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Special Article

Cardiopulmonary Resuscitation in Intensive Care Unit Patients With Coronavirus Disease 2019

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Cardiopulmonary resuscitation (CPR) in patients with severe acute respiratory syndrome coronavirus-2—associated disease (coronavirus disease 2019) poses a unique challenge to health- care providers due to the risk of viral aerosolization and disease transmission. This has caused some centers to modify existing CPR procedures, limit the duration of CPR, or consider avoiding CPR altogether. In this review, the authors propose a procedure for CPR in the intensive care unit that minimizes the number of personnel in the immediate vicinity of the patient and conserves the use of scarce personal protective equipment. Highlighting the low likelihood of successful resuscitation in high-risk patients may prompt patients to decline CPR. The authors recommend the preemptive placement of central venous lines in high-risk patients with intravenous tubing extensions that allow for medication delivery from outside the patients' rooms. During CPR, this practice can be used to deliver critical medications without delay. The use of a mechanical compression system for CPR further reduces the risk of infectious exposure to health- care providers. Extracorporeal membrane oxygenation should be reserved for patients with few comorbidities and a single failing organ system. Reliable teleconferencing tools are essential to facilitate communication between providers inside and outside the patients' rooms. General principles regarding the ethics and peri-resuscitative management of coronavirus 2019 patients also are discussed.

Key Words: coronavirus disease 2019; COVID-19; coronavirus; pandemic; cardiopulmonary resuscitation; mechanical compression device; personal protection equipment; do-not-resuscitate; critical care

THE coronavirus disease 2019 (COVID-19) pandemic has overwhelmed hospital systems and placed extraordinary demands on healthcare providers worldwide. The fast-spreading and sustained nature of the pandemic has resulted in a critical shortage of personal protective equipment (PPE). This may have contributed to significant numbers of healthcare workers in Italy and Spain testing positive for the disease.[1] Although the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) virus primarily is transmitted through close contact and droplets, airborne transmission has been observed in the healthcare setting. Procedures associated with cardiopulmonary resuscitation (CPR) can result in aerosolization of the virus and create the potential for this type of transmission.[2] A systematic review of published studies from the 2002 to 2003 severe acute respiratory syndrome epidemic concluded that intubation poses the highest risk of aerosol generation and viral transmission.[3] There is uncertainty regarding the aerosol-generating potential of chest compressions and defibrillation.[4] Exposure to chest compressions was associated with an increased risk of severe acute respiratory syndrome among healthcare workers in one case-control study.[5] However, exposure to chest compressions correlated strongly with exposure to intubation in that study, making it difficult to attribute the exposure to chest compressions alone. The need to protect and

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Fig 1. External delivery of resuscitative medications.

preserve the healthcare workforce has generated critical evaluations and revisions of hospital resuscitation policies for COVID-19 patients. These revisions have ranged from early discussions of goals of care[6] to limited duration of CPR[7] and even consideration of avoiding CPR altogether in patients who are unlikely to benefit.[8]

Interim resuscitation guidelines from the American Heart Association (AHA), in collaboration with 5 professional societies, including the American Society of Anesthesiologists, recommend a discussion of the goals of care on arrival to the hospital, mandatory use of PPE for all rescue personnel, and limited personnel in the room and use of mechanical compression devices when available to reduce provider exposure to SARS-CoV-2.[9] For intubated patients, the guidelines recommend maintaining mechanical ventilation with a high efficiency particulate air (HEPA) filter to reduce aerosolization.[9] As of May 2020, there were no published resuscitation procedures following these guidelines with widely available equipment in the intensive care unit (ICU). The authors herein propose a model of CPR in the ICU using a mechanical compression system designed to minimize infectious exposure and conserve PPE.

Preparation for Cardiac Arrest

Even though these conversations ideally should precede hospital admission, clinicians should discuss goals of care with all hospitalized patients with COVID-19 and those who are under investigation for the disease.[9] A frank discussion of available therapeutic options, including intubation, CPR, extracorporeal membrane oxygenation (ECMO), and more long-term discussion of advanced directives are necessary to align the treatment plan with the patient's goals and to avoid medically futile procedures.[6] A large epidemiologic study of 72,000 Chinese COVID-19 patients described a significantly higher case fatality rate among the elderly (age 70-79 y [8.0%]; age ≥80 y [14.8%]) and in those with preexisting cardiovascular disease (10.5%), diabetes (7.3%), and chronic respiratory disease (6.3%) than that for the general population (2.3%).[10] Among 136 patients with COVID-19 who underwent in-hospital CPR at a single center in Wuhan, China, return of spontaneous circulation (ROSC) was achieved in 18 (13.2%) patients, and only 4 (2.9%) survived for at least 30 days.[11] Candid discussions highlighting the low likelihood of successful resuscitation in the event of cardiac arrest are warranted and may prompt some patients and surrogate decision- makers to decline CPR.

In patients at risk for clinical deterioration, it is the authors' practice to preemptively place invasive lines with extensions allowing for laboratory draws and medication delivery from outside the room (Fig 1). Similarly, infusion pumps can be coupled with microbore extension tubing to allow for titration of sedative and vasoactive medications remotely (Fig 2).

Fig 2. External placement of infusion pumps.

Fig 3. External placement of the ventilator console.

Commercially available microbore extension tubing has priming volumes ranging from 0.5 mL to 2.0 mL for each 5-foot segment. The authors connect three 5-foot microbore tubing segments in a series, each with 1 mL of priming volume, to facilitate remote management of infusions. Some ventilators, such as the Hamilton G5 (Hamilton Medical AG, Bonaduz, Switzerland), allow the console to be separated by up to 10 feet from the ventilator. The authors use this separation to place the console in the hallway outside the patient's room, allowing for remote ventilator management (Fig 3). Each of these practices has been used individually at other centers during the COVID-19 pandemic.[12-15] Because tubing extensions can prevent doors from closing completely and maintaining negative pressure in the patient's room, pressure gradients may need to be tested by the hospital's biomedical engineering team before this practice is implemented.

Well-coordinated team dynamics are key to improving efficiency and reducing the potential for infectious exposure during CPR. Role designation[16] and following a pre-designed algorithm for CPR[17] are associated with better team performance. Therefore, it is the authors' practice to assign CPR roles, such as team leader and proceduralist, to members of the clinical team at the beginning of each shift (Fig 4). Newer CPR workflows, such as those intended to minimize personnel, require training to build competence. Simulation-based training was shown to improve time-to-position mechanical compression devices.[18] The authors' group conducts scenario-based CPR training to improve competence with their algorithm (Video 1). The authors also recommend the placement of all equipment necessary to manage CPR in these patients in a central location that is accessible to the clinical team and dedicated to COVID-19 patients to avoid transmission to non-COVID-19 patients.

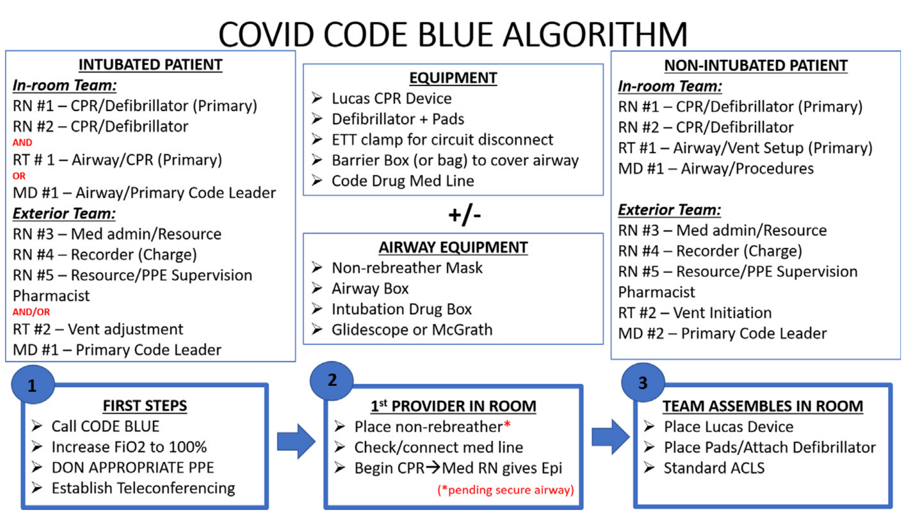

Fig 4. Schematic of suggested cardiopulmonary resuscitation workflow. ACLS, Advanced Cardiovascular Life Support; CPR, cardiopulmonary resuscitation; Epi, Epinephrine; ETT, endotracheal tube; FiO_2, fraction of inspired oxygen; MD, physician; PPE, personal protective equipment; RN, nurse; RT, respiratory therapist.

Cardiac Arrest

Initiating CPR

The authors' protocol calls for the activation of a designated CPR team when a patient experiences deteriorating hemodynamics or cardiac arrest. For patients who are not intubated or who lack vascular access, 3- to- 4 team members enter the room to carry out resuscitative efforts, including a clinician with expertise in airway management and the placement of invasive lines (proceduralist), the patient's primary nurse, an assisting nurse, and the patient's primary respiratory therapist to help with intubation and set up of the ventilator connection. This design of a minimized personnel team is consistent with published recommendations.[9,19-21] When a definitive airway and lines already are established, either the proceduralist or the respiratory therapist remains outside the room, guiding management and adjusting the ventilator from the exterior, while the other enters the room with 2 members of the nursing staff to resuscitate the patient.

Each of the personnel entering the room should be outfitted with PPE, which includes a gown, gloves, face shield, head covering, and either an N95 mask or powered air-purifying respirator.[22] All published guidelines to date recommend the use of mechanical compression devices in COVID-19 patients[4,9,13,19] because of their potential to reduce the number of personnel necessary for CPR and limit viral exposure. In the authors' experience, using a mechanical compression device allows the proceduralist and respiratory therapist to attend to the airway while nursing staff can enable the delivery of resuscitative medications. When mechanical compression devices are not available, additional personnel may be required in the room to assist with manual chest compressions. US Department of Defense guidelines recommend that 2 team members rotate to perform chest compressions on COVID-19 patients when mechanical compression devices are unavailable.[23] In patients who do not already have this attached, it is the authors' practice to connect primed intravenous tubing with necessary extensions, from a bag of fluid located outside the room, enabling more remote medication delivery from exterior team members. Depending on the design of the ICU room and the availability of a sufficiently long defibrillator cable, it is possible for the defibrillator to remain outside the room, enabling rhythm monitoring and electrical therapies by the external team. Because survival after ventricular fibrillation decreases by 7% to 10% for each minute that defibrillation is delayed,[24] these arrhythmias should be terminated before chest compressions are initiated.[4] The authors' group has used the 8-foot therapy cable accompanying the Lifepak 20 defibrillator (Stryker Corporation, Redmond, WA) to terminate arrhythmias remotely without using PPE.

After the team enters the room, the authors recommend that team members rapidly evaluate the patient for treatable causes of cardiac arrest. Mechanisms of cardiac arrest specific to COVID-19 patients include hypoxemia from acute respiratory distress syndrome (ARDS), cardiogenic shock from viral myocarditis, vasoplegic shock from sepsis, thrombotic complications, and arrhythmias from drug interactions.[25,26] Decreased frequency of radiologic imaging to reduce exposure may delay diagnosis of pneumothorax and mainstem intubation in these patients. Pneumothorax is uncommon and may result from the prolonged use of higher positive end-expiratory pressure and driving pressures to ventilate fibrotic lungs in end-stage COVID-19 ARDS.[27] Both needle decompression and chest tube placement for pneumothorax can result in air leak into the room and viral aerosolization. Trauma surgery guidelines recommend the placement of a 12- or 14-Fr percutaneous tube and attachment to a closed drainage system with an inline viral filter to reduce infectious exposure.[28] The guidelines further recommend the addition of dilute bleach rather than water to the water seal chamber.

Prone Position CPR

Prone positioning is an evidence-based procedure for the treatment of severe ARDS that has been used to treat COVID-19 worldwide.[29,30] However, there is little guidance from the literature on how to perform CPR in patients who are positioned prone. A review of 23 cases in which CPR was performed on predominantly spine surgery patients in the prone position found that a variety of "thoracic spine compression" techniques were effective in generating cardiac output.[31] One study found that performing CPR with the patient in the prone position produced higher mean arterial pressure readings than those for patients in the supine position.[32] The interim AHA guidelines recommend performing CPR without turning the patient to the supine position in COVID-19 patients who have an established airway. Defibrillator pads should be placed in the anterior-posterior position, whereas compressions should be performed over the T7- to- T10 vertebral bodies.[9] The adequacy of chest compressions can be monitored with arterial line pressure or continuous end-tidal capnography if these monitors are available. Prone patients without an advanced airway should be placed in a supine position to facilitate intubation.[9]

Intubation and Mechanical Ventilation

In spontaneously breathing patients, preoxygenation with 100% oxygen for 3- to- 5 minutes delays oxygen desaturation. AHA guidelines for CPR in COVID-19 patients recommend preoxygenation with either bag-mask devices equipped with HEPA filters or passive oxygenation using nonrebreather face masks.[9] Other CPR guidelines have recommended the use of supraglottic airways over bag-mask ventilation[4] and closed breathing circuits (Mapleson C circuit) to reduce exhalation of viral particles.[20] One study found that during bag-mask use, leakage of air from the sides of the mask actually may increase when a HEPA filter is attached to the front of the mask.[33] It is the authors' practice to passively preoxygenate patients using nonrebreather face masks to reduce the risk of infectious exposure from mask leak.

Definitive airway management should be achieved using a rapid- sequence intubation[20,34,35] performed by the most experienced laryngoscopist.[35,36] Video laryngoscopy has been shown to improve accuracy,[37] reduce intubation time,[38] and increase the distance between the laryngoscopist and the patient[39] compared with direct laryngoscopy. Even though one randomized controlled trial showed an increased incidence of severe desaturation with video laryngoscopy, the first-attempt success rate was significantly higher.[37,40] Considering the risk of aerosolization and the importance of minimizing exposure, all published guidelines to date recommend the use of video laryngoscopy for intubating patients with COVID-19.[9,20,34,35] Some institutions have used transparent barriers during the intubation procedure in an attempt to further reduce exposure to aerosolized virus.[41] After intubation, exposure to aerosolized viral particles can be reduced by connecting the endotracheal tube (ETT) directly to the ventilator, bypassing initial bag ventilation. The cuff of the ETT should be inflated before mechanical ventilation is initiated, and successful tracheal intubation should be confirmed using waveform capnography.[20] The ventilator should be set to a pressure- control mode with a fraction of inspired oxygen of 1.0, and the driving pressure should be adjusted to the minimum necessary to achieve adequate chest rise.[9] Positive end-expiratory pressure should be adjusted to attain the optimal balance between hemodynamics and oxygenation. Finally, a transparent drape or other barrier may be applied over the patient's head and neck, including the ETT and proximal tubing, to prevent contamination in the event of an accidental disconnection of the circuit.[42,43]

CPR Procedure Dynamics

To minimize the risk of viral transmission to the proceduralist, chest compressions should be paused during intubation.[9] In the authors' protocol, once the airway is adequately secured and the mechanical compression device is appropriately placed and activated, the respiratory therapist exits the room, leaving the proceduralist and 1 additional team member in the room. While the team member manages the compression device and periodically checks the pulse, the proceduralist can establish arterial or central venous access as necessary, perform point-of-care ultrasound examinations, and convey clinical information to the external team. For patients who are mechanically ventilated before cardiac arrest, only 2 team members may be required to enter the patient's room. When the authors' ICU staffing is optimal, a team leader, recorder, respiratory therapist, pharmacist, and a resource ICU nurse are present outside the room. The team leader integrates clinical, hemodynamic, and laboratory information to direct resuscitative efforts. The recorder keeps time and records interventions, the respiratory therapist manages the ventilator, the pharmacist prepares medications, and the resource ICU nurse can administer medications and mobilize necessary supplies. When ICU staffing is strained, these roles are consolidated further. For example, the team leader can manage the ventilator, and the resource ICU nurse can both prepare and inject medications.

Reliable communication between internal and external team members is critical when managing CPR using the authors' proposed pathway. There has been a marked increase in interest and utilization of telemedicine modalities during the COVID-19 pandemic,[44] and centers worldwide have reported its use to maximize communication while minimizing infectious exposure.[45,46] In the authors' experience, communicating through closed doors with internal team members who are wearing N95 masks or powered air-purifying respirators can be challenging. To overcome this, the authors have used hospital-based mobile phones and the video conferencing application Microsoft Teams (Microsoft Corporation, Redmond, WA) to facilitate secure, real-time communication during CPR. The authors' group has used video conferencing during CPR to coordinate periodic pulse checks, relay physical findings to the external team, and call for necessary equipment to be delivered to the room.

Cessation of CPR

Cessation of CPR occurs after ROSC, initiation of ECMO, or when additional resuscitation is deemed futile. Some authors have recommended cessation of CPR at 30 minutes, after careful consideration of the possible etiologies of cardiac arrest.[7] Reversible causes, such as hypoxemia and acidosis, should be treated before discontinuing CPR. Hemodynamic decompensation after ROSC is achieved should prompt evaluation for hemorrhage and tension pneumothorax, which can result from rib fractures in patients who may be on therapeutic anticoagulation. Because of the high incidence of prothrombotic coagulopathy in COVID-19 patients, thromboembolic events may contribute disproportionately to cardiopulmonary arrest.[47,48] The administration of alteplase was shown to improve outcomes after cardiac arrest when pulmonary embolism was confirmed or suspected.[49] Alteplase also was found to improve hemodynamics, ventilation, and oxygenation in COVID-19 patients with hypoxemia and refractory shock.[50] Alteplase administration therefore should be considered when pulmonary embolism or myocardial infarction is the suspected etiology of cardiac arrest in COVID-19 patients.

After resuscitation has concluded, equipment used for resuscitation should be sanitized using germicidal wipes effective against the SARS-CoV-2 virus.[51] At the authors' institution, reusable medical equipment is sanitized by nursing staff using sodium hypochlorite–based wipes. When a patient dies after CPR, the room should be deep-cleaned by personnel equipped with PPE. Deep cleaning should take place at least 20 minutes after the body is removed from the room to reduce the risk of airborne transmission of the disease.[52] Team members should doff PPE carefully as they exit the room. Because doffing PPE is associated with a risk of self-contamination and the use of assisted doffing has been shown to reduce this risk,[53,54] it is the authors' practice to use trained monitors to assist with doffing. The authors recommend that a formal team debriefing be conducted to discuss the CPR event, identify areas for improvement, and create an action plan to improve future efforts.

Extracorporeal Cardiopulmonary Resuscitation

ECMO has been used successfully to manage patients with severe respiratory failure in previous coronavirus epidemics.[55] Data from the Middle East respiratory syndrome epidemic demonstrated improved survival in patients with severe ARDS supported by venovenous ECMO.[56] A meta-analysis of patients with isolated viral myocarditis, supported by venoarterial (VA)-ECMO, found a similar survival benefit in this group.[57] As a result, elective ECMO cannulation reportedly has been used worldwide to support COVID-19 patients.[58-60] In these reports, ECMO was used to provide cardiopulmonary support and preserve end-organ function while allowing for the administration of antiviral and anti-inflammatory therapies.

However, the role of ECMO after CPR (E-CPR) in patients with COVID-19 is unclear, and there is little guidance from the literature regarding this practice. As of May 26, 2020, the Extracorporeal Life Support Organization registry contained 10 reports of COVID-19 patients who underwent E-CPR, but their outcomes were not reported.[61] The authors of the present article identified a single case report describing E-CPR in a 79 year-old-man in Shanghai, China with COVID-19 who survived for only 3 hours after VA-ECMO cannulation.[58] Another case report from Germany described the successful use of a percutaneous ventricular assist device, followed by VA-ECMO cannulation, in a COVID-19 patient who developed mixed cardiogenic and vasoplegic shock.[62] Guidelines from both the Extracorporeal Life Support Organization and the American Society for Artificial Internal Organs recommend the use of E-CPR sparingly and only in centers that already provide this service.[63-65] Candidates for E-CPR should have no significant comorbidities, have no multiorgan failure, and must have a good short- and long-term life expectancy.[64] The decision to initiate E-CPR should be made while considering the availability of ECMO resources and the risk of infectious exposure to personnel involved in cannulation and subsequent bedside management.[66]

Ethical Considerations

CPR in COVID-19 patients is a resource-intensive procedure that requires a disproportionate number of healthcare personnel and the use of scarce PPE. Procedures associated with CPR generate aerosols, which can result in airborne transmission of the SARS-CoV-2 virus. A study from Wuhan, China, which investigated outcomes after CPR in COVID-19 patients, found that only 1 of 136 patients (0.7%) survived for at least 30 days with a favorable neurologic outcome. The US Centers for Disease Control and Prevention reported that healthcare providers accounted for up to 11% of reported cases of COVID-19 in some US states.[67] The risk of exposure to healthcare workers, coupled with dismal outcomes after CPR, have prompted hospital systems worldwide to critically evaluate their policies for resuscitating COVID-19 patients. The Italian Scientific Society of Anesthesiologists addressed this ethical dilemma by recommending that health- care resources be directed to favor "greatest life expectancy."[68] Joint guidelines from The Belgian Society of Emergency and Disaster Medicine and the Belgian Resuscitation Council recommended against resuscitating patients with a nonshockable, out-of-hospital cardiac arrest resulting from hypoxia in patients with COVID-19.[69]

The ethics supporting the general provision of CPR in cardiac arrest are based on giving each patient the opportunity to survive. Among the competing ethical principles of autonomy, utility, and justice, autonomy is prioritized in the United States. The principle of autonomy has supported the use of CPR even in patients in whom medical professionals have deemed the procedure to be futile.[70] However, the risk of infectious transmission to health -care providers and use of scarce resources during the COVID-19 pandemic have shifted this balance in favor of modifying CPR interventions to protect the healthcare workforce and conserve PPE.[71] Some US hospitals have considered an extreme policy in which autonomy is completely overridden and patients with COVID-19 are universally denied mechanical ventilation and resuscitation.[8] This approach is problematic because emerging data from the pandemic suggest that up to one-third of mechanically ventilated patients survive to discharge.[72,73] Despite the high overall mortality after CPR, a universal do-not-resuscitate (DNR) approach may deny potentially life-saving interventions to patients with reversible causes of cardiopulmonary arrest, such as arrhythmias. Universal DNR policies also have the effect of eroding public trust in the healthcare system and may discourage patients from consenting to DNR orders when these are in line with their wishes.

As a result, ethical guidelines have recommended a nuanced, utilitarian approach in which CPR is provided to patients who request it when resources are available and healthcare workers can be protected adequately. The principle of utility justifies delaying CPR until healthcare workers have donned appropriate PPE, interrupting CPR during intubation, and minimizing the number of healthcare workers in the room.[74] Donning PPE and securing the airway may delay CPR by up to 10 minutes. Delaying CPR is associated with increased mortality, with each minute resulting in a 5.5% decline in the survival rate.[24] However, prioritizing the safety of healthcare workers enables them to treat a greater number of future patients and increases the long-term benefits to society. Utilitarian ethics also may be applied to the allocation of resources during an infectious pandemic. In the context of resuscitation, these include PPE, ventilators, ECMO circuits, and healthcare personnel. When any of these resources is scarce, the consensus among ethical guidelines published during this pandemic is that they are allocated to patients with the best prognosis based on available data.[68,74,75]

The authors acknowledge that this ethical approach also prioritizes utility over justice, the principle that treatments be distributed equally among patient groups. Emerging data suggest that members of socioeconomically disadvantaged communities have a diminished ability to socially distance due to increased use of public transportation, crowded housing conditions, and employment in "essential" jobs that require in-person attendance.[76,77] These communities also have a greater prevalence of comorbid conditions associated with worse outcomes in COVID-19.[77] A utilitarian approach to CPR or ECMO has the potential to perpetuate these disparities by

Table 1
Revisions to Standard Cardiopulmonary Resuscitation Workflow with Potential Problems and Suggested Solutions

CPR Revision	Potential Problems	Solutions
Mechanical chest compressions	Communicating instructions to pause or resume CPR by external team Communicating the presence or absence of a pulse by internal team	Telecommunications Videoconferencing Handheld laminated cards
External medication delivery	Increased dead space and delay in delivery Inadvertent disconnection of intravenous tubing	Low-volume, microbore tubing Periodic monitoring of intravenous connections by internal team
External laboratory draws	Dilution of laboratory sample Theoretical risk of viral transmission in blood	Low-volume, microbore tubing Measurement of tubing volume to determine wasted blood before drawing laboratory sample Protective equipment (gloves, mask) while drawing laboratory samples
External defibrillation	Communicating "all clear" by external team Communicating acknowledgement of "all clear" by internal team	Telecommunications Videoconferencing Handheld laminated cards
External ventilator management	Communicating confirmation of endotracheal intubation by external team to proceduralist	Telecommunications Videoconferencing

Abbreviation: CPR, cardiopulmonary resuscitation.

withholding life-saving therapies from vulnerable populations,[78] but this may be unavoidable in an infectious epidemic. The principle of distributive justice may be better applied by allocating healthcare resources to increase testing, surveillance, and early treatment in disadvantaged communities before their members are hospitalized.

Summary

CPR in COVID-19 patients presents a unique challenge to healthcare systems because it requires extensive preparation and planning and leveraging available resources and trained personnel. All hospitalized patients suspected to have COVID-19 should be engaged in a discussion regarding the goals of care and any existing advanced directives. Hospital systems should develop a plan for resuscitating COVID-19 patients that protects healthcare workers because a robust healthcare workforce is essential to combatting pandemic illnesses. It is essential that all healthcare providers don appropriate PPE before attempting CPR, even if it delays care. Tracheal intubation carries the greatest risk of viral aerosolization and strategies to reduce infectious exposure should be used throughout the process. Reliable communication is critical when CPR is coordinated from outside the patient's room. Telehealth modalities, which include some combination of voice and video transmission, have been used worldwide during the COVID-19 pandemic to maximize communication while minimizing infectious exposure.

Other recommendations for resuscitating COVID-19 patients include the use of video laryngoscopy, a mechanical compression system, and development of a workflow that allows for the delivery of medications from outside the patient's room. Through simulation exercises, the authors' group has identified potential problems that can occur with this revised CPR workflow. They are listed in Table 1, along with suggested solutions. Resuscitative efforts may be discontinued when further efforts are deemed futile. Reducing infectious exposure to health care workers by decreasing the number of personnel in the room during CPR is safe, feasible, and justified by utilitarian ethics.

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Conflict of Interest

No potential conflict of interest was reported by the authors.

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1053/j.jvca.2020.06.008.

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