CARDIAC ARREST AND RESUSCITATION

Patient Care Goals:
- High-quality chest compressions/CPR with minimal interruption from recognition of cardiac arrest until confirmation of ROSC or field termination of care
- Early recognition and defibrillation of shockable rhythms
- Rapid identification of potential reversible causes of cardiac arrest
- Return of spontaneous circulation (ROSC)
- Preservation of neurologic function

Patient Presentation:
- This protocol applies to patients with non-traumatic cardiac arrest
- Patients suffering cardiac arrest due to severe hypothermia (see Hypothermia protocol)
- Patients with identifiable Do Not Resuscitate or equivalent such as TPOPP order (see DNR/Advanced Directives/Health Care Power of Attorney (POA) protocol)
- Patients in cardiac arrest due to traumatic etiology (see Trauma Patient Universal Management protocol)

Treatment and Interventions: (see Appendix I and Cardiac Arrest checklist))
- The most important therapies for patients suffering from cardiac arrest are prompt cardiac defibrillation and minimally interrupted, effective chest compressions.
- For patients in cardiac arrest compressions should be immediately initiated while the AED or monitor/defibrillator equipment is being retrieved and applied and that defibrillation, if indicated, be attempted as soon as the device is ready for use.
- The maximum setting on the defibrillator should be used for initial and subsequent defibrillation attempts.
- Chest compressions should resume immediately after defibrillation attempts with no pauses for pulse checks for 2 minutes regardless of the rhythm displayed on the cardiac monitor
- All attempts should be made to prevent avoidable interruptions in chest compressions, such as pre-charging the defibrillator and hovering over the chest, rather than stepping away during defibrillations
- If feasible, IV or IO access should be obtained (IV preferred when can be obtained without delay)
- If IO is successful continue to attempt IV access and begin using IV route when established.
- Administer epinephrine (see epinephrine formulary and FRG) as soon as vascular access is obtained.
- Continue the two minute cycles of chest compressions, followed by rhythm analysis and defibrillation of shockable rhythms
Airway management should begin simultaneously with immediate compressions/defibrillation when enough providers are available on-scene. However, compressions/defibrillation take priority over airway management when lacking in adequate resources/personnel.

Regarding airway management/ventilation consider the following principles:
- **The airway management strategy should not interrupt compressions**
- Successful resuscitation from cardiac arrest depends primarily on effective, minimally interrupted chest compressions and prompt defibrillation
- **Airway management is of secondary importance and should not interfere with compressions and defibrillation.**

Options for airway management include:
- Immediate placement of SGA in adults with BVM ventilation at 10 breaths per minute (1 breath every 10 compressions), applied during the upstroke between compressions, without interrupting the compressions
- When SGA unavailable BVM/Oral Airway ventilation (2-person BVM preferred) with continuous compressions with ventilation every 10th compression (10 breaths per minute) applied during the upstroke between compressions.

- **Pediatric Consideration:** For multiple rescuer CPR in children, use 15:2 compression to ventilation ratio. (30:2 for single rescuer).
  - **BVM/oral airway is preferred method of airway management in pediatric patients for cardiac arrest**
    - If BVM is unsuccessful SGA may be placed
    - Intubation should only be attempted when BVM and SGA have failed to adequately secure the airway.

- **Newborn/Neonates Consideration:** For neonates, use 3:1 compression to ventilation ratio (see Newly Born/Neonatal Resuscitation protocol)
  - Advanced airway placement:
    - Only place endotracheal tube if unable to ventilate through less invasive methods and do NOT pause compressions to place ET tube.
    - Ventilations are provided at 10 breaths/minute for adults
  - **Pediatric Consideration:** for children, 1 breath every 3-5 seconds is recommended (12-20 breaths/minute)

- **Consider use of an antiarrhythmic** for recurrent VF/Pulseless VT that is unresponsive to CPR, defibrillation and epinephrine. (amiodarone and lidocaine are equivalent in efficacy)
  - *Amiodarone* (see amiodarone formulary and FRG)
  - *Lidocaine* (see lidocaine formulary and FRG)
  - Once patient has received maximum dose of one antiarrhythmic can consider switching to other antiarrhythmic medication.

- **Consider Double Sequential Defibrillation (DSD)** for ADULTS with refractory pulseless (VF/VT) after 5 unsuccessful single defibrillations (AED shocks count toward total) and at least one dose of epinephrine and one dose of antiarrhythmic have been given.
Mechanical CPR device can be placed after 20 minutes of resuscitation when available (acceptable to apply sooner under certain circumstances defined by Medical Director)

Consider reversible causes of cardiac arrest which include the following:
  - Hypothermia (see Hypothermia protocol)
  - The dialysis patient/known hyperkalemic patient: Additions to care include the following:
    - Administer calcium chloride (see calcium chloride formulary and FRG) should be given early in cardiac arrest
    - Administer sodium bicarbonate (see sodium bicarbonate formulary and FRG)
  - Tricyclic antidepressant overdose (TCA) - Additions to care include:
    - Administer sodium bicarbonate (see sodium bicarbonate formulary and FRG)
  - Hypovolemia - Additions to care may include:
    - Administer normal saline bolus (see normal saline formulary and FRG)
  - Hypoglycemia-Additions to care include:
    - Administer dextrose 10% (see dextrose formulary and FRG)

If at any time during this period of resuscitation the patient regains return of spontaneous circulation, treat per Post-ROSC Care protocol (see Post-ROSC checklist)

If resuscitation remains ineffective, consider termination of resuscitation when appropriate (see Termination of Resuscitation protocol/checklist)

Key Considerations:

Effective chest compressions and defibrillation are the most important therapies to the patient in cardiac arrest. Effective chest compressions are defined as:
  - Ensuring metronome use
  - Depth of at least 2 inches (5 cm) and less than 2.4 inches (6cm) for adults and children or 1.5 inches (4 cm) for infants; adolescents who have entered puberty should receive the same depth of chest compressions as an adult
  - Allow for complete chest recoil (avoid leaning)
  - Minimize interruptions in compressions
  - Avoid rescuer fatigue by rotating rescuers at least every 2 minutes.
  - Quantitative end-tidal CO2 should be used to monitor effectiveness of chest compressions
  - If ETCO2 less than 10 mmHg during the initial phases of resuscitation, attempt to improve chest compression quality
  - Use real-time feedback for CPR quality during resuscitation.
Chest compressions are usually the most rapidly applied therapy for the patient in cardiac arrest and should be applied as soon as the patient is noted to be pulseless. If the patient is being monitored with pads in place at the time of arrest, immediate defibrillation should take precedence over all other therapies, however, if there is any delay in defibrillation (for instance, in order to place pads), chest compressions should be initiated while the defibrillator is being applied.

Chest compressions should be reinitiated immediately after defibrillation as pulses, if present, are often difficult to detect and rhythm and pulse checks interrupt compressions.

Continue chest compressions between completion of AED analysis and AED charging.

Effectiveness of chest compressions decreases with any movements therefore patients should be resuscitated as close to the point at which they are first encountered and should only be moved if the conditions on scene are unsafe or do not operationally allow for resuscitation.

Chest compressions are also less effective in a moving vehicle.

It is also dangerous to EMS providers, patients, pedestrians, and other motorists to emergently transport patients in cardiac arrest.

For these reasons and because in most cases the care provided by EMS providers is equivalent to that provided in emergency departments, resuscitation should occur on scene in most scenarios for medical cardiac arrest patients.

The maximum setting on the defibrillator should be used for initial and subsequent defibrillation attempts. (see FRG for defibrillation dosing)

Principles of airway management in cardiac arrest:
  o Airway management should not interrupt chest compressions
  o Carefully follow ventilation rate and prevent hyperventilation
  o Squeeze bag on upstroke of chest compression
  o Consider limited tidal volumes and don’t oversqueeze BVM bag (use one hand only)

It is realistic for EMS providers to tailor the sequence of rescue actions to the most likely cause of arrest.

**Pediatric Considerations:** Special attention should be applied to the pediatric population and airway management/respiratory support. Given that the most likely cause of cardiac arrest is respiratory, airway management may be considered early in the patient’s care.

However, the order of Circulation-Airway-Breathing is still recommended as the order of priority by the American Heart Association for pediatric resuscitation in order to ensure timely initiation of chest compressions to maintain perfusion, regardless of the underlying cause of the arrest.

In addition, conventional CPR is preferred in children, since it is associated with better outcomes when compared to compression-only CPR.
Special Circumstances in Cardiac Arrest
  o Trauma, treat per **Trauma Patient Universal Management**
  o Pregnancy
    ▪ The best hope for fetal survival is maternal survival
    ▪ Position the patient in the supine position with a second rescuer performing manual uterine displacement to the left in an effort to displace the gravid uterus and increase venous return by avoiding aorto-caval compression
    ▪ If manual displacement is unsuccessful, the patient may be placed in the left lateral tilt position at 30°. This position is less desirable than the manual uterine displacement as chest compressions are more difficult to perform in this position
    ▪ Chest compressions should be performed slightly higher on the sternum than in the non-pregnant patient to account for elevation of the diaphragm and abdominal contents in the obviously gravid patient
    ▪ Defibrillation should be performed as in non-pregnant patients
    ▪ Early attempt to contact MD1020 for field response to any potential maternal cardiac arrest for possible peri-mortem C-section.
    ▪ Rapid transport to closest facility for possible peri-mortem C-section is indicated.
  o Arrests of respiratory etiology (including drowning) – In addition to the above, consider early management of the patient’s airway.

**Patient/Provider Safety Considerations:**
  ➢ Performing manual chest compressions in a moving vehicle may pose a provider safety concern and mechanical CPR device should be utilized when available.
  ➢ In addition, manual chest compressions during patient movement are less effective in regards to hands on time, depth, recoil and rate and mechanical CPR devices should be utilized during patient extrication/movement when available.
  ➢ Ideally, patients should be resuscitated on-scene unless environmental/logistics/operational/clinical concerns dictate otherwise.
  ➢ Risks and benefits should be considered before patient movement in cardiac arrest situations.