

## **CPR in COVID-19 ERA : Pearls from Literature review and Algorithm**

Krunal Patel \*, Anuj Clerk\*\*

\*Consultant Intensivist, \*\*Head, Intensive care services,  
Sunshine Global Hospital, Surat, Gujarat  
E Mail: [krunalpatel96@gmail.com](mailto:krunalpatel96@gmail.com)

### **A call for revision in CPR algorithms in COVID Era:**

Corona virus led pandemic [COVID-19] spread over 170 countries involving over 4.2 million people with more than 0.28 million death by 12<sup>h</sup> of May, 2020. India has more than 70 thousands of SARS CoV-2/ COVID 19 positive cases with more than 22,000 deaths.<sup>1</sup>

Large majority of infected patient remain asymptomatic or mildly symptomatic, 12%-19% require hospital admission and only 3%-6% are seriously ill to require Intensive care.<sup>2-4</sup> Acute respiratory distress syndrome (ARDS), myocardial injury, ventricular arrhythmias, and shock due to Covid-19 infection predisposes them to suffer cardiac arrest,<sup>5-8</sup> Even proposed treatments, like hydroxychloroquine and azithromycin can prolong the QT and generate arrhythmias.<sup>9</sup>

Health care workers [HCWs] treating COVID patients, are contracting such infection and deaths reported in them too.<sup>10-12</sup> Limited sensitivity of tests for diagnosis, limitations in extent of testing and capability of even mild infections in spreading virus, has led to a call for extensions in standard precautions by HCWs. Till effective medications are invented or vaccine developed, COVID pandemic is going to continue. Medical practice patterns have to modified to mitigate the risk to HCWs.

Cardio Pulmonary Resuscitation [CPR] involves many high aerosol generating procedures (AGP), like, chest compression, oropharyngeal suction, insertion of artificial airway, assisted ventilation [manual and mechanical]. It involves many HCWs in close contact for prolonged time during CPR. Thus CPR on COVID patient has potential to infect many HCWs and contaminate space where it was conducted. Unless protocols are made to minimize the same, HCWs will be afraid to perform full hearted CPR and result not only in poor outcomes but also infection in HCWs.

Just the availability of equipment like personal protective equipment, negative pressure isolation rooms with its dedicated equipment may not ensure good quality safe CPR unless conventional CPR algorithms are modified to accommodate the changes.

Major changes like avoidance of mouth to mouth ventilation, minimizing Bag mask ventilation, early intubation, covering victim's mouth and nose are desired deviations and calls for retraining in COVID era. This is possible only after we have practicable and agreeable revised COVID-19 CPR Algorithms.

We have reviewed recent literature, compiled them in points and conceptualize it in the form of an algorithm. This when discussed among peers can lead to revisions and ultimately new Indian guidelines.

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### **Special consideration suggested in COVID 19:**

**OHCA:**As 8 out of 10 patients are asymptomatic or mildly symptomatic and therefore the probability of them suffering cardiac arrest with COVID19 rather than due to COVID19 remain substantial.<sup>2-4</sup> Timely Bystander CPR is a key for good outcome in OHCA<sup>14-16</sup> but lay rescuers performing CPR without protective gears, are prone to exposure of COVID19. Those who are aged and have co-morbidities like diabetes, hypertension, heart disease, chronic lung disease<sup>4</sup> are at high risk of becoming seriously ill if get infected with COVID19.<sup>16</sup> In India, approximately 80-90 % of OHCA occur at home,<sup>18</sup> likelihood of which will increase during lockdown due to COVID19. Not only patient but family members are likely to be infected as well and need consideration during close contact with them during transporting victims.

**IHCA:** In this era, all victims of cardiac arrest must be handled as covid19 infected, until proved otherwise, and this fact must be considered at the time of revising CPR policy for the hospital. However few measures are too labor, cost, resource intensive that they may have to be restricted to confirmed cases only.

### **Pearls from Literature on CPR in COVID19 era:**

1. Always first is scene safety should include consideration for location of arrest, for example red or orange zones, quarantine setups, COVID19 dedicated hospitals. This calls for mock drill guided preparation for the setup to ensure rescuer safety and provision and use of PPE by EMS team visiting high risk zones.
2. Check for responsiveness. If victim has agonal gasps than give him mask or cloth to cover mouth and nose to reduce aerosol generation and exposure.
3. The call center for EMS system should include questions for screening for symptoms of COVID19 in the patient and around the locus, in their call receiving set. Encourage lay rescuer for hands only or Compression Only life support in Covid19 Era. Inform the EMS team to don PPE for suspected/confirmed COVID19 cases before reaching the scene.<sup>19</sup>
4. Those who are still following the old method of look,listen and feel for assessment of breathing must be encouraged to follow the recent guideline insisting on assessment by visualization of respiratory chest movement only.<sup>20</sup>
5. Even in Covid19 era , Mouth to mouth breathing is encouraged in Cardiac arrest among children as respiratory causes dominate the cause list.<sup>16</sup>As family of the victim deemed to be exposed and infected, they can be encouraged to do so, however precautions like , barrier devices [pocket mask] are can be used to reduce the risk of exposure to respiratory secretions.
6. As defibrillation is not an aerosol generating procedure[ AGP], recommendation for AED use remains unchanged.<sup>19</sup>

7. Family members and other contacts of patients with suspected or confirmed COVID-19 should not ride in the same transport ambulance. <sup>19</sup>
8. Pre arrest: Patients requiring intubation and ventilation in case of COVID 19 have poor survival rates <sup>5,21</sup>and probability of survival after an arrest become poorer. However tachyarrhythmia due to myocarditis will benefit from defibrillation and need special consideration.<sup>23</sup>
9. In extremely ill COVID19 patients with multiorgan failure and co morbidities; or patient with exiting living will for limitation of care [ eg DNR, DNI], it is desirable to discuss direction and limits of care much in advance to prevent last moment hassles. Covid19 pandemic, calls for a relook at “end of life” or “direction of care” policy of the institute to prevent ambiguity at ground level. Whenever possible, let direction of care be decided before large number of health care workers are exposed,.
10. Emergent resuscitation not only contaminates the space and personnel but propagates a wave of fear among onlookers. All suspected or confirm cases of COVID19 are closely monitored for signs and symptoms of deterioration and advised to have policy involving preemptive actions like,
11. Early transfer to at least a closed door room if negative pressure room not available,<sup>19</sup>
12. For early planned intubation in controlled surrounding equipped for the same.<sup>19</sup>
13. Chest compressions, artificial airway insertion and assisted ventilation have high potential to generate aerosols and must be restricted to be done by rescuers donned in airborne PPE at an appropriate space.<sup>24</sup>
14. Allow minimal essential personnel in the room during resuscitation to minimize exposure. <sup>19</sup>
15. Ensure closed loop communication and documentation about COVID-19 status of the victim with receiving team before their arrival on the scene or receipt of the patient when transferring to a second setting.<sup>19</sup>
16. First responders in Emergency Department should be wearing at least a surgical mask, eye protection and gloves all the time in covid19 era. first responders should wear droplet PPE for any victim high-risk for COVID-19 or in case of lack of information.<sup>24</sup>
17. To prevent contamination by droplet or spray, use of Hudson mask with oxygen flow of up to 10 L/minute, with additional cover of clear plastic sheet, towel, cloth or surgical mask over the victim’s face.<sup>25</sup>
18. Defibrillation is not considered an AGP<sup>26</sup>however cover of patient’s mouth and nose as above is desirable.
19. To prevent fire, any oxygen source is turned off prior to defibrillation attempts and do not forget to restart after that.<sup>24</sup>
20. If local protocols and availability permit, use mechanical compression devices over manual ones to limit the rescuer’s exposure. <sup>19</sup>
21. Until in an appropriate location with staff donned in airborne PPE, postpone suctioning of oral cavity or throat with conventional method e.g. Yankuer’s set.<sup>19</sup>

22. Bag-mask ventilation(BMV) should be done 2 handed, 2 person technique. One person should seal the mask with mouth-nose by VE grip(specially advised in obese patient to ensure proper sealing) along with head tilt chin lift maneuver and second person should provide 2 rescue breaths at the time of pause after 30 compressions.<sup>26,28</sup>

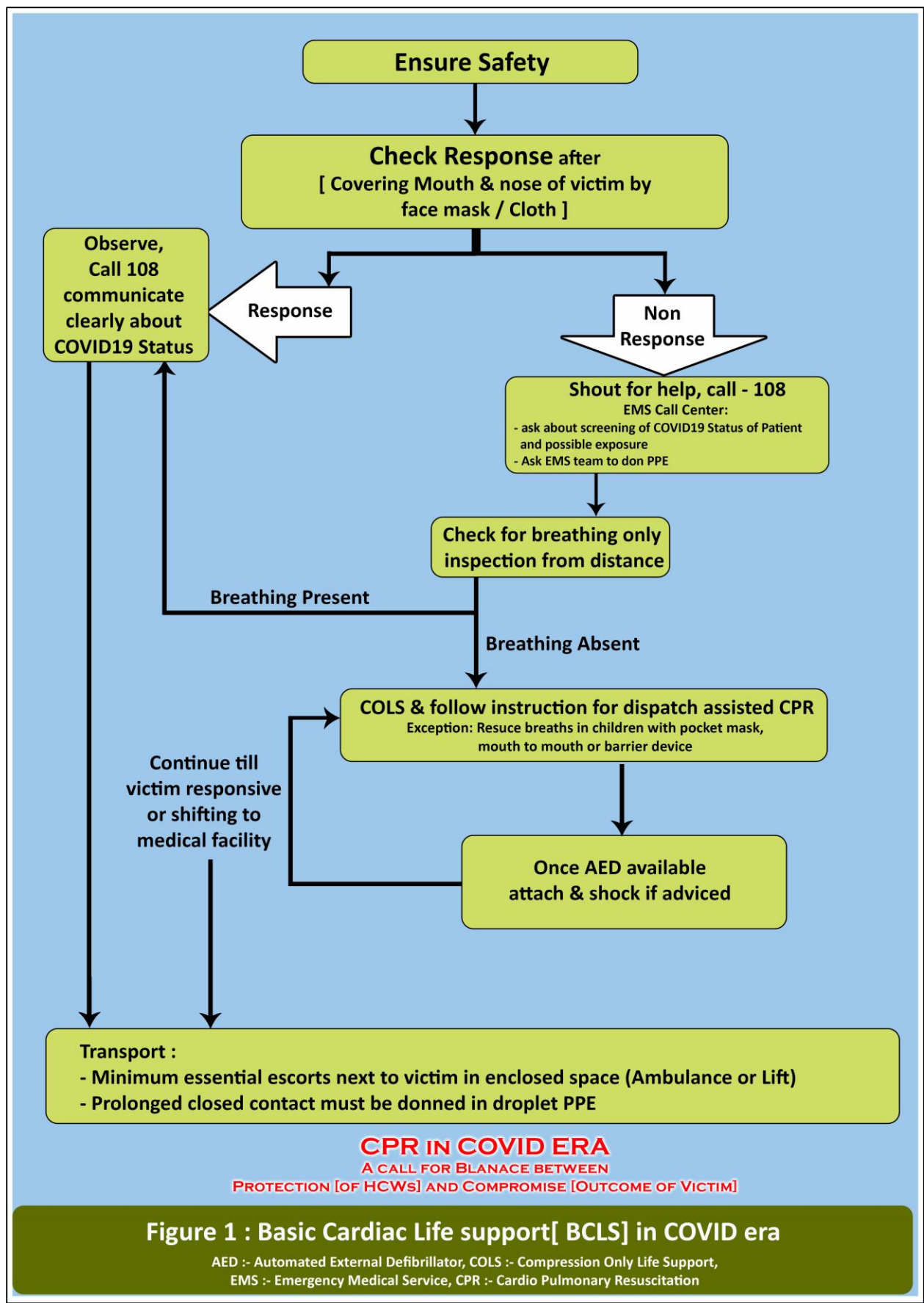


Picture: Showing 2 person , 2 hand V.E Technique of Bag to mask Ventilation in COVID CPR. Please note the transparent plastic sheet to minimize droplet exposure in HCWs

23. Supraglottic airway (SGA) devices cause less aerosol generation , so preferred over BMV even while intubation is delayed or failed.<sup>29</sup>
24. SGA device insertion or endotracheal intubation should be done while pause of compressions by senior most provider to reduce chance of first attempt failure and cuff has been inflated properly to prevent leak .<sup>19,24</sup>
25. It is desirable to use continuous ETCO<sub>2</sub> monitoring to confirm the placement of SGA device or endotracheal tube and assess the quality of CPR, as with airborne PPE, auscultation of chest is difficult.<sup>30</sup>
26. Ventilate the patient with positive pressure once in at appropriate location with airborne PPE donned staff and heat available and moisture exchanging (HME) viral filter is connected to airway devices (endotracheal tube, SGA device, BMV) close to patient along with all connection are secured well.<sup>24,27</sup>
27. If available, it is desirable to use video laryngoscope for endotracheal intubation as it reduce exposure of aerosolized particles to the provider.<sup>19</sup>

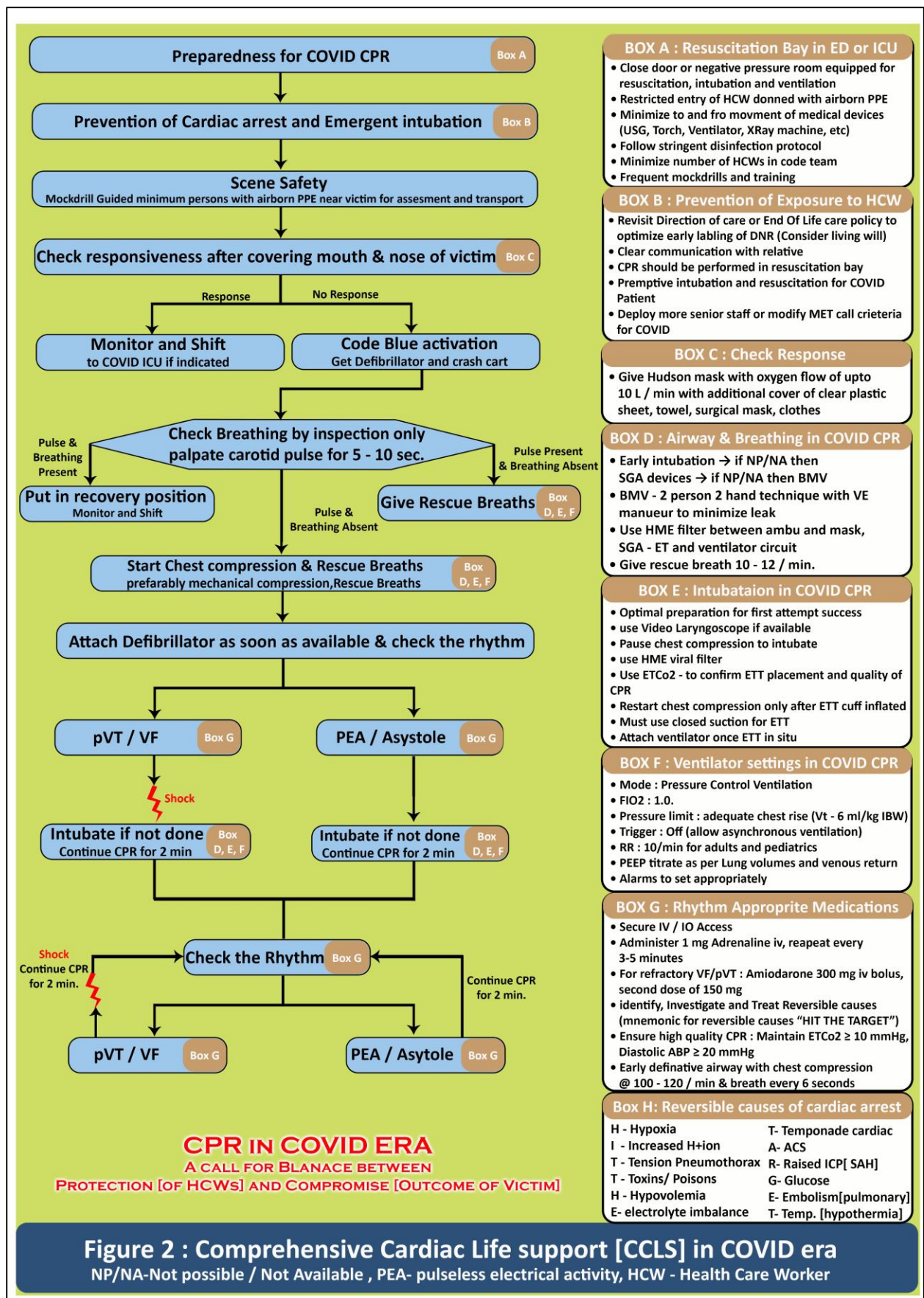
28. Once SGA device or endotracheal tube in place, close circuit (double limb) of ventilator along with HME viral filters near patient and at ventilator end of expiratory limb and close inline suction device should be attached and secured to prevent disconnections.<sup>19</sup>
29. Once connected to mechanical ventilator, it is desirable to adjust ventilator settings as described to allow asynchronous ventilation (10 breaths per minute).<sup>19</sup>
  - Pressure Control Ventilation mode
  - FIO<sub>2</sub> should be 1.0.
  - Pressure limit to generate adequate chest rise (Tidal volume of approximately 6 ml/kg of ideal body weight)
  - Trigger should be Off ( prevent the ventilator from auto-triggering with chest compressions)
  - Respiratory rate of 10/min for adults and pediatrics.
  - Positive end-expiratory pressure (PEEP) adjusted as per balance of lung volumes and venous return.
  - Alarms to set appropriately to prevent alarm fatigue.
  - Properly secure endotracheal tube and all connection of circuit to prevent unplanned disconnections.
30. Once ROSC (return of spontaneous circulation) ventilator settings adjusted as per patients' clinical condition.
31. Currently ECPR( ECMO cardiopulmonary resuscitation) in presumed case of COVID-19, is not recommended, due to a high likelihood of futility.<sup>24</sup>
32. Once ROSC is achieved prior to intubation, then its need and potential benefits should be assessed.<sup>24</sup>
33. If COVID19 patient has cardiac arrest along with respiratory failure without any potentially reversible cause identified, than provider should consider futility of resuscitation and can terminate resuscitation early.<sup>17</sup>
34. At the end of event, PPE doffing should be done appropriately as per local guideline under supervision to prevent breach in infection control protocol PPE to monitor for possible breaches in infection control procedures.<sup>24</sup>
35. Disposable equipments should be discarded and reusable equipment should be cleaned and disinfected according to hospital protocols.<sup>24</sup>
36. As there is lots of panic regarding COVID19, it is desirable to conduct a debriefing meeting of team members including special consideration for PPE and prevention of COVID-19 transmission, communication, clinical care and decision-making.<sup>24</sup>
37. Family members are restricted outside resuscitation room in this COVID era with some exception like cardiac arrest in a child. They should be allow with all precautions for only seeing the body if resuscitation is unsuccessful as per hospital protocols.<sup>22</sup>

### **CPR Algorithms in COVID ERA:**



**CPR IN COVID ERA**  
 A CALL FOR BLANACE BETWEEN  
 PROTECTION [OF HCWs] AND COMPROMISE [OUTCOME OF VICTIM]

**Figure 1 : Basic Cardiac Life support[ BCLS] in COVID era**  
 AED :- Automated External Defibrillator, COLS :- Compression Only Life Support,  
 EMS :- Emergency Medical Service, CPR :- Cardio Pulmonary Resuscitation



- BOX A : Resuscitation Bay in ED or ICU**
- Close door or negative pressure room equipped for resuscitation, intubation and ventilation
  - Restricted entry of HCW donned with airborne PPE
  - Minimize to and fro movment of medical devices (USG, Torch, Ventilator, XRay machine, etc)
  - Follow stringent disinfection protocol
  - Minimize number of HCWs in code team
  - Frequent mockdrills and training

- BOX B : Prevention of Exposure to HCW**
- Revisit Direction of care or End Of Life care policy to optimize early labling of DNR (Consider living will)
  - Clear communication with relative
  - CPR should be performed in resuscitation bay
  - Premptive intubation and resuscitation for COVID Patient
  - Deploy more senior staff or modify MET call crieteria for COVID

- BOX C : Check Response**
- Give Hudson mask with oxygen flow of upto 10 L / min with additional cover of clear plastic sheet, towel, surgical mask, clothes

- BOX D : Airway & Breathing in COVID CPR**
- Early intubation → if NP/NA then SGA devices → if NP/NA then BMV
  - BMV - 2 person 2 hand technique with VE manueur to minimize leak
  - Use HME filter between ambu and mask, SGA - ET and ventilator circuit
  - Give rescue breath 10 - 12 / min.

- BOX E : Intubataion in COVID CPR**
- Optimal preparation for first attempt success
  - use Video Laryngoscope if available
  - Pause chest compression to intubate
  - use HME viral filter
  - Use ETCo2 - to confirm ETT placement and quality of CPR
  - Restart chest compression only after ETT cuff inflated
  - Must use closed suction for ETT
  - Attach ventilator once ETT in situ

- BOX F : Ventilator settings in COVID CPR**
- Mode : Pressure Control Ventilation
  - FIO2 : 1.0.
  - Pressure limit : adequate chest rise (Vt - 6 ml/kg IBW)
  - Trigger : Off (allow asynchronous ventilation)
  - RR : 10/min for adults and pediatrics
  - PEEP titrate as per Lung volumes and venous return
  - Alarms to set appropriately

- BOX G : Rhythm Appropriate Medications**
- Secure IV / IO Access
  - Administer 1 mg Adrenaline iv, reapeat every 3-5 minutes
  - For refractory VF/pVT : Amiodarone 300 mg iv bolus, second dose of 150 mg
  - identify, Investigate and Treat Reversible causes (mnemonic for reversible causes "HIT THE TARGET")
  - Ensure high quality CPR : Maintain ETCo2 ≥ 10 mmHg, Diastolic ABP ≥ 20 mmHg
  - Early defnitive airway with chest compression @ 100 - 120 / min & breath every 6 seconds

- Box H: Reversible causes of cardiac arrest**
- |                          |                        |
|--------------------------|------------------------|
| H - Hypoxia              | T- Temponade cardiac   |
| I - Increased H+ion      | A- ACS                 |
| T - Tension Pneumothorax | R- Raised ICP[ SAH]    |
| T - Toxins/ Poisons      | G- Glucose             |
| H - Hypovolemia          | E- Embolism[pulmonary] |
| E- electrolyte imbalance | T- Temp. [hypothermia] |

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**Figure 2 : Comprehensive Cardiac Life support [CCLS] in COVID era**  
 NP/NA-Not possible / Not Available , PEA- pulseless electrical activity, HCW - Health Care Worker

### **Scope of application of COVID CPR Algorithms:**

Who is not infected with Covid-19 ? Until answer to this question is clear, one might have to scrutinize each deviation [in CPR algorithm] on its protective [to HCWs] ability vs compromising [outcome of victim] potentials. Till this brain storming task is done, these deviations can be considered guideline at its best and local modifications are desirable. Unless it is considered “New Normal”, scope of its implementation [universal or covid19 victims only], be determined, in institutional CPR committee and published as advisory. Weight of these decisions must not be levied upon the stressed ACLS team leader, to decide on “case to case basis” onsite

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