

GUIDELINES ON RESUSCITATION DURING COVID-19 PANDEMIC – VERSION 4/2021

1. Introduction

The global pandemic of COVID-19 virus has presented new challenges to health care providers worldwide. A guideline to address gaps in existing clinical processes and practices in resuscitation is essential to ensure that cardiac arrest patients, with or without COVID-19 continue to get the best possible chance of survival without compromising the safety of rescuers, who will be needed to care for future patients.

Approximately 12% -19% of COVID-19 positive patients require hospital admission and 3 – 6% become critically ill. Amongst those with critical illness, patient with hypoxemic respiratory failure secondary to acute respiratory distress syndrome (ARDS), myocardial injury, ventricular arrhythmias and shock.

The World Health Organization (WHO) has described two modes for transmission of COVID-19 infection: droplet transmission and airborne transmission. Droplet transmission occurs when a person is exposed to the infective respiratory droplets through direct contact with a COVID-19 patient or indirectly through contact with surfaces in the surrounding environment or objects used on the infected person. Airborne transmission can occur in specific circumstances when procedures or support treatment that generate aerosols are performed. Rescuers performing cardiopulmonary resuscitation (CPR) are at an increased risk of contracting the disease when they respond to cardiac arrest events in infected patients.

This guideline aims to address some of the challenges in resuscitations during this global COVID-19 outbreak and also to provide guidance to all health care workers (HCW) to continue delivering timely and high-quality resuscitation to all patients without compromising their own safety and wellbeing.

2. Clinical concerns

2.1. COVID-19 is highly transmissible during CPR. Health care workers are at the highest risks of contracting the disease [This may be compounded by shortage of Personal Protective Equipment (PPE)] during resuscitation. Reasons are:

- CPR involves numerous Aerosol Generating Procedures (AGP): chest compression, positive pressure ventilation and establishment of advanced airway.
- Resuscitation efforts require numerous providers to work in close proximity with the patient and to one another.

- These are high-stress situation whereby the immediate needs of the patient requiring resuscitation may result in lapses of infection control practices.

2.2. 'Safety comes first' during the resuscitation is of utmost importance to prevent transmission of infection to HCW performing CPR. HCW must also be aware of the inherent delay in donning PPE. Therefore, measures must be taken to strike a balance between protection of the HCW involved without compromising the level of patient care.

3. Personal Protective Equipment (PPE)

3.1. Personal protective equipment (PPE) includes:

- Respiratory protection:
 - ❖ N95 respirators or respirators that offer a higher level of protection should be used instead of a facemask when performing or present for an aerosol-generating procedure.
 - ❖ Usage of Powered Air-Purifying Respirator (PAPR) is recommended if available.
- Eye protection (goggles or face shield)
- Gloves
- Isolation gown (fluid-repellent long-sleeved gown)
- Head cover
- Boot cover/shoe cover (only when anticipating spillage and vomiting)

All of the above are needed in performing an AGP.

3.2. Appropriate PPE (especially N95 masks and eye protection goggles or face shield) are strongly recommended to be used at all times while attending to all cardiac arrest patients regardless of their risk for COVID-19 infection: regardless of negative screening results.

4. Guidance on Cardiopulmonary Resuscitation (CPR)

4.1. Pre-Resuscitation Measures

- Early identification of patients with COVID-19-like illness who are at risk of acute deterioration or cardiac arrest. Steps must be taken to prevent cardiac arrest and avoid unprotected CPR. The probability of arrest and anticipated resuscitation should be discussed earlier.
- Critical patients who are identified to be at risk for cardiac arrest, should be moved to a negative pressure room, if available, to minimise risk of exposure to rescuers during a resuscitation.

- While the outcomes for cardiac arrest in COVID-19 is still unknown, the mortality for critically ill COVID-19 patients is high and is increasing with advancing age and comorbidities, particularly cardiovascular disease. It is reasonable to consider age, frailty, comorbidities, and severity of illness in determining the goals of care and establishment of a Do Not Attempt Cardiopulmonary Resuscitation (DNACPR) directives.
- Early identification of patients for DNACPR can be considered based on pre-existing medical condition and prior discussions with the next of kin. DNACPR are not legally binding. It is part of an Advanced Care Planning for the patient.
- Staff safety is paramount. Adherence to appropriate PPE and other protective gears or measures MUST be strictly observed during resuscitation. Full AGP PPE must be worn by all members of resuscitation team before entering the room.
- HCWs must be trained to put on (don) and to remove (doff) the PPE safely.
- Specific preparations such as PPE, viral filter, endo-tracheal tube (ETT) closed suction device, clear plastic sheet and double-sealed plastic bag must be kept ready at the resuscitation cart at all time.
- Verbal communication may be difficult when everyone involved in resuscitation are wearing powered air-purifying respirators (PAPRs). Therefore, some pre-learned sign language might be useful.

4.2. Resuscitation Measures in the Event of Cardiac Arrest

- In case of cardiac arrest, do not listen or feel for breathing.
- Look for absence of signs of life and gasping.
- Check for carotid pulse if trained.
- If defibrillator is available, defibrillate shockable rhythms rapidly prior to starting chest compressions. The use of self-adhesive defibrillation pads is recommended to increase the distance between the patient and the defibrillator operator.
- Cover patient's head-end with clear plastic sheet during CPR (to minimize risk of aerosol exposure).
- Consider replacing manual chest compressions with mechanical CPR device, if available.
- Restrict number of HCW in the resuscitation room, allocate gatekeeper.
- Do not do mouth-to-mouth ventilation or use a pocket mask. If the patient is already receiving supplemental oxygen therapy using face mask, leave the mask on.
- Consider passive oxygenation with non-rebreathing face mask (NRFM) covered by a surgical mask.

- Prioritise tracheal intubation by using a cuffed ETT with a viral filter to enable early establishment of a close circuit ventilation and to minimise aerosol generation.
- Airway interventions must be carried out by an experienced operator to ensure highest likelihood of first-pass success.
- Pause chest compression just prior to ETT placement and resume once ETT is in place with a closed circuit.
- Video laryngoscopy may reduce operator's exposure to aerosolized particles and should be considered, if available.
- The cuff of the ETT must be inflated sufficiently to prevent aerosol dissemination especially during CPR.
- The ETT should be anchored securely to prevent dislodgement during vigorous resuscitation effort.
- Ensure that a viral filter is secured to the mechanical ventilation circuit in the path of exhaled gas before administering any breaths.
- Clamp ETT prior to circuit disconnection or when connecting to ventilator.
- Use of in-line closed ETT suction devices to avoid open tracheal suctioning.
- Once on a closed circuit, minimize disconnections to reduce aerosol generation.
- Identify and treat any reversible causes before considering stopping CPR
- Dispose of, or clean, all equipment and any work surface used for airway/resuscitation
- Equipment used in airway intervention should not be left lying on the patient's pillow, but is instead placed in a double-sealed bag.
- Do not leave the Yankauer sucker under the patient's pillow, put the contaminated end inside a disposable glove.

4.3. Post Resuscitation Measures

- Remove PPE safely to avoid self-contamination and dispose clinical waste bags as per infection control protocols.
- Hand hygiene is important – thorough hand wash with soap and water, or alcohol rub is essential.
- Clearly communicate COVID-19 status to any new providers before their arrival on the scene or receipt of the patient when transferring to a second setting.
- Communication with Intensive Care Unit (ICU) regarding disposition and timing of transfer.
- Use transport ventilator (with viral filter attached to the expiratory limb) if available.
- Avoid chest X-ray (CXR) / echocardiography (ECG) until ICU admission.
- Resuscitation team to doff current PPE and don a new prior to transfer of patient as it is assumed to be heavily contaminated following a resuscitation.

- Ensure a clear path to ICU destination.
- There is insufficient evidence to recommend Extra Corporeal Membrane Oxygenation (ECMO) for COVID-19 patients.

5. Out of Hospital Cardiac Arrest (OHCA)

- 5.1.** Rescuers in the community are unlikely to have access to adequate PPE and, are at increased risk of exposure to COVID-19 during CPR.
- 5.2.** Rescuers of advancing age or with comorbid conditions, such as heart diseases, diabetes, hypertension, and chronic lung disease, are at increased risk of becoming critically ill if infected with SARS-CoV2.
- 5.3.** Chest compressions for adults:
- Lay rescuers should perform at least hands-only CPR after recognition of a cardiac arrest event.
 - A face mask or cloth covering the mouth and nose of the rescuer and/or victim may reduce the risk of transmission to a non-household bystander.
- 5.4.** Chest compressions for children:
- Lay rescuers should perform chest compressions and consider mouth-to-mouth ventilation, if willing and able, as there is a higher incidence of respiratory arrest in children.
 - A face mask or cloth covering the mouth and nose of the rescuer and/or victim may reduce the risk of transmission to non-household bystanders if unable or unwilling to perform mouth-to-mouth ventilation.
- 5.5.** Public access defibrillation:
- Because defibrillation is not expected to be a highly aerosolizing procedure, lay rescuers should use an automated external defibrillator, if available, to assess and treat victims of OHCA.
- 5.6.** Telecommunication (Dispatch):
- All calls should be screened for COVID-19 symptoms (e.g. fever, cough, shortness of breath), known COVID-19 infection in the victim, any recent contact with a COVID-19 positive patient including any household members or epidemiologically at risk with history of travel/from red zone.
 - For lay rescuers, telecommunicators should provide guidance about risk of exposure to COVID-19 for rescuers and instructions for compression-only CPR, as above should be explained.
 - For Emergency Medical Services (EMS), telecommunicators should alert dispatched EMS teams to don PPE if there is any suspicion for COVID-19 infection.

5.7. Transport:

- Family members and other contacts of patients with suspected or confirmed COVID-19 should not ride in the transport vehicle.
- If return of spontaneous circulation (ROSC) has not been achieved after appropriate resuscitation efforts in the field, consider not transferring to hospital given the low likelihood of survival for the patient: balanced against the added risk of additional exposure to prehospital and hospital providers.

6. In- Hospital Cardiac Arrest (IHCA)

6.1. Early monitoring and detection to avoid unprotected CPR.

6.2. Reduce personnel in the room for all resuscitations during pandemic for social distancing purposes.

6.3. Don full PPE before entering the room.

6.4. Close the door when possible, to prevent airborne contamination of adjacent indoor space.

6.5. Cover the head-end with clear plastic sheet during CPR.

6.6. If patient is in ICU, leave the patient on the mechanical ventilator with viral filter to maintain a closed circuit and reduce aerosol dissemination. Avoid manual bag-mask ventilation unless airway patency is in doubt.

6.7. Adjust the ventilator settings to allow for asynchronous ventilation:

- Increase the FiO₂ to 1.0.
- Change mode to PCV (Assist Control) and limit pressure as needed to generate adequate chest rise (6 mL/kg ideal body weight is often targeted).
- Adjust the trigger to Off to prevent the ventilator from auto-triggering with chest compressions, thus preventing hyperventilation and air trapping.
- Adjust respiratory rate to 10/min.
- Assess the need to adjust positive end-expiratory pressure level to balance lung volumes and venous return.
- Ensure endotracheal tube/tracheostomy and ventilator circuit connections are well secured to prevent disconnection or dislodgement of tubes.
- If return of spontaneous circulation (ROSC) is achieved, set ventilator settings appropriate to patients' clinical condition.

6.8. Post cardiac arrest care protocol should be instituted as per the existing guidelines.

7. Patient in prone position at the time of arrest

- 7.1.** For suspected or confirmed COVID-19 patients who are in a prone position without an advanced airway, attempt to place patient in supine position to continue resuscitation.
- 7.2.** For those patients who are in the prone position with an advanced airway, avoid turning the patient to supine position unless able to do so without risk of equipment disconnections and aerosol dissemination.
- 7.3.** Instead, consider placing defibrillator pads in the anterior-posterior position or bi-axillary positions and provide CPR with the patient remaining prone with hands in the standard position over the T7/10 vertebral bodies.

8. Oxygenation and Ventilation

- 8.1.** Managing the airway for those with suspected or confirmed COVID-19 is challenging due to the nature of transmission of the disease. Standard principle of infection control and droplet precaution must be prioritized when dealing with airway.
- 8.2.** Staff safety is of paramount importance. Aerosol generating procedure (AGP) during endotracheal intubation and mask ventilation must be dealt with great care to protect the HCW from contracting the disease. Any airway intervention performed without the proper PPE will endanger the HCW of being infected with the illness.
- 8.3.** During the event of resuscitation of a victim for IHCA, a full AGP PPE must be readily available and worn by all the team members as CPR is a highly aerosolizing procedure. No CPR or airway procedure will be undertaken without full AGP PPE.
- 8.4.** No mouth-to-mouth ventilation or ventilation using pocket mask. If patient has been receiving supplemental oxygen using face mask, leave it as it is, to limit the aerosol dissemination and allow passive oxygenation while covering the mouth with a surgical mask.
- 8.5.** If endotracheal intubation is delayed, consider manual ventilation using Bag Mask Ventilation (BMV) with high-efficiency particulate arrestor (HEPA)/Viral filter attached. A supra-glottic airway (SGA) device is preferred if available.
- 8.6.** Endotracheal intubation should be done as early as possible to limit aerosol spread. Tracheal intubation and SGA insertion must only be attempted by a

skilled individual to achieve first-pass success as multiple attempts will increase the chances of aerosol generation. A cuffed endotracheal tube should be used in this situation to limit aerosol spread. Ensure an adequate cuff pressure to prevent leaks. Video laryngoscopy may reduce the intubator's exposure to aerosolized particles and should be considered if available.

8.7. Prevention of aerosol generation with SGA and Bag Mask ventilation is less reliable compared to endotracheal intubation. The following steps should be considered to minimize the aerosol spread.

- A supra-glottic airway device provides better sealing capability compared to bag-valve mask.
- Minimize duration of bag mask ventilation.
- Use 2 hands E-C clamp technique to ensure tight seal for bag mask ventilation. This requires a second rescuer – the person doing chest compressions can squeeze the bag after 30 compressions.
- Pause chest compression during endotracheal intubation.
- ETT must be cuffed adequately and anchored securely.
- A clear plastic sheet should be used to cover the patient's head-end during CPR.

8.8. Summary for oxygenation and ventilation strategies.

- Don PPE for AGP before entering resuscitation scene.
- Consider passive oxygenation as alternative to bag and mask ventilation for short duration.
- Early intubation with cuffed endotracheal tube.
- If intubation is delayed, consider SGA.
- Competent and highly skilled individual to intubate the patient.
- Stop chest compression during intubation /SGA insertion.
- Consider video laryngoscopy if available.
- Use HEPA/Viral filter for all ventilation.
- Minimize closed circuit disconnection.



Bag mask with an attached HEPA

9. Ethical Issues in Cardiopulmonary Resuscitation during Pandemic COVID-19

9.1. Safety First, Do No Harm and “No Emergency during Pandemic”

- Cardiopulmonary resuscitation is carried out to preserve life. However, during the current COVID-19 pandemic, healthcare workers (HCWs) involved in resuscitation are at highest risk of contracting the disease due to the interventions involved during CPR and the highly contagious nature of SARS-CoV-2 virus. In a recent systematic review by International Liaison Committee on Resuscitation (ILCOR), CPR is considered an aerosol-generating procedure (AGP) as it involves interventions in close contact with the patient particularly during chest compression and airway management including bag mask ventilation, tracheal intubation and suction.
- Rescuers and HCWs involved in resuscitation need to be familiar with donning and doffing of Personal Protective Equipment (PPE) for airborne-precaution in order to minimise the risk of disease transmission. It is acknowledged that the process of donning PPE may lead to a brief delay to initiate CPR, but safety of HCWs remains as first priority and should not be compromised. Unprotected CPR should be avoided as far as possible. A well-established workflow and adequate training on these measures are equally important to not jeopardize patient’s safety.

9.2. Advanced medical planning and communication barriers

- Resuscitation should not be started in cases where safety of HCWs cannot be assured or when a valid advanced medical plan is established. Discussion on advanced medical planning including withholding CPR should be communicated early especially in cases where the predicted outcome is expected to be poor in the event of a cardiac arrest. It is also important to understand that during this period of pandemic, barriers in communication exist in order to ensure social distancing and minimize physical contact.
- Communication through PPE and absence of physical contact between patient and their loved ones may add to frustration and potential conflict and stress. Unconventional approaches such as using phone or video calls to discuss end-of-life matters with next-of-kin may in turn lead to difficulty in establishing an advanced medical plan. Regular and progressive assessment of each individual patient on their long-term outcomes and responses towards intensive therapy need to be done before a decision on goals of care can be made.
- Establishing Do Not Attempt CPR(DNACPR) early during the course of care helps to prevent misunderstanding, confusion and fear amongst HCWs and next of kin. An advanced medical plan needs to be communicated and documented particularly in patients with high risk of deterioration and developing cardiac arrest. The risk of harm to exposure may outweigh the anticipated benefits of resuscitation in patients who develop cardiac arrest secondary to severe hypoxemia from COVID-19 pneumonia, therefore early cessation of resuscitation may be considered.

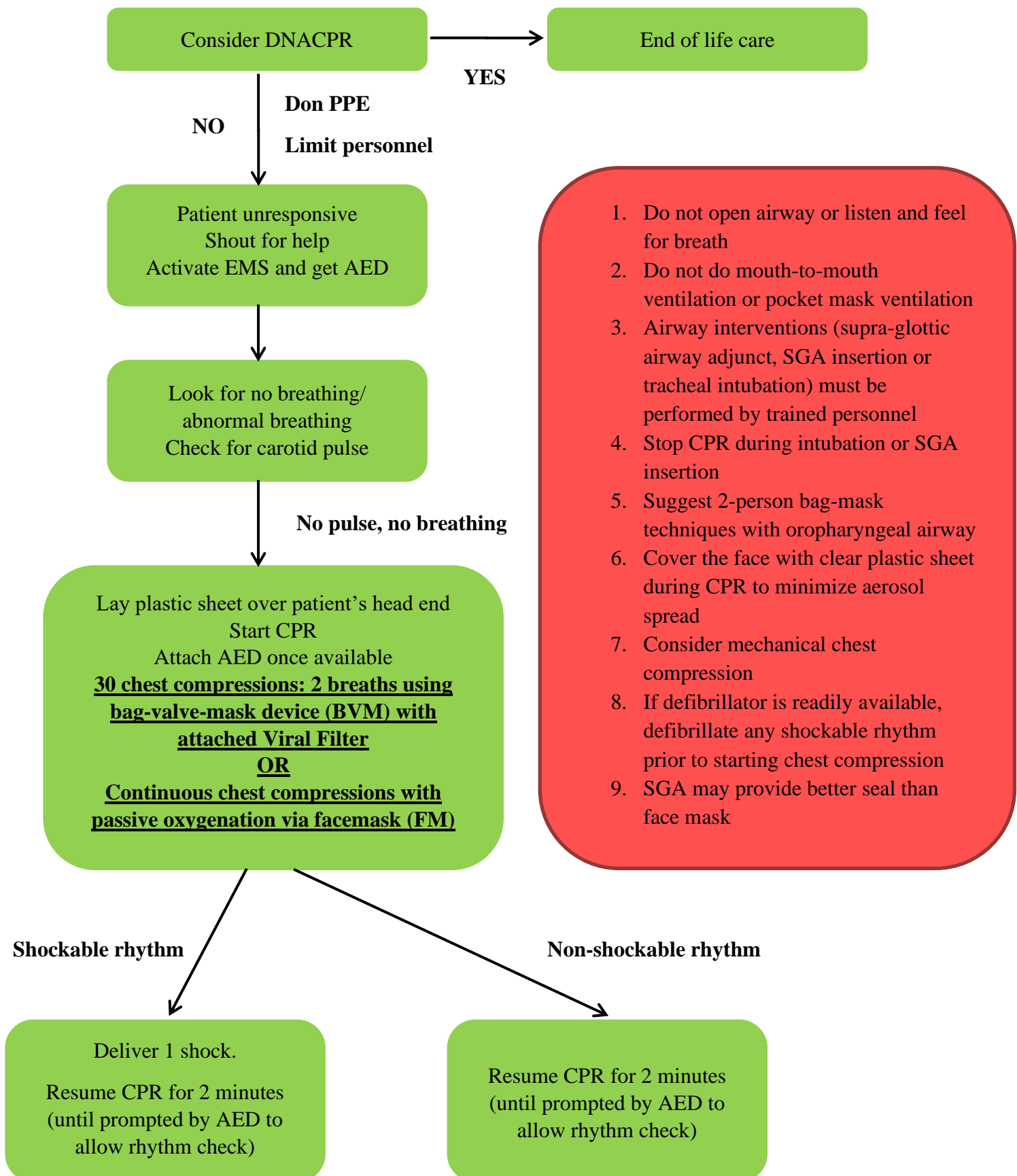
9.3. Ethical decision making

- The basic principles of ethics in medical treatment including CPR remain applicable and valid although challenging during the current pandemic situation as knowledge gaps exist with scarcity of guidelines or criteria to withhold or withdraw resuscitation. For such guidelines and criteria to be adopted, we need to consider individual healthcare systems or setup, ethnic, religious or even cultural norms. There is no one-size-fit-all approach especially when resources are limited during a disaster or pandemic with sudden surge of demand for PPEs, human resource, life-support equipment or even hospital beds may overwhelm the capacity of a healthcare system. Equal access to healthcare and high-quality resuscitation for both COVID-19 and non-COVID-19 while ensuring safety of HCWs are fundamental considerations during the current pandemic.

9.4. Key Messages

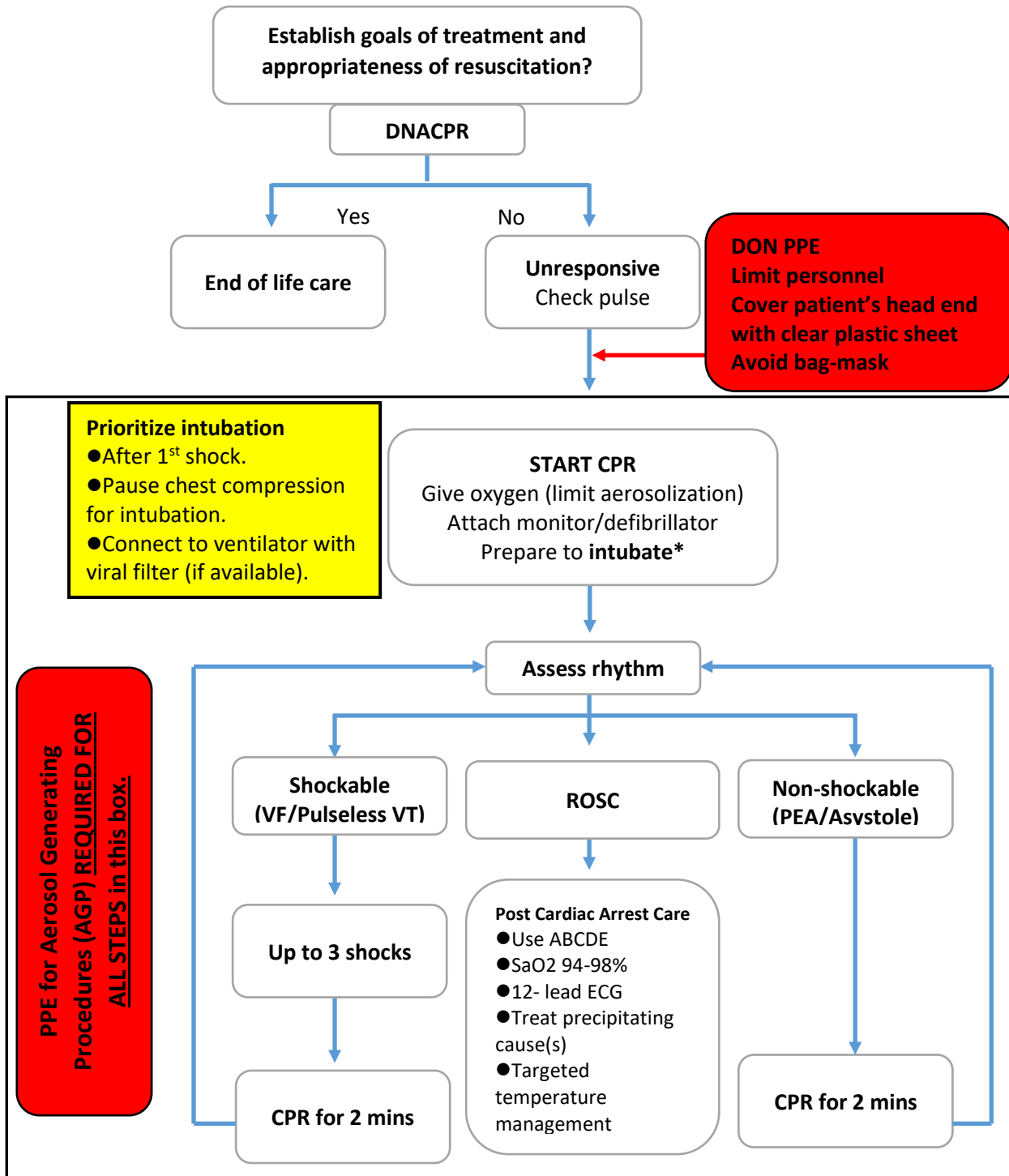
- Safety of rescuers and team members is the first priority.
- Do not perform CPR if rescuers are not adequately protected with airborne precaution PPE.
- HCWs need to be familiar with correct donning and doffing of PPE.
- Establish advanced medical plan early. Communicate and document plan clearly.
- New approaches are needed to overcome the barriers to effective communication.
- Ethics in resuscitation remain valid and should be applied when deciding the goals of care.

Adult BLS Algorithm in COVID-19 Pandemic





**Advanced Cardiac Life Support during COVID-19 pandemic:
NCORT consensus statement**



DNACPR = do not attempt cardiopulmonary resuscitation, ROSC = return of spontaneous circulation

During CPR	Recommended PPE (AGP)	Consider
<ul style="list-style-type: none"> • Ensure high quality chest compressions and minimise interruptions • Give oxygen. • Consider reversible causes (4Hs and 4Ts). • Continuous compression when advanced airway in place. • Vascular access. • Give adrenaline every 3-5 mins. • Give amiodarone after 3 shocks. 	<ul style="list-style-type: none"> • N95 respirator (N100/PPAR if available). • Isolation gown (fluid-repellent long-sleeved gown). • Plastic apron. • Gloves. • Eye protection (face shield/goggles). • Head cover. • Boot/shoe cover. 	<ul style="list-style-type: none"> • Mechanical chest compression (if available). • Early intubation (with 1st pass success) • Minimize closed circuit disconnection. • Video laryngoscopy if available • Use of a clear plastic sheet cover over the head end to minimise aerosol exposure



Advanced Cardiac Life Support during COVID-19 pandemic: NCORT consensus statement

ACTION ITEMS	
1	<p>Early identification of DNACPR.</p> <p>Don appropriate PPE before attending to patient</p> <p>Recognise cardiac arrest. Look for the absence of signs of life and normal breathing. Feel for a carotid pulse. DO NOT listen or feel for breathing by placing your ear and cheek close to the patient's mouth. Restrict the number of rescuers involved.</p>
2	<p>If a defibrillator is available, attach and defibrillate any shockable rhythms quickly.</p>
3	<p>ALL rescuers must don appropriate PPE for Aerosol Generating Procedure (AGP) before attempting chest compression or any airway procedures. A clear plastic sheet should be available and placed over the victim's head-end.</p>
4	<p>Start compression-only CPR and monitor the patient's cardiac arrest rhythm. Put a simple oxygen mask on the patient to limit aerosol spread (passive oxygenation). Consider mechanical chest compression (if available).</p>
5	<p>Prioritize intubation after first shock. Pause chest compression for intubation and connect viral filter to bag-mask-valve or ventilator. Consider PAPR or N100 (if available).</p>
6	<p>Identify and treat any reversible causes (e.g. 4Hs, 4Ts) before considering stopping CPR.</p>
7	<p>Dispose or clean all equipment and work surfaces used during CPR according to hospital infection control guidelines. Place all equipment used in airway interventions (e.g. laryngoscopes, face masks) in a double-sealed bag. Contaminated end of the Yankauer suction should be placed inside a plastic sheet or disposable glove.</p>
8	<p>Doff PPE, hand hygiene and dispose of clinical waste bags.</p>

Note. Table adapted from *Guidance for the resuscitation of adult COVID-19 patients in acute hospital settings*, 2020. Resuscitation Council UK.

References:

- 1) Advanced Life Support Training Manual; 2015. (MOH)
- 2) Interim Guidance of Life Support for Covid-19, Circulation AHA, 2020
- 3) European Resuscitation Council COVID-19 Guidelines, 2020
- 4) Resuscitation Council UK Statement on COVID-19 in relation to CPR and resuscitation in acute hospital setting
- 5) Recommendations on Palliative Care in the Critically Ill Patient during COVID-19 Pandemic. Malaysian Society of Intensive Care (MSIC) COVID-19 Guidelines.2020

This guideline was developed by the ALS Subcommittee, National Committee on Resuscitation Training, Ministry of Health Malaysia

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