



Challenges in the management of cardiopulmonary arrest during the COVID-19 pandemic: a reflection study

Desafios no manejo da parada cardiorrespiratória durante a pandemia da COVID-19: um estudo de reflexão

Desafíos en el manejo del paro cardiorrespiratorio durante la pandemia de COVID-19: un estudio de reflexión

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ABSTRACT

Introduction: With the onset of the pandemic, concerns emerged about the management of cardiorespiratory arrest in suspected and confirmed cases of COVID-19 considering its singularities and scientific publications on the subject. Thus, this study presents a reflection about the new recommendations for patient care that must be adopted by multiprofessional teams. **Method:** This is a theoretical qualitative descriptive study that analyzed conventional and unconventional documents issued by the main regulatory bodies and high impact magazines addressing the study topics. No time frame was considered when selecting the bibliographic references. **Results:** The results addressed patient care with human and material resources involving the theme, the airway management in patients affected by COVID-19, whether they were using endotracheal intubation or not, and the approach for individuals in prone position. **Conclusion and implications for the practice:** In view of the discussions presented, health institutions and professionals must update their routines as a mechanism to protect and maintain the quality of care provided.

Keywords: Cardiac arrest; Cardiopulmonary resuscitation; Aerosols; Patient care team; Coronavirus infections.

RESUMO

Introdução: Com o início da pandemia, inquietações quanto à condução da parada cardiorrespiratória em casos suspeitos e confirmados da COVID-19 surgiram ante as peculiaridades e publicações científicas quanto à temática. Dessa forma, o presente estudo apresenta uma reflexão e demonstra as novas recomendações acerca dos cuidados necessários a serem adotados pela equipe multiprofissional. **Método:** Trata-se de um estudo de reflexão teórica, de caráter descritivo e abordagem qualitativa com base em documentos convencionais e não convencionais emitidos pelos principais órgãos reguladores e revistas de grande impacto que abordam as temáticas discutidas. Além disso, não houve recorte temporal para a seleção do referencial bibliográfico. **Resultados:** Os resultados expostos abordaram o cuidado relacionado com os recursos humanos e materiais envolvendo a temática, o manejo da via aérea nesse evento em pacientes que estavam ou não em uso de intubação endotraqueal, assim como em relação aos indivíduos em posição prona. **Conclusão e implicações para a prática:** Diante das discussões apresentadas, é evidente a necessidade de atualização por parte das instituições de saúde em suas rotinas e dos profissionais que se encontram neste estudo como mecanismo de proteção e manutenção da qualidade do cuidado prestado.

Palavras-chaves: Parada cardíaca; Ressuscitação cardiopulmonar; Aerossóis; Equipe de assistência ao paciente; Infecções por coronavírus.

RESUMEN

Introducción: Con el inicio de la pandemia, preocupaciones sobre la conducción del paro cardiorrespiratorio en casos sospechosos y confirmados de COVID-19 ante las peculiaridades y publicaciones científicas sobre el tema. Así pues, este estudio presenta una reflexión y demuestra las nuevas recomendaciones sobre los cuidados que deben adoptarse por el equipo. **Método:** Se trata de un estudio de reflexión teórica, de carácter descriptivo y enfoque cualitativo, basado en documentos convencionales y no convencionales emitidos por los principales organismos reguladores y revistas de alto impacto que abordan los temas tratados. Además, no hubo un recorte temporal para la selección de la referencia bibliográfica. **Resultados:** Los resultados expuestos abordaron el cuidado relacionado con los recursos humanos y materiales involucrando la temática, el manejo de la vía aérea en este evento, en pacientes que usaban o no intubación endotraqueal, como también en relación de individuos en posición prona. **Conclusión e implicaciones para la práctica:** Ante las discusiones presentadas, es evidente la necesidad de actualización por las instituciones de salud en sus rutinas y de los profesionales que se encuentran en este estudio, como mecanismo de protección y mantenimiento de la calidad del cuidado ministrado.

Palabras clave: Paro Cardíaco; Reanimación Cardiopulmonar; Aerosoles; Grupo de Atención al Paciente; Infecciones por Coronavirus.

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INTRODUCTION

Cardiorespiratory arrest (CRA) consists of a multi-factor cardiovascular emergency of high prevalence and high morbidity and mortality rate, characterized by a sudden interruption of the ventricular and respiratory mechanical function, and absence of consciousness but with cerebral and biological viability. In Brazil, ventricular fibrillation (VF) and ventricular tachycardia (VT) are the main cardiac rhythms of out-of-hospital CRA, accounting for 80% of these events; while for in-hospital CRA, the main cardiac rhythms are pulseless electrical activity (PEA) and asystole, with survival rates below 17%.^{1,2}

In this sense, cardiopulmonary resuscitation (CPR) consists of an organized sequence of maneuvers in response to an episode of CRA aiming to restore spontaneous circulation by reversing the process that triggered the event. The development of international protocols and algorithms ensured the organization and standardization of care to CRA victims, whether out-of-hospital or in-hospital environments, guiding specific procedures according to the clinical situation and optimizing patient outcomes.^{2,3}

In December 2019, in Wuhan, the capital of Hubei Province in China, the first cases of SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2), or COVID-19, were identified. It is the seventh type of coronavirus identified to date, resembling the coronavirus causing the severe acute respiratory syndrome (SARS), which occurred in China in 2002-2003, and the Middle East respiratory syndrome (MERS), which affected the Middle East in 2012. However, SARS-CoV-2 has a higher transmissibility.^{4,5}

On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a pandemic due to its fast spread around the world, which still grows exponentially. Around 181 countries were affected, with 2,423,470 confirmed cases and 166,041 deaths by April 20, 2020; with the United States of America being the country with the highest number of cases (764,265). In the same period, 40,581 cases and 2,575 deaths were reported in Brazil, reaching a lethality rate of 6.3%.⁶

Driven by concerns about the management of CRA in suspected and confirmed cases of COVID-19 and considering its peculiarities and the scientific publications about this theme, this study aims to present a theoretical reflection about the required precautions to be taken by patient care teams while performing CPR on patients.

METHOD

This is a descriptive study conducted in May 2020, based on a qualitative literature review and the perception of the authors about the main evidence and updates related to CPR in patients with suspected and confirmed COVID-19.

The bibliographic review used a topic-based system for the study development by the authors in order to address content of high impact on the practice of health services and contribute to routine optimization by providing pathophysiological knowledge about the present infection, its impact on the routine and risks of health professionals, and aspects and responsibilities regarding their protection until CPR is performed on the patients.

The theoretical reference was selected from recommendations and guidelines of the main bodies involved which were chosen due to their importance and impact of content covered and presented worldwide. Both conventional and unconventional documents were selected, such as technical reports and Brazilian government documents. Examples include reports and other documents from the American Heart Association, the Intensive Care Society, the Ministry of Health and the National Health Surveillance Agency (ANVISA) in Brazil, as well as databases such as Circulation and JACC CardioOncology.

Considering the diversity of topics covered, such as legislation and COVID-19, a recent topic, the authors chose not to determine a time frame for the theoretical reference to ensure the selection of the most significant publications.

RESULTS AND DISCUSSION

Disease transmission and impact among health professionals

SARS-CoV-2 is transmitted through salivary droplets from cough or sneeze of an infected individual or through contact with surfaces and objects contaminated with the virus. In addition, some hospital procedures – such as intubation and tracheal aspiration, non-invasive mechanical ventilation, manual ventilation, nebulization, nasotracheal sample collection, and CPR – release aerosols that increase the risk of virus transmission.^{7,8}

Considering the above, health service professionals constitute a high-risk group for COVID-19, requiring the adoption of measures to prevent, control and protect their health. Society engagement for conscious adoption of precautionary measures requires immediate and rigorous changes in individual and collective behaviors. In addition, documents such as the Brazilian Constitution of 1988, Convention 155 of the International Labor Organization (ILO), and the Organic Law of SUS nº 8.080 of September 19, 1990 show the responsibilities of companies regarding worker safety and protection from workplace risks, providing all personal protective equipment (PPE) items for work practice.⁹⁻¹²

The multidisciplinary CRA team is highly important in this procedure, and its members must have good interactions and high individual performance, promoting successful care of the team. In addition, patient care must be provided in a dynamic, quick and efficient manner, learned through training, search for scientific knowledge and technical skills, as well as awareness that it is a process in stages using a choreography approach.^{3,13}

CRA places high stress on the care team, causing psychological distress with this situation of dealing with life and death, in addition to feelings like anxiety and insecurity. In this context, emotional control becomes an essential element to achieve good results in their practice. In agreement with this idea, a study concluded that 67% of health professionals handling CRA claim stress reported by a team member influences the quality of CPR.^{13,14}

Considering the scenario of health institutions and COVID-19, a high level of stress due to CRA and immediate patient needs favors the occurrence of mistakes in infection management practices,

such as how to wear PPE, requiring a balance between patient needs and professional safety. In addition, health professionals are at higher risk for contracting this infection.¹⁵

With increasing exposure and infection among health professionals, there is a concern about reduced human resources and increased work overload, factors that affect the quality of care and the response to this pandemic. In addition, in this emergency situation seen worldwide, admission of new health professionals and transfer of others to different routines can contribute to a new risk pattern of exposure and transmission.^{15,16}

CPR and COVID-19

Performing effective chest compressions in CRP victims is determinant to restore spontaneous circulation and maintain a good neurological function in cases of survival. Then, in adults, it is recommended to position the hypothenar region of the hands on the lower half of the sternum, compressing it at a rate of 100 to 120/min, reaching a depth of about one third of the anteroposterior chest diameter, equivalent to 2-2.4 inches (5-6 cm), allowing full return of the chest after compression.³

Basic Life Support (BLS) and Advanced Cardiovascular Life Support (ACLS) mention that coordinated initiatives of several

rescuers during CPR can increase the probability of successful resuscitation, with functions and interventions prioritized and distributed as more resources are obtained for the patient. Thus, high-performance teams share tasks during this procedure, so that an individual assumes the role of leader, who is responsible for organizing, distributing tasks and assisting the group, and focused on general patient treatment, while the others members must know their roles and responsibilities and be prepared for them. Regarding PPE, these items vary according to the situation and institutional protocols.^{17,18}

In view of the current pandemic, the American Heart Association has published provisional guidelines for the management of cardiac arrest victims with suspected or confirmed COVID-19. One of the topics addressed refers to the number of health professionals who will be exposed during care provision. Some strategies also indicate that all health professionals should be properly equipped with personal protective equipment (protective glasses, N95 respirators, caps, aprons, gloves and visors), the team should have only essential professionals and avoid excessive professionals, and always communicate to others in advance about the patient's infection and risk of contamination. Another important aspect refers to the use of mechanical devices

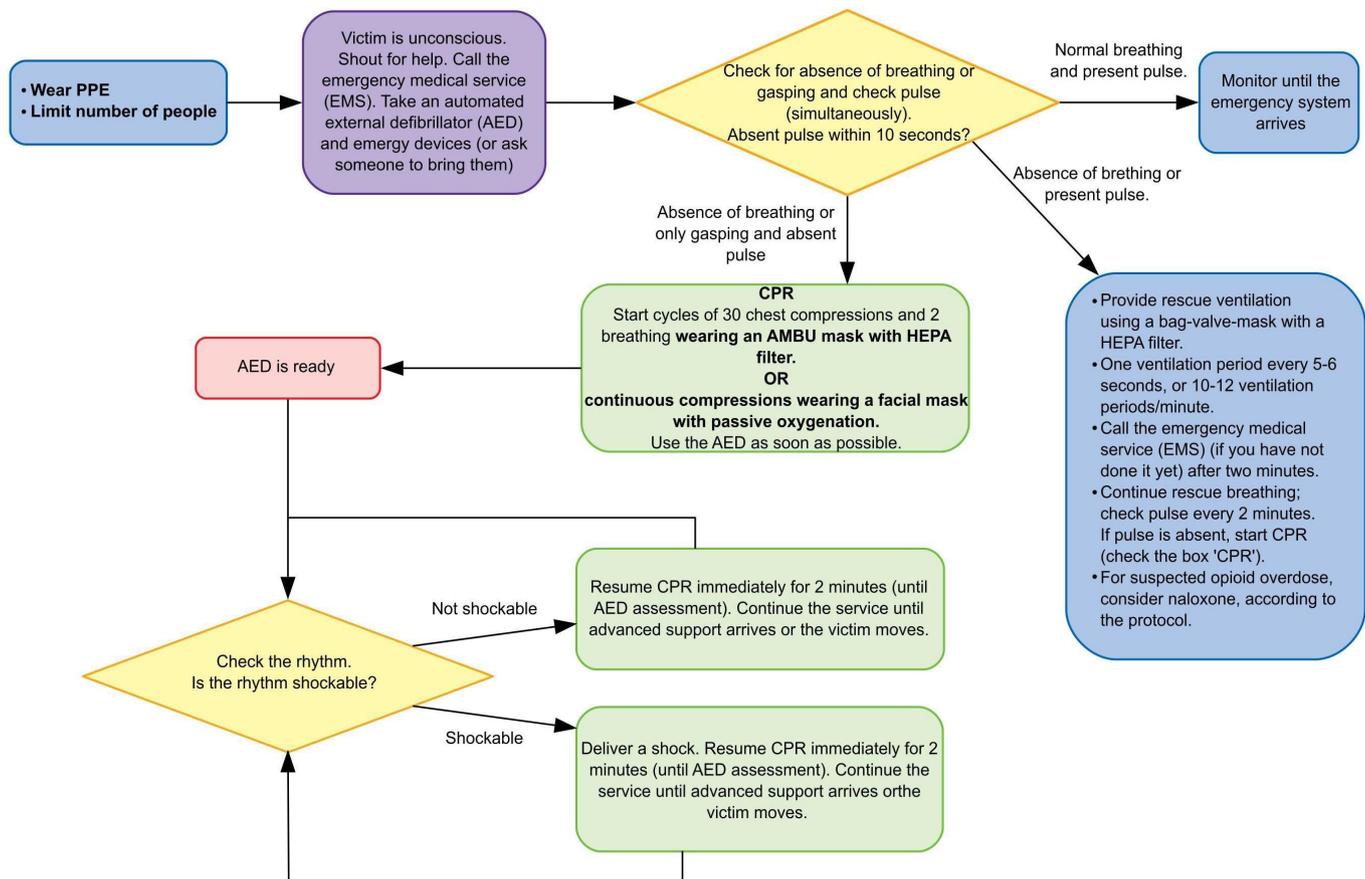


Figure 1. Illustration of the basic life support algorithm in CRA patients with suspected or confirmed COVID-19. São Paulo, São Paulo, Brazil, 2020.

Source: Developed by the authors.

Chart 1. Rationale for the provision of basic life support in COVID-19. São Paulo, São Paulo, Brazil, 2020.

Algorithm recommendations	Rationale
Wear PPE and limit the number of people	- Attention to the proper use of PPE during care provision; - Limit the number of people who will perform the service.
Check whether the victim is conscious or not	- Check if the victim responds; touch him/her on the shoulders and ask in a loud voice: Are you ok? - If the victim does not answer, shout for help, call the EMS (emergency medical service) and request an AED.
Detect a respiratory arrest (RA) or a cardiorespiratory arrest (CRA)	- If the pulse is present and the victim breathes normally, monitor him/her until the EMS can be provided. - With absent breathing and present pulse, perform rescue ventilations (one ventilation period every six seconds) wearing an AMBU mask with a HEPA filter. Continue ventilation until the EMS can be provided or every two minutes. Check for pulse presence; if absent, consider CRA. - Consider opioid overdose; if possible, use naloxone according to the local protocol.
CPR	- Start CPR if there is no pulse and ventilation. Perform cycles of 30 chest compressions (central area of the chest, lower half of the sternum bone, deepening 5-6 cm and at a rate of 100/minute), for every two ventilation periods of one second each, wearing an AMBU mask with a HEPA filter. - Or perform continuous chest compressions at a rate of 100/minute wearing a facial mask with passive oxygenation.
AED	- CPR rhythm will be analyzed and, if shockable, apply a single shock and immediately resume CPR until the AED assessment after two minutes. Continue the service until the SME can be provided or until the victim moves. - If the rhythm is not shockable, resume CPR for two minutes until the AED assessment; continue the service until the SME can be provided or until the victim moves.

to perform chest compressions in order to restrict the number of employees providing care and protect them from a high risk of infection. Of note, no benefit has been reported regarding the use of these devices, so manual chest compressions remain as the gold standard, but they are recommended in challenging or dangerous situations for the team.^{3,15}

The chain of survival for in-hospital CRA care recommends immediate high-quality CPR. However, a safety assessment of the scene by the health provider before starting victim care is essential for continuing this process – as it has always been recommended for emergency care in reference guidelines – a condition that also applies to CRA care in the event of suspected or confirmed cases of COVID-19.^{3,19}

In this perspective, the time spent for standard precaution of the whole team and the aerosol generated delay the beginning of the CRA procedures, and the maintenance of these PPE items in their proper positions can be impaired during the body maneuvers. However, wearing these PPE items by the health professionals on the scene is essential for everyone’s safety. For this reason, the provision of kits in the emergency vehicle reduces the time to start chest compressions and ensures care continuity.²⁰

Regarding basic life support, specific resources are available in order to reduce the risk of COVID-19 transmission. When screening victims for COVID-19 symptoms, telecommunicators are advised to provide information to lay rescuers about the risk of exposure; for example, regarding the use of a mask or facial protection covering the mouth and nose of both the rescuer and

the victim to minimize the risk of transmission to non-domestic observers, since, when the event occurs at home, probably rescuers have already been exposed.¹⁵

Minimizing the frequency and duration of intervals between compressions to less than ten seconds to maximize the number of compressions per minute has great relevance in the resuscitation process – except when the victim moves – during the defibrillator analysis stage, while positioning the advanced airway, or at rescuer exhaustion. For advanced airways, a simplified ventilation frequency of one breath every six seconds (ten breaths per minute) is recommended.^{3,20}

Regarding airway management in COVID-19, some procedures are potentially generators of aerosol (PGAs); therefore, oxygenation and ventilation strategies of low risk of aerosol generation are prioritized. For this reason, orotracheal intubation is recommended as soon as possible to minimize the possibility of failure. Then, pre-oxygenation is recommended using a bag-valve-mask device connected to a high-efficiency particulate air filter (HEPA), performed by experienced professionals and, if available, using videolaryngoscopy, interrupting chest compressions during intubation and minimizing ventilator disconnections after establishing a closed loop.¹⁵⁻²¹

In the event of a delay in the procedure, manual ventilation with a supraglottic airway is considered, which also allows closed-loop mechanical ventilation while a definitive access to the airway is obtained. However, in situations where CRP occurs in patients on mechanical ventilation, the connection to the ventilator should be

maintained, with 100% fraction of inspired oxygen and respiratory rate between ten and twelve per minute, in asynchronous mode and sensitivity off. Of note, some ventilators offer a CPR/CRA function with automatic setting of parameters.¹⁵⁻²²

The assessment of heart rate for rapid defibrillation in the presence of shockable rhythms (ventricular fibrillation and pulseless ventricular tachycardia) is one of the components of the care chain for in-hospital CRA; it is performed as soon as possible by placing one of the defibrillator blades on the right infraclavicular region and the other blade on the cardiac apex region. In cases of COVID-19, this guidance becomes even more precise, since the restoration of spontaneous circulation through early defibrillation can eliminate the need for new resuscitation measures, consequently reducing the team exposure.^{3,20}

An important maneuver for the management of patients with major deficits in the ventilation/perfusion ratio is placing them in prone position. It allows CPR in decubitus, taking into account the impossibility of returning to the supine position, and the risk of orotracheal tube displacement, disconnection of vascular accesses, as well as injuries to the patient and the care team.²³

However, there is little evidence of the ideal position of the hands while performing CPR in the prone position, but

recommendations indicate the two overlapped hands should cover an intermediate area on the thoracic spine between the two scapulae. Also, with the help of another professional, pressure should be applied under the sternum. Immediate defibrillation should be performed with the electrodes in a lateral posterior position, one on the left mid-axillary line and the other one on the right scapula.^{23,24}

Another important aspect refers to the use of extracorporeal cardiopulmonary resuscitation (ECPR) for COVID-19. However, the literature still has insufficient data about its use in these patients.¹⁵

For better visualization of CRA care for COVID 19 patients, two algorithms and two rationales were developed: for basic care (Figure 1 and Chart 1) and advanced care (Figure 2 and Chart 2), according to the guidelines of the American Heart Association.

CONCLUSION AND IMPLICATIONS FOR PRACTICE

In addition to important previous issues in managing a cardiopulmonary arrest, such as performing effective chest compressions and immediate defibrillation, some modifications are required when performing it in patients with COVID-19

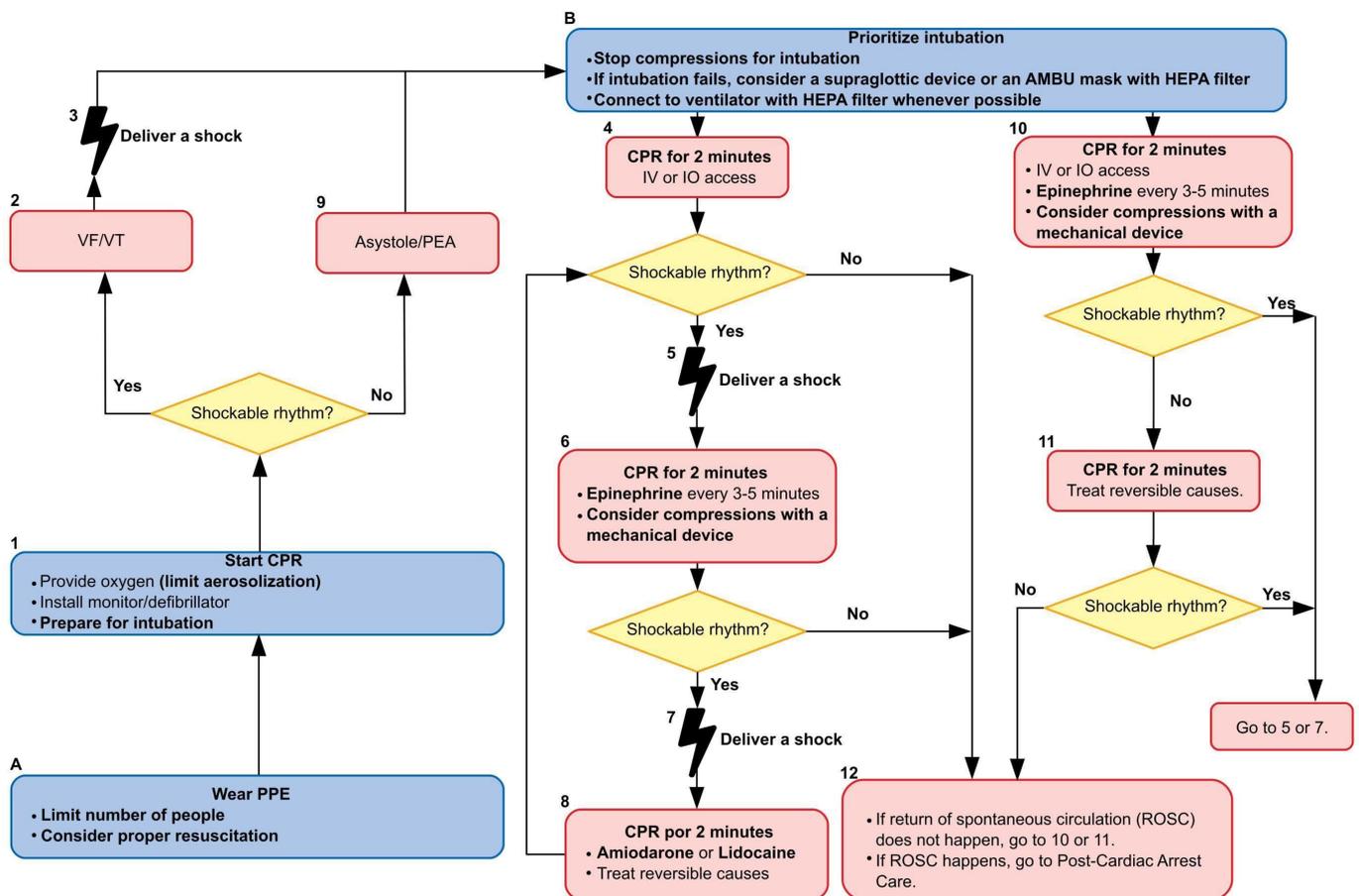


Figure 2. Illustration of the advanced life support algorithm in CRA patients with suspected or confirmed COVID-19. São Paulo, São Paulo, 2020.

Source: Developed by the authors.

Chart 2. Rationale for the provision of advanced life support in COVID-19. São Paulo, São Paulo, Brazil, 2020.

Algorithm recommendations	Rationale
Wear PPE, limit the number of people and consider proper resuscitation	<ul style="list-style-type: none"> - Attention to the proper use of PPE during care provision; - Limit the number of people who will perform the service; - Assess patients who are eligible for reanimation.
Start CPR, provide oxygen, install monitor/ defibrillator and prepare for intubation	<ul style="list-style-type: none"> - Start CPR if there is no pulse and ventilation. Perform cycles of 30 chest compressions for every two ventilation periods of one second each, using an AMBU mask with a HEPA filter. - Or perform continuous chest compressions at a rate of 100/minute using a facial mask with passive oxygenation. - Check the CRA rhythm as soon as possible. - Prepare the material for invasive airway passage as soon as possible.
Check the heart rate	<ul style="list-style-type: none"> - If a shockable heart rate is detected (ventricular fibrillation - VF and pulseless ventricular tachycardia - VT), deliver a shock using a two-phase defibrillator of 120-200J energy level or a single-phase defibrillator of 360J energy level. - Non-shockable rhythm (asystole and pulseless electrical activity).
Prioritize orotracheal intubation	<ul style="list-style-type: none"> - Stop chest compressions during intubation, minimize interruptions considering ten-second intervals. - Prioritize professionals with more experience to perform the procedure and consider using videolaryngoscopy, if possible. - If the procedure fails, consider using a supraglottic device or an AMBU mask with a HEPA filter. - Minimize disconnection of devices to limit aerosolization, connect to a ventilator with a HEPA filter as soon as possible. - Consider using waveform capnography to confirm the procedure. - Provide a ventilation period every six seconds (ten ventilation periods/minute) with continuous compressions.
VF/pulseless VT	<ul style="list-style-type: none"> - After the first shock, resume chest compressions immediately. - Provide venous or intraosseous access. - After two minutes of CPR, check the heart rate and, if VF or pulseless TV is observed, perform new defibrillation. - Resume CPR for two minutes, consider chest compressions with a mechanical device. - Use 1 mg epinephrine IV or IO during the second cycle of CPR and consider it every 3-5 minutes. - After two minutes of CPR, check the heart rate and, if VF or pulseless TV is observed, perform new defibrillation. - Use 300 mg amiodarone (1st dose) IV or IO in the third cycle of CPR and after 3-5 minutes consider the second dose of 150 mg, or lidocaine, first dose 1-1.5 mg/kg and second dose 0.5-0.75 mg/kg. - Continue the service while VF/pulseless VT is observed then, check the rhythm, deliver a shock, perform CPR and give medications, considering the medication interval and maximum antiarrhythmic dose. - Treat the reversible causes of CRA: hypovolemia, hypoxia, acidosis (H+), hypo or hyperkalemia, hypothermia, pulmonary tension, cardiac tamponade, toxics, pulmonary thrombosis, and coronary thrombosis.

Chart 2. Continued...

Algorithm recommendations	Rationale
Asystole and PEA	<ul style="list-style-type: none"> - After the first shock, resume chest compressions immediately. - Provide a venous or intraosseous access. - Use 1 mg epinephrine IV or IO during the second cycle of CPR and consider it every 3-5 minutes. - Treat the reversible causes of CRA.
Return of spontaneous circulation (ROSC)	<ul style="list-style-type: none"> - If the patient shows return of spontaneous circulation, perform post-CRA care: consider a proper airway and fixation, check the position using waveform capnography, check vital signs, consider fluid replacement and use of vasoactive drugs, provide laboratory tests, perform chest radiography and electrocardiogram, consider temperature control (32-36°C for at least 24h) if the patient is unconscious.

to protect the team and optimize patient outcomes. These modifications include the organization of a team with a limited number of members for these services, use of appropriate personal protective equipment by the team, use of mechanical devices to perform chest compressions, optimal management of the airways to avoid aerosolization, and performance of this maneuver in patients in a prone position.

The recommendations for the management of patients with suspected or confirmed SARS-CoV-2 have to be incorporated into the work process of healthcare institutions, with the development of routines that support decisions regarding the safe start and end of cardiopulmonary resuscitation considering the severity of the infection, balancing the likelihood of success with the risk for rescuers and other patients who need the material and human resources.

One of the study limits is directly related to the constant update of knowledge involving COVID-19 by health services and the patient care team through training and guidance for each work routine, considering information about the theme has been constantly provided.

AUTHOR'S CONTRIBUTIONS

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Selection of texts that contribute to reflection. Francine Jomara Lopes. Joathan Borges Ribeiro. Rafaelly Stavale. Douglas W Bolzan. Solange Guizilini. Rita Simone Moreira Lopes.

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Reflective interpretation. Francine Jomara Lopes. Joathan Borges Ribeiro. Rafaelly Stavale. Douglas W Bolzan. Solange Guizilini. Rita Simone Moreira Lopes.

Writing and critical review of the manuscript. Francine Jomara Lopes. Joathan Borges Ribeiro. Rafaelly Stavale. Douglas W Bolzan. Solange Guizilini. Rita Simone Moreira Lopes.

Approval of the final version of the article. Francine Jomara Lopes. Joathan Borges Ribeiro. Rafaelly Stavale. Douglas W Bolzan. Solange Guizilini. Rita Simone Moreira Lopes.

Responsibility for all aspects of the content and integrity of the published article. Francine Jomara Lopes. Joathan Borges Ribeiro. Rafaelly Stavale. Douglas W Bolzan. Solange Guizilini. Rita Simone Moreira Lopes.

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