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Best Practices in Managing Cardiac Arrest in the Emergency Department During the COVID-19 Pandemic

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Abstract

Infection by severe acute respiratory syndrome coronavirus 2 has led to cardiac complications including an increasing incidence of cardiac arrest. The resuscitation of these patients requires a conscious effort to minimize the spread of the virus. We present a best-practice model based in four guiding principles: (1) reduce the risk of exposure to the entire health care team; (2) decrease the number of aerosol generating procedures; (3) use a small resuscitation team to limit potential exposure; and (4) consider early termination of resuscitative efforts.

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The novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the etiologic agent of coronavirus disease 2019 (COVID-19), has rapidly spread throughout the world, infecting just over 25.3 million people as of August 31, 2020, and has claimed more than 848,000 lives.[1] Of admitted patients, 27.8% have evidence of myocardial injury with mortality among hospitalized patients as high as 69.4%.[2] In addition to classic mechanisms of cardiovascular collapse, such as systemic inflammatory response, destabilized coronary plaques, and hypoxia, SARS-CoV-2 also directly infiltrates the myocardium resulting in myocarditis and reduced systolic function.[2-4] Rates of out-of-hospital cardiac arrest around the world have dramatically increased since the pandemic; Italy has reported a 50% increase whereas New York City has reported a three-fold increase compared with the prior year.[5,6] Although one-third of this increase is accounted for by COVID-19 infection and complications, two-thirds were due to delays in presentation and care. Nevertheless, this results in an increase in the number of patients who present to the emergency department (ED) in cardiac arrest or the immediate post-arrest state.

In contrast to the in-patient setting, which often has the advantage of a documented COVID-19 status, the ED is faced with an unselected cohort of patients presenting in extremis or frank cardiac arrest with an unknown COVID-19 status. Emergency department clinicians should presume that each patient is infected for a variety of reasons: the true incidence of COVID-19 disease is still unknown and considerable geographic variation exists, symptoms may vary from frank respiratory distress to anosmia and malaise,[7] as many as 90% of patients with SARS-CoV-2 infection may be asymptomatic,[8] polymerase chain reaction testing, particularly early in the disease, has a reported sensitivity of just 32% to 63%,[9] and finally, SARS-CoV-2 has a reported high viral infectivity (R0 of 2.3 to 2.7).[10,11]

As a consequence, the resuscitation of ED patients during the COVID-19 pandemic requires a conscious effort to minimize infection risk. Ideally, this would be informed by controlled clinical trials. In the absence of evidence-based guidance, the purpose of this narrative is to present a best-practice

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model for resuscitation based on four guiding principles: (1) reduce the risk of exposure to the entire health care team; (2) decrease the number of aerosol-generating procedures (AGPs); (3) use a small resuscitation team to limit potential exposure; and (4) consider early termination of resuscitative efforts.

REDUCE THE RISK OF EXPOSURE TO THE ENTIRE HEALTH CARE TEAM

Although some controversy exists, cardiopulmonary resuscitation (CPR) is generally classified as an AGP.[11-17] Special emphasis should be placed on ensuring proper donning and doffing of personal protective equipment (PPE) for health care workers involved in the patient's care and adherence to appropriate isolation guidelines. One approach would be the use of a dedicated PPE safety coordinator whose primary role is to enforce compliance with PPE recommendations.

During all AGPs, including CPR and intubation, health care workers should be in appropriate PPE: gown + gloves + powered air-purifying respirator or N95 mask + goggles or a face shield.[11,18] Once AGPs are complete, members of the health care team still must wear modified droplet and airborne precaution PPE for a duration dependent on the air exchanges per hour for the room. It is imperative that the air of the treatment room be completely turned over before discontinuation of N95s or powered air-purifying respirators as the virus can remain viable in the air.[11,18] After this period, other members of the team can enter the room after they don modified droplet precautions PPE: gown + gloves + a surgical mask or respirator + goggles or a face shield (Table).

A patient who arrives in the ED with either a cuffed endotracheal tube that is inflated with a good seal and attached to a viral filter or a well-sealed supraglottic airway, such as a King LT-D/second generation LMA (Air-Q) with a sealed gastric port and attached to a viral filter, is not considered to present a significantly increased risk of aerosolizing the virus. However, placement of these devices is an AGP. Care should be taken to avoid inadvertent tubing disconnection, such as when transferring a patient, as this does present an increased aerosolization risk and health care personnel should be in appropriate PPE to mitigate the risk this poses.

TABLE. Personal Protective Equipment Based on Level of Protection Required

Modified droplet precautions PPE
Gown + gloves + a surgical mask or respirator + goggles or a face shield.
Modified droplet with aerosol generating procedure PPE
Gown + gloves + powered air-purifying respirator or N95 mask + goggles or a face shield

If there is prehospital notification of a patient arriving in cardiac arrest or immediately post-resuscitation, identified team members (below) should don PPE appropriate for AGPs and be ready in a negative pressure room (when possible) to receive the patient.

For circumstances in which cardiac or respiratory arrest occurs in the ED, or if a patient arrives with no pre-hospital notification, the resuscitation team must don PPE and attend to the patient only after they are protected. Although this potential delay in patient care is counter to the historical approach to managing patients in extremis, it is supported by medical ethics.[19-21]

In an effort to minimize staff requirements and exposure risks during the cardiopulmonary resuscitation of adult patients, a mechanical CPR device should be used if available.[22] To prevent contamination of items, the resuscitation cart should not be brought into the patient's room, and medications should not be retrieved from an in-room medication dispensing system. Not using the in-room medication dispensing system also helps to preserve PPE as many machines require fingerprint access. For adult medical resuscitations, consider the creation of a COVID medication resuscitation kit which contains standard resuscitation medications including advanced cardiac life support medications. The kit

we use contains two vials each of: epinephrine, atropine, naloxone, amiodarone/lidocaine, calcium chloride/gluconate, and sodium bicarbonate.

Additional equipment and medications should be passed from a team member outside the room or in an anteroom to a team member wearing appropriate PPE within the room using a bin or a plastic bag. This team member dons modified droplet PPE as well, as this suffices in protecting these care team members. For intubated patients with return of spontaneous circulation, paralytics, analgesics, and sedation medications should be readily available. Ideally, these medications should be placed on a pump before transferring them into the room to facilitate ease of initiation. Bolus dosing can be considered if there are adequate personnel. Finally, consider the use of extended intravenous tubing to enable the pump to be placed and adjusted outside the room.

DECREASE THE NUMBER OF AGPs

The early restoration of circulation may prevent the need for further resuscitative measures; therefore, a defibrillator should be attached as soon as it is available, and shockable rhythms should be immediately addressed.

When emergency medical service arrives, compressions should be halted as the patient is moved to the hospital gurney. If the patient arrives via emergency medical service and the patient is being ventilated via a bag-valve-mask, ventilations should be paused as the patient is transported from the ambulance bay to the designated ED area as this is an AGP.[23] Once in a controlled environment, if there is a prehospital airway, placement should be confirmed and secured by those in modified droplet and airborne precautions PPE, a viral filter placed or confirmed, and a mechanical CPR device attached if available and not already present. An attempt to exchange a prehospital supraglottic airway to an endotracheal tube (ETT) when the prehospital device is functional is not recommended given the risk of aerosolization. The process of converting a supraglottic device to an ETT should only be attempted after return of spontaneous circulation (ROSC) is obtained, and ETT placement should be performed under videolaryngoscopy to optimize success on the first try and minimize direct airway exposure. Medications should not be given via the ETT as this disrupts the closed ventilator circuit, creating an increased aerosolization risk.

If a patient arrests in the ED or a patient arrives with no prehospital notification, the airway should be managed in a manner that maximizes first-pass success. The use of an supraglottic airway (SGA) is an appropriate first option for patients in arrest.[24] Vascular access should follow standard advanced cardiac life support procedure, with intraosseous placement preferred over intravenous access as it can be secured more rapidly.

USE A SMALL RESUSCITATION TEAM TO LIMIT POTENTIAL EXPOSURE

The composition of the resuscitation team should be designed to limit the number of people exposed to the patient and to AGPs. A sample team composition for adult cardiac arrest is provided in the Figure. The team composition will be dictated in part by the available ED personnel.

A similar team should be assembled for the resuscitation of pediatric patients. As mechanical CPR devices are typically not used in pediatric resuscitation, one to two additional individuals may be needed to perform compressions (as decided by the team leader).

Ancillary responders should remain outside the room and enter only if requested by the team leader. They should wear the appropriate level of PPE before entering the room. These ancillary personnel may include: additional clinicians, pharmacist, lab service technicians/phlebotomists, and radiology technicians, chaplain or social worker, and others deemed necessary. If a pharmacist is not available to help obtain/dose/verify the medications, a nurse may be necessary outside the room, especially during a pediatric resuscitation.

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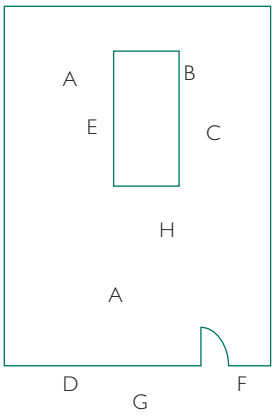

FIGURE. The emergency department care team for an adult resuscitation is composed of: A, One to two physicians or advanced practice providers (determined in real time based on patient situation and available resources). B, One respiratory therapist. C, One nurse to administer medications and defibrillate. D, One nurse to record (consider use of telehealth device to facilitate this role outside the room). E, One individual to attach and monitor the mechanical cardiopulmonary resuscitation device (can be done by a nurse or emergency medical service provider already in the room). F, Runner to hand medications and equipment. G, Additional clinicians, pharmacist, lab service technicians/phlebotomists, and radiology technicians, chaplain, or social worker. H, Two additional providers may be necessary for pediatric resuscitations.

CONSIDER EARLY TERMINATION OF RESUSCITATIVE EFFORTS

Current advanced life support cardiac arrest termination of resuscitation guidelines typically recommend extended resuscitative efforts be performed.[25,26] However, during a pandemic, alterations in standard resuscitative efforts may need to occur based upon patient surge volumes. Several studies support the decision to abrogate resuscitative efforts during crisis standards of care. Ninety percent of patients who survive out-of-hospital cardiac arrest achieve return of spontaneous circulation (ROSC) within 15 minutes.[27] In patients with COVID-19, regardless of the rhythm, the likelihood of survival to discharge beyond 10 minutes of resuscitation efforts is slim, and this should help guide termination efforts.[28-30] Even though recently published data shows effectiveness of extracorporeal membrane oxygenation (ECMO) in acute respiratory distress syndrome in COVID-19,[31] the decision regarding whether to provide extracorporeal life support (ECLS) to COVID-19 patients and potential ECLS candidacy criteria should be determined ahead of time at each institution.

CONCLUSION

During a pandemic, health care workers are a limited resource. The resuscitation of patients during the COVID-19 pandemic requires conscious efforts to limit health care worker exposure and subsequent infection risk, including using a small team, reducing AGPs, and consideration of early termination of resuscitative efforts. All of these are paradigm shifts in patient care, and as such require both acceptance and deliberate practice. The best practices presented to manage, and terminate, resuscitation during the devastating pandemic caused by COVID-19 is meant to provide a balance between the safety of the health care team and the ethical dilemmas that may arise.

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