



Cardiopulmonary Resuscitation (CPR) in Critically-ill COVID-19 Patients

Cardiopulmonary Resuscitation (CPR) for the critically-ill COVID-19 patients in ICU poses new challenges from existing practice and guidelines. CPR is known potentially to be an aerosol generating procedure as it involves multiple interventions in close contact with the patient that include chest compression, ventilation, tracheal intubation and suctioning as suggested by the International Liaison Committee on Resuscitation (ILCOR).

Safety of rescuers and their team members remains as a first priority and should never be compromised. In order to prevent and minimize spread of infection during CPR, rescuers are needed to don Personal Protective Equipment (PPE) for aerosol-generating procedure. This may lead to a brief delay in initiation of resuscitation efforts and life-saving interventions. Therefore, health care providers (HCPs) need to be aware of the benefits and risks of these interventions to ensure that due care for this group of patients is not compromised and at the same time prevent disease transmission to the rescuers or their colleagues.

Personal protective equipment (PPE) for aerosol-generating procedure includes:

- Minimum N95 respirator or higher.
Powered Air-Purifying Respirator (PAPR) is preferable when available.
- Goggles or face shield
- Gloves
- Isolation gown (fluid-repellent long-sleeved gown)
- Head cover
- Shoe cover (if anticipating spillage and vomiting)

HCPs need to be familiar with the correct steps of donning and doffing PPE to prevent contamination during these processes.

In a recent systematic meta-analysis, close to 5% of COVID-19 patients admitted to hospitals developed severe disease and needed ICU admission. The overall fatality rate in this study was 3.1%. In another case series of > 44000 COVID-19 patients in China, the fatality rate was 2.3% with 46% mortality amongst critically ill patients admitted to the ICU.

Cardiac arrests mainly resulted from severe hypoxemia secondary to pneumonia/ARDS. In a report of 136 patients with COVID-19 pneumonia who developed cardiac arrest in Wuhan, China, asystole accounted for most of the initial cardiac arrest rhythm, followed by PEA and VF. Thus, the majority of cardiac arrests are likely to present as non-shockable rhythms. However, arrhythmias associated with drugs used to treat COVID-19 pneumonia e.g. hydroxychloroquine and/or antiviral agents may lead to shockable rhythms that warrant prompt interventions by HCPs in the ICU.

Critically-ill patients with COVID-19 pneumonia with severe disease needing oxygen supplementation should be monitored closely in the ICU, preferably in a negative pressure room, if available. Early identification of this group of patients is important to allow early detection of clinical deterioration. This may allow ample time for HCPs to prepare for appropriate interventions e.g. tracheal intubation or initiate measures to prevent progression to cardiac arrest. Safety of HCPs remains as a top priority and unprotected CPR must be avoided.

CPR for non-intubated patient with cardiac arrest

1. Establish cardiac arrest – patient unresponsive and not breathing or gasping.
2. If cardiac arrest is confirmed, alert team members and don PPE for AGP (if not already on), and bring a defibrillator.
3. If patient in prone position, turn patient supine.
4. Minimize number of rescuers in resuscitation room.
5. Establish rhythm and deliver shock if shockable rhythm. If rhythm remain shockable, attempt up to three shocks. Use disposable self-adhesive defibrillation pads if available.
6. Initiate chest compression continuously until bag valve mask arrives.
7. If patient is on face-mask, do not remove the mask until Bag mask valve (BMV) with viral filter is available.
8. Manual ventilation with bag mask should be minimized and performed only by experienced HCPs.
9. Bag mask ventilate with viral filter using two hands to hold mask for optimal seal to minimize aerosol generation.
10. Intubation should be done by the most senior rescuer to ensure successful first pass attempt.
11. Stop chest compression during laryngoscopy. Use of video laryngoscope is preferable.
12. Connect the fully inflated cuff of ETT to a direct in-line closed suction system with a viral filter or HME filter with end-tidal CO₂.
13. Resume chest compression without synchronizing with manual ventilation once ETT placement is confirmed.
14. Switch mechanical ventilator to standby mode and turn on only when securely connected to the ETT.
15. Correct possible reversible causes for cardiac arrest.
16. Establish goals of care with ICU consultant/specialist in-charge.
17. If ROSC, follow post-cardiac arrest care protocol available in the unit.
18. Inform patient's next of kin via phone.

CPR for intubated patients with cardiac arrest

1. In patients whom CPR is inappropriate, decisions should be made and communicated to establish Do Not Attempt CPR. If no prior decision has been made, proceed with resuscitation.
2. Establish cardiac arrest from arterial line waveform and ECG monitor and pulse check.
3. Alert team members and don PPE for AGP (if not already on). Bring defibrillator.
4. If patient in prone position, continue CPR in prone position by performing chest compression by pressing patient's back (between the scapulae).
5. Attached defibrillator pads either
 - a. Anterior – posterior (front and back) or
 - b. Bi-axillary (both armpits)

6. Turn patient supine if:
 - a. CPR is ineffective based on the arterial line waveform (aim for diastolic pressure > 25mmHg) or
 - b. Airway intervention is needed or
 - c. Unable to secure circulation promptly
7. Do not disconnect ETT from mechanical ventilator circuit.
8. Increase Fio₂ to 1.0 and adjust ventilator to achieve tidal volume of 6-8 ml/kg and respiratory rate at 10 breaths per minute.
9. Promptly ensure airway patency (blocked ETT and filter clogging is common) and ventilator settings/function. If in doubt, bag mask ventilate with viral filter in between ETT and bag mask device. Switch ventilator to stand-by mode before disconnecting from ventilator circuit.
10. Correct possible reversible causes.
11. Establish goals of care with ICU consultant/specialist in-charge.
12. If ROSC, follow post-cardiac arrest care protocol available in the unit.
13. Inform patient's next of kin via phone.

Resuscitation should not be started or continued in cases where safety of HCPs cannot be assured or when a valid advanced medical plan is available. Advanced medical planning including withholding CPR should be considered when and where possible based on predicted poor outcome in the event of cardiac arrest. However, barriers in communication amongst HCPs or HCPs and family members to ensure social distancing measures and to prevent disease transmission add a new dimension from our standard approach that may result in conflict or distrust leading to difficulty in establishing an advanced medical plan especially in the context of a pandemic. Regular and progressive assessment of each individual patient on their long term outcomes and responses towards intensive therapy need to be done by the ICU team before a decision on goals of care can be made.

Ethics in medical therapy including CPR such as autonomy, justice, maleficence and beneficence should remain as our guiding principles when delivering care to these critically-ill patients especially in deciding the appropriateness of performing CPR and eventually shifting from treatment to comfort care measures when the inevitable need arises. This is particularly challenging in the context of the current COVID-19 pandemic due to knowledge gaps and lack of specific guidelines on withholding or withdrawing resuscitation.

Key Messages

1. Safety of rescuers and team members is the first priority.
2. Do not perform CPR if rescuers are not adequately protected with airborne precaution PPE.
3. HCPs need to be familiar with correct donning and doffing of PPE.
4. Establish advanced medical plan early, when and where possible.
5. Ethics in resuscitation remain valid and should be applied when deciding goals of care in the critically ill patient.

References:

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4. European Resuscitation Council COVID-19 Guidelines. 2020
5. Resuscitation in COVID-19 pandemic. Interim Guidelines from National Committee of Resuscitation Training (NCORT), Ministry of Health, Malaysia. 2020