riesgo-beneficio es esencial antes de indicar la cirugía. Por ello, es evidente que los cambios en los protocolos globales son importantes para la minimización de los aerosoles, ofreciendo una mayor seguridad a todos los implicados, ya sean profesionales os pacientes.
Palabras clave: Pandemia de COVID-19; Brote por el Coronavirus 2019-nCoV; Infección por SARS-CoV-2.

1. Introduction

The new coronavirus, which causes severe acute respiratory syndrome (SARS-CoV-2) and responsible for the pathological condition called coronavirus disease 2019 (COVID-19), is the protagonist agent of the current pandemic, as defined since March 2020 by the World Organization Health Organization (Who, 2020).

It is believed that the primary mode of viral transmission occurs through the spread of respiratory droplets, which transport viral particles of approximately 0.125 microns (Sharma et al., 2020). Such particles were found over distances greater than two meters and on the contaminating surfaces on which they land, and may be viable in the air for at least three hours (Convissar et al., 2020). Although respiratory inhalation is the main route of infection, others are plausible, such as ophthalmic contamination, fecal-oral and hematological route (Tang & Wang, 2020; Steward et al., 2020).

In this context, aerosols are fine solid particles or liquid droplets that are suspended in the air or in another gas, and are not so well filtered by surgical masks. When health professionals approach the patient's face, there is an exponential increase in the density of aerosols, thus increasing the risk of contamination (Mick & Murphy, 2020).

Due to the pandemic, hospital procedures for the treatment of critically ill patients are considered factors of high risk of contamination, resulting from the high possibility of causing the spread of the virus, in addition to the possibility of nosocomial contamination (Respiratory, 2020). The growing demand for aerosol-generating medicais procedures (AGMP), combined with the scarcity and limited availability of negative pressure rooms, generated a need for innovation in new equipment for biohazard isolation and the creation of a negative pressure environment for patients with COVID-19 (Convissar et al., 2020).

Accordingly, according to Qualliotine e Orosco (2020), the US Centers for Medicare & Medicaid Services issued recommendations to postpone non-essential surgeries and procedures, aiming to increase the capacity of hospitals to meet the expected volume of cases and decrease the rates of virus transmission. It should also be highlighted the need for practices that focus on infection prevention, as well as clear communication from the hospital and intensive care unit (ICU) leadership, in addition to a mental health support network through multidisciplinary teams Arabi et al., 2020).

This article was developed with the objective of presenting a review of the current protocols that aim at guidance on the approach to the patient with COVID-19, as well as the conducts and procedures recommended by the current researches and regulatory bodies in relation to the AGMP.

2. Methods

A narrative literature review was conduct in the electronic database Medline via PubMed to answer the question: How to deal with medical procedure to reduce the contamination by SARS-CoV-2 and have a better prognosis for the patient. The surveys were conducted in June and July 2020, using the search strategy following terms: SARS-CoV-2, COVID-19, surgery, intubation, anesthesia, hospital bed capacity, rapid sequence induction and intubation, resuscitation, aerosols, emergency medical services, cross infection and suction (Table 1).

In addition, aiming at the resolution, conference proceedings was carried out in the 2020 guidelines and authoritative texts of the Brazilian Intensive Medicine Association (BIMA), American College of Surgery (ACS), Centers for Disease Control and Prevention (CDC), WHO, Royal College of Surgeons (RCS) e Society of American Gastrointestinal and Endoscopic Surgeons (SAGES).

Studies involving subjects of interest were selected, such as: personal protective equipment (PPE), surgery, anesthesia, ventilation, urgency or emergency. To reduce bias, three independent reviewers oversaw data extraction. Studies were excluded if the topic were not pertinent to the purpose of the study.

Table 1: Medline virtual database search strategy and results.

	Search strategy	Retrieved references	Selected articles
(SARS-CoV2 OR COVID-19)	AND Surgery AND Intubation AND Anesthesia	21	2
	AND Hospital Bed Capacity	36	3
	AND Rapid Sequence Induction AND Intubation	5	4
	AND Resuscitation AND Aerosols	25	6
	AND Emergency Medical Services AND Cross Infection	9	3
	AND Suction	27	10

Source: Authors.

3. Personal Protective Equipment (PPE)

According to Arabi et al. (2020), hospital transmission between patients and health professionals has been an important feature of SARS, Middle East Respiratory Syndrome (MERS) and, currently, COVID-19 outbreaks.

In order to prevent infections, it is recommended use of masks, aprons, gloves and eye protection, such as glasses or face shield for health professionals who provide direct care to the patient.

The minimum PPE recommended for performing invasive procedures correspond to the PFF3 mask with confirmed seal, surgical cap, eye protector and double gloves (Broderick et al., 2020). This Watch, it is essential that there is adequate training on the specific steps of using and removing such equipment, along with hand hygiene (Phua et al., 2020; Broderick et al., 2020).

During the pandemic, before starting any type of procedure that integrates airway management, it is necessary that all equipment will be use it is open and ready for use, such as sharps and preparation of medications, in order to avoid possible errors or accidents during the execution of the maneuver (Matava et al., 2020). Along with this, any suspicion of contamination should be reported to the hospital infection control sector, in order to assess the need for quarantine.

4. Tracheostomy

It is observed that health professionals who perform the tracheostomy are 4.15 times more likely to become infected with SARS-CoV-2, compared to other professionals, since the viral load in the upper respiratory tract is higher, mainly in the nasal cavities[6]. Therefore, it is contraindicated to perform a tracheostomy in patients with COVID-19 who are still in the transmission period. Such a procedure should be considered only in cases of ventilatory inefficiency of the endotracheal tube, to provide an adequate airway (Sommer et al., 2020).

In order to provide a safer postoperative treatment for tracheostomized patients, the systematic use of two devices was established: heat and humidity exchangers in combination with a bacterial and viral filter (HMEF) and the closed endotracheal suction system. The HMEF reduces the risk of viral and bacterial cross-contamination. Closed endotracheal suction systems are recommended for the prevention of ventilator-associated pneumonia, as these systems allow aspiration of endotracheal secretion, without the risk of spreading the aerosol in the environment (De Seta et al., 2020).

Before and after transfer the patient to the procedure room, aspiration of the oral cavity is necessary, in order to reduce the amount of secretions when the trachea is opened. After transfer, the anesthetist must maintain adequate muscle relaxation. The surgeon should not enter the procedure room until 20 minutes after IOT, in order to allow air to be recirculated. The circuit must remain closed, by emptying the air balloon and stopping the ventilator from functioning (moment when the tracheostomy tube is inserted into the trachea). Finally, the balloon is reinflated while the endotracheal tube advances into the trachea. O_2 capnography, gold standard to confirm the procedure, should be used (Broderick et al., 2020).

5. Orotraqueal Intubation (OTI) and Mechanical Ventilation (MV)

According to AMIB (2020), in infected patients, intubation is indicated when they need oxygen supplementation via a nasal catheter greater than 5 L/min, to maintain peripheral O_2 (SpO_2) saturation greater than 93%; tachypnea (> 28 irpm) or acidosis, through arterial pressure of carbon dioxide ($PaCO_2$> 50 mmHg) and / or hydrogen potential (pH < 7.25).

The most experienced physician on the team should be chosen to perform the OTI and prefer “fast sequence intubation”, so that smooth manipulation and reduction of airway activation reflexes are achieved, since OTI in infected patients is considered difficult (Yao et al., 2020). In addition, there is great psychological pressure on professionals who perform OTI, and care should be taken with the materials used, so that the procedure can be performed with less aerosolization (Meng et al., 2020; Pinheiro & Pereira, 2020). Therefore, it is recommended, as the gold standard of the intubation technique, the use of videolaryngoscopy instead of direct laryngoscopy, when possible, since the use of videolaryngoscope increases the distance between the patient's airway and the face of the health professional, in addition to minimizing the number of attempts and consequently the occurrence of complications (Sorbello et al., 2020).

Thus, timely and not premature intubation is the key word in decision making. Criteria such as SpO_2 and the ratio of arterial oxygen pressure (PaO_2)/inspired oxygen fraction (FiO_2) were defined to facilitate the preparation for intubation. It is also seen that silent hypoxemia may be responsible for the rapid deterioration in some patients, as it provides a false sense of well-being, due to the low O_2 reserve index, increasing the possibility of cardiorespiratory arrest (CRP) during and immediately after the IOT (Meng et al., 2020).

Experts from the Chinese Society of Anesthesiology deliberated and wrote recommendations on the proper practice of OTI after standard oxygen therapy and on symptoms (breathing difficulty, respiratory rate > 30 / min and oxygenation index < 150 mmHg) that persisted or exacerbated after nasal oxygenation of high flow or NIV for two hours (Zuo et al., 2020). However, there is a description in the literature of a potential increase in aerosolization in these oxygenation practices, not being suggested in routine use in face of invasive ventilation (Guimarães et al., 2020).

AMIB (2020) does not recommend that doctors attempt to ventilate more than one patient with a single ventilator, as this increases the risk of cross-infection among patients. In addition, there would be difficulty in adjusting the ventilatory parameterization, such as individualized titration of positive end-expiratory pressure (PEEP) and FiO_2, impairing therapeutic measures.

The respiratory rate (RR) must be established between 20 and 35 irpm, to maintain the CO_2 measurement at the end of expiration ($ETCO_2$) between 30 and 45 mmHg and / or $PaCO_2$ between 35 and 50 mmHg. In cases of PaO_2 / FiO_2 less than 150, with adequate PEEP according to the PEEP / FIO_2 table, it is suggested to use protective ventilation with the patient in a prone position for at least 16 hours. To do this, at least five properly qualified health professionals are necessary for the safe execution of the rotation. Furthermore, it is essential that there is adequate silk-analgesia and, if necessary, curarization. The patient can remain in the supine position if, after being "unresponsive", he/she remains with the PaO_2 / FIO_2 ratio > 150, monitored through arterial blood gases (Amib, 2020).

In the process of removing invasive ventilation, it is necessary to ensure the clinical improvement of the patient, allowing the superficialization of sedo-analgesia and the performance of the Spontaneous Breathing Test (ERT). For this conduct, the essential parameters are: satisfactory oxygenation and ventilation (FiO_2 < 40%, PaO_2 > 70-80 mmHg, PEEP < 8 cmH2O and pH > 7.34); ability to trigger the ventilator in ventilation mode with pressure support without neuromuscular blockers, and preferably, without continuous intravenous sedation; hemodynamic stability and Glasgow Coma Scale > 8 (Amib, 2020).

6. Cardiopulmonary Resuscitation (CPR)

It is necessary to understand, at first, that the available literature is still inadequate to direct physicians to determine a standard in the performance of CPR before the patient with COVID-19 (Kapoor et al., 2020).

Although some studies suggest the negative interference of the use of PPE's in the effectiveness of CPR, claiming a statistical decrease in the depth of compressions due to the use of a large amount of equipment (Malysz et al., 2020), others, however, demonstrate that it is possible to conduct the procedure properly. For this, the stop car must be moved away in order to obtain more space in the movement of the team. In addition, the procedure room can be divided into zones divided by colors. The hot zone (red) is the location directly around the patient; the warm zone (yellow), is a more distant region, but with potential for contamination, where materials and medications are transferred and the cold zone (green), is the area responsible for maintaining the supplies possibly necessary for the procedure, in addition to people not involved in the situation (Livingston et al., 2020). For better performance of the procedure, BIMA (Pinheiro & Pereira, 2020) documented some recommendations that must be followed by the professional teams, which are shown in Tables 2 and 3.

Table 2: Functions of each team member during cardiopulmonary resuscitation.

Team members	Functions
Doctor 1	• Leader. • Command the airway. • Seal the mask on the patient's face or ventilate by pressing the device. • Evaluate the help of another professional.
Doctor 2	• Assist in controlling the airway. • Assist in cardiac compression.
Nurse	• Assist in controlling the CPR car, as well as medications. • Perform cardiac compressions. • Perform other technical procedures.
Nursing techinician 1	• Control the CPR car. • Prepare materials and medications.
Nursing techinician 2	• Note the procedures performed. • Write down medications administered. • Control the CPR time.
Physiotherapist	• Installations and configurations of tge mechanical fan. • Evoluation of arterial blood gases.

Source: Adapted from Pinheiro & Pereira (2020).

Table 3. BIMA recommendations for cardiopulmonary resuscitation.

Aspects of CPR	Recommendations
Cadiac compression	• Consider replacing manual compressions with mechanical equipment that fulfills this function. • Pause compressions during IOT, in order to avoid dispersion of aerosols. • Change the compressor every 2 minutes, or before that if the professional gets tired. • Maintain a frequency of 15 compressions for 2 breaths, in patients who are not in an advanced airway. • Patient in prone position with MV - perform compressions between the thoracic vertebrae T7 and T10. • Patient in prone position without advanced airway - place him in supine position to start compressions.
Ventilation	• Avoid mouth-to-mouth breathing, use of a pocket mask or bag-mask-valve (BMV) device without a bacterial filter. • Recommended antibacterial filters - HEPA and HMEF. • Prefer passive to active ventilation. • Patient with advanced airway - administer 01 ventilation every 06 seconds, with continuous chest compression. • After the OTI, the patient must be connected directly to the ventilator, with connections and filters in a closed system. • Patient with Mechanical Ventilation - stay in a closed ventilation system, with 100% FiO2, in asynchronous mode, respiratory rate (RR) between 10 and 12 irpm, PEEP ≤ 5 and Tidal Volume (VT) of 10 ml / kg. • Use capnograph to validate the procedure. • Avoid auscultation with the stethoscope.
Medicines	• Avoid administration of drugs via the endotracheal route.
End of the procedure	• Carry out the correct PPE clearance, in addition to the correct disposal and cleaning of the materials used.

Source: Adapted from Pinheiro and Pereira (2020).

6. Intensive Care Unit (ICU)

For the protection of other patients and healthcare professionals, critical patients with suspected or confirmed COVID-19 should be admitted to an airborne infection isolation room (AIIR), which is under negative pressure in relation to the surrounding areas, with accessible sinks and gel alcohol dispensers for your hands. If isolation rooms are not available, patients can be placed in adequately ventilated individual rooms with doors closed, as recommended by WHO. In places where there are no individual rooms in the ICU, shared rooms with beds far apart and properly trained staff is an alternative (Goh et al., 2020).

In this sense, effective actions in the face of the pandemic would be: adding beds; provision of intensive care outside the ICUs and a substantial increase in the amount of equipment, pharmaceuticals and professionals. In addition, transferring

patients to designated hospitals is considered, although centralizing resources can improve results and efficiency compared to displacement risks (Arabi et al., 2020; Phua et al., 2020).

7. Surgical Procedures

During the COVID-19 pandemic, it is imperative that a risk-benefit assessment be performed before indicating surgery (Steward et al., 2020; Ashokka et al., 2020). The American College of Surgery (ACS) (American, 2020) guidelines, when describing the Elective Surgery Acuity Scale, stresses the importance of recognizing that the decision to cancel or perform a surgical procedure must be made in the context of numerous medical and logistical considerations.

When surgery is indicated, patients need to be stratified as to anesthesia. The literature is controversial as to the technique of choice. For Tang et al. (2020), general anesthesia with rapid sequence induction and videolaryngoscopy is recommended to reduce airborne transmission and contamination of the team, however spinal anesthesia is still recommended for pregnant women without or with COVID-19. However, there are findings in the literature that support block anesthesia, since this technique that support block anestesia, since this technique minimizes aerossol riskc and preserves hospital resources (Ashokka et al., 2020).

In the preoperative period, screening for COVID-19 is recommended, in order to promote the isolation of infected patients from non-infected ones[5]. Elderly patients with comorbidities are predisposed to infection and risk greater morbidity and mortality. However, everyone who presents for surgical intervention should be suspected of infection and, therefore, transmissibility, even if asymptomatic (Heffernan et al., 2020).

Between performing open or minimally invasive surgery, there is also no consensus on the guidelines of surgery organizations. Therefore, according to ACS (American, 2020), laparoscopy should be avoided. The Royal College of Surgeons (RCS) (Royal, 2020), advocates laparoscopy only in cases where the clinical benefits outweigh the risk of viral transmission. However, the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) (Sages, 2020) reports minimal risks of transmission during laparoscopy. To choose the surgical approach, the health professional must take into account the risk of aerosol formation, length of hospital stay, time of surgery and the surgeon's familiarity with the procedure. Another point of paramount importance is adequate hemostasis, since many patients infected with the new coronavirus have coagulation abnormalities (Broderick et al., 2020).

8. Conclusion

We may conclude that medical procedure aerosol generators are frequent in the hospital and present a risk for patients as well as for heathy care staff. To minimize this kind of procedure, and thus the contamination by SARS-CoV-2, the best techniques for performing such procedures should be established. Therefore, it is evident that changes in the management of medical procedures are of paramount importance to minimize cross-infection and a better prognosis for the patient. Lastly, more information is needed, and further studies are warranted to investigate the relationship between aerosol and COVID-19 disease. The analysis of the published studies showed that science has fulfilled its role and has offered society rapid answers, considering the severity and speed of dissemination of COVID-19. However, some nuances on the issue still lack a closer look from researchers. Consensus and management recommendations may assertively support physicians' decision-making and contribute to the accumulation of knowledge and evidence on the management of patients with COVID-19.

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