Resuscitation in Covid-19

Abstract

Covid-19 is a complex disease which has challenged the way in which care is provided. Cardiopulmonary resuscitation (CPR) is recognised as a potential aerosol-generating procedure, in consequence, a modified advanced life support approach needs to be followed. This article describes the actions for an adult in cardiac arrest with suspected of confirmed Covid-19 disease in a hospital setting.

Key words

Resuscitation, Covid-19, SARS-CoV-2, Critical Care,

Key points

- Patients with severe Covid-19 disease can rapidly deteriorate, Early Warning Scoring tools may not be sensitive enough to detect deterioration.
- Cardio-respiratory arrest in patients with suspected or confirmed Covid-19 requires a modified approach to resuscitation.
- During the pandemic, hospitals have had to respond to increased numbers of cardiac arrests due to patients with severe Covid-19 disease, in consequence, staff involved in incidents must have access to structured de-briefing and to support.

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Introduction

Resuscitation is arguably one of the most physically and mentally challenging tasks that a healthcare professional can undertake. Patients admitted due to COVID-19 have an increased propensity for rapidly progressive respiratory failure, necessitating critical care admission [1], and it is essential that early consideration should be made for advanced care planning. It is important to establish with the patient and the people that are important to them what treatments are likely to be of benefit. This includes discussing the implications of critical care admission and resuscitative treatment. Therefore, this article focusses on the impact of the additional stressors and challenges that must be considered when delivering resuscitative treatment during the COVID-19 pandemic. It reviews the evidence and guidance that has been developed to help health care professionals carry out resuscitation for patients in the presence of the clinical symptoms of Covid-19. It also explains practical application of the guidance developed in the context of usual and expanded critical care environments

Before carrying out resuscitation, there are some important factors that all teams need to be aware of, as they may vary according to the clinical environment. As many ward and specialist settings have been reconfigured or expanded due to the pandemic, carrying out in situ simulation of cardiac arrests can be of benefit to teams. These enable staff to practice and familiarize themselves with the non-technical skills and equipment unique to this situation and through this can contribute to improving patient outcomes [2]. Teams can check all staff are aware of where level 3 personal protective equipment (PPE) is kept, who the Team leader will be if there is a cardiac arrest, what other team roles need to be assigned, and how the Cardiac Arrest team is summoned. Information can be shared regarding where the cardiac arrest equipment is kept and its layout. Should any members not know how to use the equipment (e.g. defibrillator) appropriate training can be given before an actual clinical incident arises. During the pandemic the re-deployment of staff has made need for re-training much more frequent, and it is recommended that skills assessments are made when staff move to a new, and possibly very different, clinical environment.

It is a cause for concern that in some settings contradictory advice has been given. For example, in the UK, both the International Liaison Committee on Resuscitation and Resuscitation Council (UK) [3, 4] identify cardio-pulmonary resuscitation (CPR) as an aerosol generating procedure (AGP), yet this was not reflected in Public Health England guidance which deemed CPR not to be an AGP [5]. As a result, at local level, hospitals have implemented and adapted their own specific algorithms, for example, all inpatients are considered Covid-19 suspected regardless of reason for admission [6]. In consequence, healthcare teams must have clear communication regarding actions for a cardiac arrest in a ward setting.

Advanced Care Planning

Advanced care planning is key to efficient care delivery, therefore nurses need to know the documentation used and understand the legal and clinical implications of the decisions made. A Do Not Attempt Cardio-Pulmonary Resuscitation (DNA-CPR) order is a legal document. However, some clinicians and the general public have a perception that this also dictates the level of treatment that a patient receives, seeing it as the clinical equivalence of 'giving up' [7], this is not true. While it does specify that cardiopulmonary resuscitation (CPR) will not be initiated if a patient does suffer cardiac arrest, it does not dictate the 'ceilings of care' for the patient, or dictate whether the patient should be admitted to Critical care. The setting and timing of the discussions needed for advanced care planning should also be carefully considered [8]. There are legal considerations to the discussion of DNA-CPR orders. To prevent misunderstandings and mis-communication the BMA, RCN and RC (UK) have all sought to clarify the current legal and ethical considerations of this process through the publication of a joint statement [9]. Nursing professional organisations have also published further guidance emphasizing the need for an individualized, patient-centered approach to this process during the current pandemic [10].

Treatment Escalation Plans are becoming more commonplace in acute healthcare settings. These set out clearly for members of the multidisciplinary team what interventions the clinical team, in discussion with the patient/next of kin have decided would be appropriate should the patient deteriorate. This may include whether the patient should be admitted to critical care or receive Non-Invasive Ventilation (NIV). These plans are beneficial if they are made prior to deterioration as they provide the opportunity for the patient and their next of kin to ask questions and to have the risks/benefits and rationale of the decisions being made, explained to them. This can also be an opportunity for practitioners to discuss the current prognosis and expected clinical course. To support clear documentation of all aspects of decisions made, several organizations have collaborated to form the Respect process [11] which provides resources to support these conversations and a standardized format of documentation to accompany the shared discussions.

Professional and Patient Safety

The International Liaison Committee on Resuscitation (ILCOR) state that chest compressions have the potential to generate aerosols and recommends that healthcare professionals should wear appropriate PPE for resuscitation attempts [4] . The Aerosol Generating Procedures (AGPs) essential to Advanced Life Support (ALS) represent a hazard of contamination and infection to anyone in the immediate vicinity as droplets are expelled from the patient into the area around them. In some clinical areas, such as critical care, where the nature of care services provided means there are already AGPs ongoing, team members may already be wearing the appropriate PPE for resuscitation. This should lead to reducing delay in commencing chest compressions.

It has to be accepted that in this current pandemic, there are situations where the team may not be wearing full PPE, and consequentially will not be in an appropriate state of preparedness to immediately start chest compressions. Therefore, to minimise delays, in areas where there is a possibility of sudden presentation of possible or confirmed COVID-19 cases, such as the Emergency Department, full PPE should be readily available and accessible, with all practitioners aware of its location.

After a cardiac arrest has been recognized, during the Covid-19 pandemic there needs to be a careful balance between risks versus benefit. It is essential to ensure that there are sufficient team members with an appropriate skill-mix for the attempt, whilst minimizing exposure to AGPs by restricting staff in the environment to those essential for the resuscitation attempt [2]. RC (UK) also advises placing a simple oxygen mask on the patient's face, to limit the dispersal of contaminated droplets [2]. During resuscitation attempts this may pose an increased risk of transmission of Covid-19 to responders and other patients within the vicinity [12]. This is an important consideration, because previous infectious disease outbreaks have shown the transmission of viruses to health care professional despite them wearing PPE during resuscitation attempts [13, 14].

Recognition of the Deteriorating Patient

Individuals with severe Covid-19 disease may develop respiratory failure without accompanying circulatory failure. They can deteriorate rapidly, with the unique feature of requiring a sudden increase in oxygen requirements without significant changes to other parameters and symptoms of respiratory distress. Early Warning Scoring tools may not be sensitive enough to detect such changes [15]. In consequence, this may impact on recognition of the deteriorating patient and the team response to clinical deterioration.

The decision to initiate resuscitation during a pandemic is complex. In some settings it has been proposed that CPR should not be initiated without adequate PPE [16]. In the early phase of the UK pandemic, reports of restrictive resuscitation practices include the recommendation that patients in cardiac arrest outside the emergency department can only be given defibrillator treatment if they have a "shockable" rhythm [17]. While these practices have been condemned as they do not follow national or international guidance, nevertheless they will have impacted on patient survival rates.

Therefore, hospitals must have appropriate plans in place for the management of the deteriorating patient for all cardiac arrest situations.

Recognition of Cardiac Arrest

Prior to the COVID-19 pandemic a 'Look, Listen, Feel' detection method was advised [18], whereby the practitioner would bring their face close the patient's mouth to recognize cardiac arrest. In the presence or possibility of COVID-19 this method has considerable potential for contamination and/or infection of the practitioner. In consequence, the guidelines have been updated, and now recommend that the practitioner still performs the look listen and feel detection, but stands further distanced from the patient's face [2] and for no longer than 10 seconds. If the patient's breathing is absent or abnormal (agonal gasping), then chest compressions should be initiated.

Manual pulse palpation at the carotid can be performed if you have been trained to do so. However, there is now some documented evidence of false positives/negatives arising during manual pulse palpation [19]. Therefore, if the practitioner has not be trained in this technique, confirmation of cardiac arrest should be specified as above by solely checking for 'normal breathing'.

Calling for help

Activation of the cardiac arrest team should be the first consideration after confirmation of a cardiac arrest. The process for this can differs as it tends to be based on local guidelines. Clinical areas such as Critical Care or the Emergency Department may manage cardiac arrests 'internally' whilst most ward environments will call for the cardiac arrest team via a telephone/bleep system. All staff need to be fully orientated to local guidelines and all communication should make it clear when and if there is a potential risk of COVID-19 infection.

Assessment of Rhythm

Consideration should be made for early application of an automated external defibrillator (AED) or manual defibrillator to determine the patient's cardiac arrest rhythm. Previously chest compressions would have been immediately initiated after confirmation of cardiac arrest, but the change in approach has been made because this intervention is thought to produce additional aerosolized droplets, increasing the potential for contamination and/or disease transmission. The benefit of a 'defibrillator-first' approach is that it can be carried out whilst other team members don PPE and prepare to provide chest compressions. Once the defibrillation pads are applied to the patient, rhythm assessment can take place.

Today, many In-hospital defibrillators have an AED mode. This enables the machine to automatically detect the cardiac rhythm of the patient and recommend the appropriate treatment strategy (Shockable or Non-Shockable). When using the AED mode, it is important to follow all cues the machine provides to ensure correct rhythm analysis, as continuing CPR during this process can in some instances lead to inappropriate treatment. The risk/benefit of using the defibrillator in AED mode is complex. It is possible that the AED mode can decrease the time to first defibrillation attempt (12). However, there is an argument that using manual mode can decrease 'pre-shock pauses' and in doing so can theoretically improve the chances of achieving return of spontaneous circulation (ROSC) (13). Nevertheless, those that have only been trained to use the AED mode, should avoid the use of the manual mode. This requires additional training, as it needs rapid identification of cardiac arrest rhythms, and a good understanding of the safe defibrillation sequence.

Throughout ALS the cardiac arrest rhythm is re-assessed every two minutes and treatment administered as per the appropriate branch of the algorithm. As previously highlighted; chest compressions generate ECG artifacts that can lead to misinterpretation of the cardiac arrest rhythm. Therefore, CPR needs to be paused to enable effective analysis of the rhythm to be made. As with any interruption in chest compressions, this pause should be minimized and take no longer than five seconds [20]. If the defibrillator is being used in manual mode, then the team leader should have a good view of the defibrillator screen prior to pausing CPR.

There are four classifications of cardiac arrest rhythm. The Resuscitation Council (UK) (RC (UK)) has produced guidance and an algorithm to maximize the effectiveness for resuscitation in the context of COVID-19 [2]. The management of these is separated into two branches of the algorithm - Shockable and Non-Shockable.

Non-shockable rhythms

Non-shockable rhythms include pulseless electrical activity (PEA) and asystole. PEA is a rhythm that would be compatible with life, and therefore a member of the team should attempt to palpate a carotid pulse if this is seen. If there is insufficient cardiac output to generate a pulse, CPR should be recommenced. Asystole can be characterized as a 'flat' line, although typically there may be some small amounts of drift. It is indicative of an absence of mechanical and electrical cardiac activity. Once a non-shockable rhythm has been identified, CPR should be immediately re-initiated.

Shockable rhythms

Cardiac arrest rhythms which can be restored by defibrillation, include pulseless Ventricular Tachycardia (pVT) and Ventricular fibrillation (VF). pVT is characterized as a tachycardia, with regular broad QRS complexes. VF can be recognized as a disorganized irregular rhythm, with no discernible P, Q, R, S, T waves. This is due to random twitching and electrical activity across the muscle fibers of the heart.

Defibrillation

If the patient is in a shockable rhythm, early defibrillation is associated with a greater likelihood of ROSC [21]. RC (UK) recommends that whilst the defibrillator is charging, CPR is recommenced with all other team members (other than the CPR provider) instructed to stand clear. Once the defibrillator is charged the CPR provider should also be instructed to stand clear, the shock administered, and CPR immediately recommenced [18]. If, as per the modified COVID-19 algorithm, the defibrillator has been attached prior to CPR and the patient is in a shockable rhythm; up to three shocks can be administered in an attempt to convert the patient to a rhythm compatible with life whilst awaiting others to commence chest compressions.

It is vital that safety is maintained throughout any defibrillation attempt. Due attention must be made to the area within which the shock is being administered. No-one should be in contact with the patient or their immediate area, this prevents any risk of shock transference, which could potentially harm team members.

There are some concerns around the perceived risk of ignition caused by defibrillation due to the presence of oxygen. The European Resuscitation Council (ERC) reports that there is no evidence of this occurring when self-adhesive pads were used. ERC advises that practitioners exercise caution when performing defibrillation, ensuring that direct sources of oxygen such as a mask or nasal cannula be removed to one meter away from the patient. Also that a ventilation bag should remain attached to an ETT or SGA during shock delivery [20]. In critical care, patients may be ventilated, during CPR to prevent disconnection of the ventilator, a mandatory mode of ventilation with a set respiratory rate of 12 breaths per minute and a FiO_2 of 1.0 can be set. If disconnection from the ventilator is required, the ventilator should be placed into the stand-by mode, to prevent aerosolisation of particles. During defibrillation, the charge should be delivered during expiration to prevent transthoracic impedance.

Chest Compressions

Chest compressions should be delivered at a rate of 100-120 compressions per minute, vertically to a depth of 5-6Cm (or a third of the anterior-posterior depth of the patient's chest). Chest compression should be delivered with the heel of the practitioner's hand in the center of the low half of the patient's sternum [22]. Since the onset of the pandemic, patients with severe Covid-19 who are unstable have been observed to deteriorate, resulting in cardiac arrest while in the prone position, as this has been increasingly used to improve oxygenation for both intubated and conscious patients with COVID-19 [23. 24]. Returning a patient to the supine position is the optimum for resuscitation. However, as this necessitates a coordinated team procedure, particularly for a patient that is intubated, it may not be immediately possible. In consequence, CPR can be commenced in the prone position. The Intensive Care Society has highlighted that there is limited evidence available regarding this, but recommends a two-handed technique between the scapula [25]. The ERC also endorse this technique, recommending a similar rate and depth as supine (usual) CPR [26]. It has to be noted that applying sternal counter-pressure may help to generate higher Mean Arterial Pressures (MAP) [27]

Consistent quality of chest compressions is positively associated with ROSC [28] ; however, provision of effective chest compressions is physically tiring, and in this pandemic providers are also encumbered by PPE and thus are likely tire sooner. As the provider tires there will be drop off in overall quality of chest compressions. Swapping providers often to maintain efficacy of chest compressions is an easy means of negating this. Therefore, team members need to monitor the quality of chest compressions. This can be achieved visually, using a metronome or using CPR feedback devices where available, or a diminishing EtCO2 trace can be another indicator of compression provider fatigue. In Covid-19 areas, the number of responders may be limited due to availability of staff and those who are wearing appropriate CPR. In consequence, teams may need to swap providers more frequently and rotate all team members (excluding the team leader) to perform CPR.

Throughout the resuscitation attempt any interruption in CPR should be no greater than 5 seconds. This is due to the rapid drop-off in perfusion pressure when there is no CPR. In order to minimize the interruption when swapping CPR providers, it should be clearly established and stated, as to who will be taking over, and a clear countdown should be given “3…2…1”. To further minimize interruptions in CPR these changeovers should, where possible, be integrated with the necessary pauses for rhythm assessment [20].

In some settings mechanical chest compression devices may be available. These devices perform chest compressions at a set rate, particularly useful for prolonged cardiac arrests where team member fatigue becomes a significant risk to chest compression quality. It is important to recognize that as with all medical equipment, these devices require specific training to ensure they are applied appropriately and effectively. In addition, in the Covid-19 environment, equipment may not be immediately available and after the resuscitation attempt will need to be appropriately decontaminated.

Vascular access

If the patient has an existing intravenous (IV) access this should be assessed for patency. If this is insufficient or not patent, further access should be gained to enable the administration of drugs and fluids. The peripheral IV cannula is the equipment most healthcare professionals will be familiar with, so inserting wide-bore cannula bilaterally may be the most readily available means to gain IV access, however, in the absence of cardiac output the patients vasculature will peripherally shut down making this more challenging.

Intraosseous (IO) access is a good alternative to traditional vascular access with equipment available in many in-hospital environments. The correct insertion technique for these devices requires additional training, however there are several benefits to using IO during cardiac arrest. For a trained practitioner, the landmarking and insertion process can be faster than typical Central Venous Catheter (CVC) placement [29] . Evidence has shown that medications can take as little as three seconds to reach the heart via the humeral head intraosseous route, demonstrating its viability for resuscitative purposes [30]. However, there are several contra-indications to intraosseous access including the presence of any hardware/trauma in the limb and recent attempted/successful previous IO insertion.

CVC or central lines are typically established in critical care patients. It is important to account for the additional dead space in these lines, therefore, flushing with an appropriate volume of 0.9% Sodium chloride is required so that the entire dose is administered.

Drugs

During cardiac arrest it may be appropriate to administer drugs, depending on the rhythm, timing and cause of the cardiac arrest. Adrenaline (Epinephrine) (1mg) [31] has been given historically in cardiac arrest due to its alpha-adrenergic vaso constrictive effects which increase cerebral and coronary perfusion [20]. It is administered in both the shockable and non-shockable algorithm but is dependent on the initial cardiac arrest rhythm [20]. In non-shockable rhythm, Adrenaline (Epinephrine) is administered immediately, and subsequent doses should continue to be administered every 3-5 minutes. Practically speaking this would be after every alternate rhythm assessment, at four-minute intervals.

If the initial rhythm is shockable, then this adrenaline regime should only be initiated after the third shock has been administered. If the patient converts to a non-shockable rhythm, then the adrenaline regime is commenced. Once the adrenaline regime has commenced it continues irrespective of subsequent cardiac arrest rhythms.

Amiodarone is an anti-arrhythmic drug that slows atrioventricular conduction and appears to improve response to defibrillation [20]. It is administered if the patient is in a shockable rhythm, this should be administered after the third shock [32]. After a fifth shock a further dose of 150mg should be considered [20]. There are ongoing clinical studies for both medications and their impact on cardiac arrest outcomes and guidelines may be updated in the future dependent on quality and significance of evidence.

Airway Management

Placement of an advanced airway allows for continuous (asynchronous chest compressions). This should be done by a practitioner who is experienced and competent in airway management. Ideally, the patient will be intubated using an endo-tracheal tube (ETT), however a supraglottic airway (SGA) such as an iGel or LMA may be used. To minimize risk of exposure to team members a viral filter should be integrated into the airway circuit [26]. Once the airway is secured the patients ventilation will need to be continuously monitored to ensure adequate oxygenation. This can be done in three ways by visually by confirming bilateral chest movement, by auscultation of the chest to confirm bilateral air entry and via End-tidal CO2 (ETCO2) monitoring. However, in Covid-19 it may not be possible to auscultate the chest due to PPE and the risk of breaching PPE. In consequence, other methods may be relied upon. ETCO2 waveform monitoring also has other applications for cardiac arrest management. Interpreting the values and waveforms generated during the resuscitation attempt, can be indicative of quality of CPR, prognostication and ROSC [33-35].

Reversible causes and etiology

As management of the cardiac arrest proceeds from basic to ALS any potentially reversible causes of the cardiac arrest should be considered and addressed. These are often described as the four 'H's and T's' [20]. 'H's include hypoxia, hypovolaemia, hypo/hyperkalaemia (including metabolic disorders) and hypothermia. 'T's include tension pneumothorax, tamponade, toxins and thrombosis. The aim of resuscitation is to restore spontaneous circulation as soon as possible, therefore those factors most likely to be contributing to the cardiac arrest should be addressed first. Key to this process is understanding the potential etiology of cardiac arrest in the context of COVID-19. In the presence of COVID-19 infection hypoxemia secondary to Acute Respiratory Distress Syndrome (ARDS) is a potential causative factor of cardiac arrest. Consequentially an early consideration should be made to ensure hypoxia is effectively and definitively countered with advanced airway management, and manually ventilated with a high concentration of oxygen [26].

There is some evidence to suggest COVID-19 severity is associated with electrolyte imbalance, specifically sodium, potassium and calcium deficiencies [36]. There is also growing evidence of acute kidney injury in COVID-19 patients requiring Renal Replacement Therapy (RRT) [37]. Significant electrolyte derangement is associated with increased risk of sudden cardiac arrest [38]. As a constituent of effective cardiac arrest management electrolytes should be checked using a rapid point-of-care test, typically an Arterial Blood Gas (ABG) sample, to detect any electrolyte imbalance. This should then be corrected appropriately.

The evidence of increased risk of acute kidney injury in COVID-19 patients (31) has been partially attributed to hypovolemia, secondary to fever and dehydration common in this patient group [39]. This can be corrected intra-arrest with crystalloid intravenous fluids such as 0.9% sodium chloride or Hartmann's solution in boluses [20].

Hypothermia is unlikely in the context of in-hospital COVID-19 patients but should be ruled out for patients arriving as Out-of-Hospital-Cardiac Arrests (OHCAs). This can be corrected with warmed IV fluid infusion and external warm air [38].

Emerging evidence has suggested there has been an increased incidence of thromboembolic events in COVID-19 patients [40]. In the context of cardiac arrest, the treatment for this is fibrinolytic drugs. Once fibrinolytic drugs have been administered resuscitation may continue for 60-90 minutes in order to ensure that this medication can break down any potential thrombus [38].

COVID-19 patients are often intubated due to ARDS and consequentially can have poor lung compliance undergo sustained periods of ventilation. These are known risk factors for pneumothorax formation [41]. A multicentre case series has also demonstrated these patients are more prone to pneumothoraxes [42]. A pneumothorax can be detected by observing the chest for asymmetrical chest movement and auscultating for asymmetrical poor or absent air entry. If there is an ETT in situ, then unintentional endobronchial intubation is a possible differential diagnosis. Tracheal deviation is another indication of tension pneumothorax; however, this is a late sign, therefore the team should not wait to observe this prior to initiating treatment. The initial treatment for a tension pneumothorax is a needle thoracentesis (decompression). Historically this would be performed using a wide bore cannula in the second intercostal space, midclavicular line. There is now evidence to suggest that performing this in the fifth intercostal space on the mid-axillary line has a higher success rate [43]. A tension pneumothorax must be definitively treated by inserting an underwater sealed chest drain or by thoracostomy [38].

Cardiac tamponade can be difficult to detect intra-arrest and will likely only be present with an indicative history such as chest trauma or recent cardiac surgery. Use of ultrasound intra-arrest can be used to diagnose this, however this should only be attempted by trained clinicians to avoid prolonged interruption to chest compressions [20]. If this is detected then a resuscitative thoracotomy would be indicated.

Where there is evidence of toxic or therapeutic substances contributing to the cardiac arrest, expert help via online databases or poison centers should be sought to administer the appropriate antidote where possible [38]. Prolonged resuscitation may be required if this may enable the excretion or metabolization of a causative toxin or for an antidote to take effect [38].

Communication

Co-ordination of the multi-disciplinary team during a cardiac arrest is pivotal to ensuring that interventions are enacted promptly as the situation develops. The use of PPE will impact the identification of team members and communication. A popular means of overcoming this has been to write names/roles in large lettering on the front of PPE, being mindful to not compromise these protective barriers. As team members will be wearing PPE this will lead to vocal muffling and the loss of lip-reading ability and other non-verbal facial communication cues. Teams should be aware of this negative factor and be mindful of unnecessary noise and the flow of communication during the resuscitation attempt. Use of closed loop communication has been demonstrated to improve this [44]. Establishing and using gestures and other non-verbal communication tools with colleagues may also be helpful.

Termination of attempt

As the situation develops and after potentially reversible causes of the cardiac arrest have been addressed, the team should consider the potential success of this resuscitation attempt. The ERC states that *"Asystole for more than 20 min during ALS in the absence of a reversible cause is generally accepted as an indication to abandon further resuscitation attempts. However, there are reports of exceptional cases that do not support the general rule, and each case must be assessed individually"* [45]. The termination of a resuscitation attempt can be challenging. The decision ultimately rests with the team leader, however there may be a benefit to asking others involved in the resuscitation attempt if they have any concerns/treatments to suggest prior to discontinuing (43)

The evidence gathering related to in-hospital cardiac arrest outcomes for COVID-19 patients is ongoing. Current studies have demonstrated outcomes for COVID-19 positive cardiac arrest cases range from 13.2% to 42% ROSC rate [47-48], with one study in Wuhan, China reporting a 2.9% survival at 30 days [47]. However, a case series in USA reported no patients survived to hospital discharge [48].

Post-resuscitative care

If the patient shows any signs of life/a pulse, then post-resuscitative care should begin. As soon as ROSC is confirmed the team around the patient should then co-ordinate assessment using an airway, breathing, circulation, disability and exposure (A, B, C, and D, E) systematic approach. The airway is assessed to ascertain if the patient is tolerating any airway interventions and are they still effective? If this is an SGA or ETT this can be confirmed by the same means as set out above. Sedation and analgesia infusions may need to be initiated in order for the airway device to be tolerated. In Covid-19 areas it may not be possible to confirm air entry. However, an ABG should be taken to confirm effective gas exchange and detect any respiratory failure. Determining SpO2 using a peripheral sensor may not be immediately possible due to the patient's poor perfusion state. In the critical care environment consider if the patient can now be connected to a ventilator and further optimized. It is advisable to perform a chest x-ray as part of post-resuscitative care to detect any potential chest resuscitation related injury such as a pneumothorax and confirm the placement of any medical devices such as an ETT [49].

Post cardiac arrest, patients may be cardiovascularly unstable. Therefore, patients should be assessed to confirm that the patient does not require further intervention due to cardiac arrythmias in order to prevent re-arrest. If the patient is unstable then it may be of benefit for one member of the team to maintain a position palpating the carotid pulse, in case the patient deteriorates into a PEA, as cardiac monitoring would continue to show a rhythm compatible with life in this case. A 12 lead ECG should be taken, in order to detect cardiac arrythmias, heart blocks or myocardial ischemia that may have contributed to the cardiac arrest.

A neurological assessment of the patient should take place to assess the patient post-arrest. This should include a Glasgow Coma Scale score and pupillary reflexes. More advanced neurological assessment including imaging may be required and contribute to prognostication [50].

The ERC advises the avoidance of hyperthermia in the post-arrest period, which can be common in the first 48 hours [50]. This can be achieved via several methods include active cooling pads and antipyretics. There is additionally ongoing evidence gathering around the process of Targeted Temperature Management (TTM) and the optimal maintenance temperature that may positively impact neurological recovery post-ROSC [50].

Equipment

All surfaces and equipment involved in the cardiac arrest should be decontaminated or disposed of appropriately and as per manufacturer guidance, particularly those associated with airway management [51]. PPE should be carefully removed to avoid contamination.

De-briefing

There are often practical learning points to be taken away from a resuscitation attempt. Sharing these as a team after the event gives an opportunity to highlight any concerns they have, or anything they thought went well and should be replicated. This can contribute to improved patient outcomes [52]. There are various models that have been developed for debriefing. A debrief can be as simple as thanking team members for their work and asking if they have any immediate questions or concerns about the event. The level of sudden deterioration and mortality during the pandemic is of a scale unseen by many healthcare professionals. Team members may feel that they benefit psychologically from debriefing [53]. Acute healthcare settings should ensure that anyone exposed to a resuscitative event has access to psychological support.

Conclusion

There are several alterations to typical resuscitation practice that healthcare professionals should be aware of as they deliver care during the pandemic. Effective dissemination of these adjustments alongside preparation of teams and environments will benefit resuscitation attempts. The causative factors of cardiac arrest in COVID-19 and the outcomes for these patients are the topic of ongoing research, and so there is a need for practitioners to continuously update themselves, enabling them to provide evidence-based practice to this vulnerable patient group.

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