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Mini Review

Managing Cardiac Arrest in the New Norm: The Resuscitation Must Go On

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Abstract

Cardiac arrest (CA) calls for timely decision making and management at the frontline. It is one of the "bread and butter" cases emergency physicians have to face in the course of their work everyday. Since the COVID 19 pandemic, the management of CA patients has been one of the most significantly affected condition in view that:

1. There are multiple steps involved in the resuscitative process which are aerosol-generating or potentially aerosol-generating.
2. The (COVID 19 or infectious) status of these CA patients are unknown or uncertain and
3. There are a multitude of complex, multi-faceted and emotional aspects involved in the resuscitation.

This short paper shares the personal observations and practices in the management of CA patients who are sent to the Emergency Department at Singapore General Hospital.

Keywords: *Cardiac Arrest; COVID 19; Aerosol Generating Procedures*

Introduction

When Cardiac Arrest (CA) occurs, cardiopulmonary resuscitation (CPR) is administered. At the frontline, Emergency Physicians (EP) are familiar and well trained in the management of not only CA, but also any medical and surgical emergencies. Patients presenting acutely are not likely to know their infectivity status, nor their COVID 19 status, thus, universal precautions and protection must be applied. From the SARS, MERS Coronavirus, H1NI and other earlier outbreaks, infection control measures have become synonymous with frontline practice [1-3]. High levels of vigilance and alert as well as never letting our guard down at the institution's 'front door' has become standard practice. Most of the CA patients seen at the ED at Singapore General Hospital are not due to COVID 19. From the medical perspective, whether patients in CA are suspected to be COVID 19 positive, proven COVID 19 positive or the regular non COVID 19 positive patients, the appropriate decision pertaining to their resuscitation must be made and communicated appropriately to their next of kin.

On 11 March 2020, the World Health Organization (WHO) declared COVID 19 as a global pandemic. WHO also categorized CPR as an aerosol generating procedure (AGP), requiring the appropriate PPE (personal protective equipment) [4,5]. This means EPs must strike a balance between caring for their patients as well as maintaining their own health and safety. Maintaining the necessary barriers, upholding the recommended PPE practices, keeping the numbers of staff involved to the minimum needed and using environmental control measures such as negative pressure rooms, with additional HEPA (High Efficiency Particulate Air Filter) filters are some of the steps in place at the ED [6-9].

To date, over the last one and half years since the pandemic started, there have been various consensus statement, guidelines and advisories on the risks of aerosol transmission and classification as aerosol generating procedures, pertaining to CPR. Each step of CPR has had its fair share of comments ie. chest compression, defibrillation, airway management (basic airway maneuvers, bag valve mask ventilation, supra-glottic airway management and endotracheal intubation). Some of these also involve laboratory studies [6-22]. Even as some areas remain controversial, in making decisions pertaining to what frontline EPs and other staff should don to ensure adequate protection, we apply the practices as in table 1 in our ED. Ensuring the safety and well-being of our staff must take precedence. Even in areas where there are controversies, we tend to err on the side of caution and instill the necessary precautions.

Stage of Cardiac Arrest Management	Preparation, Information and Interventions	PPE Recommendations
"Standby" Call by EMS Transport by "Special 993 Ambulance"	Call via VHF (Very High Frequency) multi-channel radio Risk Information shared include: High risk for COVID + ARI (Acute Respiratory Illnesses) symptoms Non-ARI symptoms These will be for COVID+ patients, Patients on Quarantine Order Patients on "Stay Home Order" Patients from community isolation facilities	Paramedics and EMS personnel are all in compulsory PPE (N95 masks, face shields, gloves, impervious long sleeve gowns) EMS personnel have to comply with both personal and environmental/ambulance hygiene. Ambulances will be kept well ventilated when high risk cases are transported e.g. windows will be kept opened
Preparation Phase	Choice of cubicle in negative pressure resuscitation room. To ensure doors are shut once patient arrives Getting equipment ready	Staff will don appropriate PPE (N95 masks, face shields, gown, caps, gloves, shoe covers) Airway management staff (1-2 doctors and 1 nurse) will put on their PAPR as well Resuscitation cubicles are stocked with necessary equipment. Autopulse* (mechanical CPR device) will be prepared

Arrival of Cardiac Arrest Patient Decision Making Stage	Most direct route from ambulance drop-off to the resuscitation cubicle assigned (reception staff will direct accordingly) The practice of not 'bagging' the patient whilst en-route to the resuscitation cubicle (the distance is very short, approximately 10-15 seconds) Decision as to whether to resuscitate or not. Check for: Advanced Medical Directive 'Do Not Resuscitate' orders Palliative care orders Maximum Supportive Care/ Maximum Ward Care or Conservative Management only	All staff are in PPE (don during the preparatory phase)
Management: Defibrillation	Defibrillation first as needed (for shockable rhythms), using attached pads and standing 1-2 meters away from patient	As all staff have donned PPE, shock can be delivered without delays through chest pads attached (these pads are the same ones used by the EMS personnel, thus this saves time as no switching is required)
Airway Management	Airway management Mask with seal Airway assessment using checklist Endotracheal intubation Use video-laryngoscopy Most senior and experienced personnel to intubate Backup: manual laryngoscopy and other devices are readily available	Staff with PPE +PAPR will be involved
Chest Compression	Chest compression: use of mechanical CPR device. EMS personnel use LUCAS* and the ED uses Autopulse* (there is an option whether to switch or to continue with the LUCAS* device)	All staff in appropriate PPE and in negative pressure cubicle/ room

Return of Spontaneous Circulation (ROSC)	For mechanical ventilation: clamp the ETT before disconnecting from patient TTM (Therapeutic Temperature Management) Chest XRay Other investigations as appropriate Nasopharyngeal Swab for COVID 19 Admission to Isolation ICU bed with negative pressure	Radiology staff are all in PPE XRay cassette will be cleaned and disinfected appropriately (as per guidelines) Swabs are done by trained staff in negative pressure room/cubicle in full PPE/ PAPR All such admissions are discussed with the Infectious Diseases consultant on duty
No ROSC and Patient Dies	Performance of "Last Office" Include post-mortem nasopharyngeal swab Body is not released to family but isolated, until swab results are known in 1 hour	Staff in PPE Swabs are done by trained staff in negative pressure room/ cubicle in full PPE/ PAPR
Post Resuscitation Hygiene	Equipment, trolley, cubicle wipe-down and terminal cleaning according to institution guidelines	Appropriate Doffing of PPE and disposal Wipe down of PAPR/ Recharge batteries Appropriate hand hygiene
Debrief and Notification to MOH	Appropriate debriefing will be conducted by the resuscitation lead/ senior attending Notification of COVID + cases/ high risk cases will be done according to institution and Ministry of Health guidelines	Any comments and sharing arising from use of PPE can be shared e.g. any challenges, PAPR battery running out in the midst of resuscitation, checking out for each other.

Table 1: *Stages of cardiac arrest, interventions and personal protective equipment (PPE) recommendations.*

Training and personal protective equipment (PPE)

All staff in our Academic Medical Center (AMC: which includes: Singapore General Hospital, all SingHealth Cluster Institutions and Duke NUS Graduate medical School) have been trained on infection control measures and PPE donning and doffing. The training is compulsory and is tracked, inclusive of the refresher training. The types of mask each staff has been fitted for is also monitored. Certain staff in higher risk areas also have to go through PAPR training and certification. This would include staff working in the Emergency Department (ED), Resuscitation Rooms, Intensive care Units, Isolation Wards, Respiratory Medicine Units and Infectious Diseases Units. The other components of PPE include eye goggles, face shields, impervious long sleeved gowns, shoe covers and head covers (caps). Gloves are for routine use and in some cases, double gloving will be observed. All staff are also advised to shower at the end of their shifts. Staff have been wearing tee- shirts and scrub pants issued and laundered, by the institution during the pandemic.

In the ED, frequent audits are done and direct observations are made on performance of hand hygiene, proper donning and doffing of PPE, proper use of masks as well as the compulsory use of the national Trace Together Application (via mobile devices) or the Trace

Together Token. Both these represent our national initiative for contact tracing and tracking. Healthcare workers within institutions too must adhere to their usage. Besides these, staff must also be familiar with the workflow for different categories of patients such as:

- Patients with ARI (Acute Respiratory Illness) symptoms.
- Patients who fall in the NARI (Non-ARI) category.
- Screening pathways for high risk patients, including use of ART (Antigen Rapid Testing) and rapid nasopharyngeal PCR swabs.

Criteria for admission into isolation wards and ICUs

Understanding the reasoning behind these categorization and pathways is important for the staff, thus these are shared frequently by the leadership in the ED. As the pandemic evolves and new information is obtained, changes to these pathways and protocols are expected. With these, there may be a need to perform in situ simulation and healthcare failure mode effect analysis to assess the suitability and flow in the ED before rapid finalization [23,24].

Conclusion

What we have found important is the adaptability of our frontline staff, as we change and customize practices to ensure safety with evolving evidence. The way we conduct in situ testing, sharing of information and tweaking our educational methodologies to align with our clinical practice, are all important. Just as we ensure our staff safety and wellness, both physically and psychologically, we must never forget our patients well-being as well. Screening and segregating them appropriately, according to their epidemiological risks for COVID 19 and other infections is important. One final thing not to forget is that there are also our 'usual', non COVID 19 patients to be managed. Current practices represent the new norm which has evolved. We must be ready to embrace acceptable universal precautions in the 'new norm', but also be ready to make changes as we move into the future [25-27].

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