CARDIAC ARREST

GENERAL CONSIDERATION

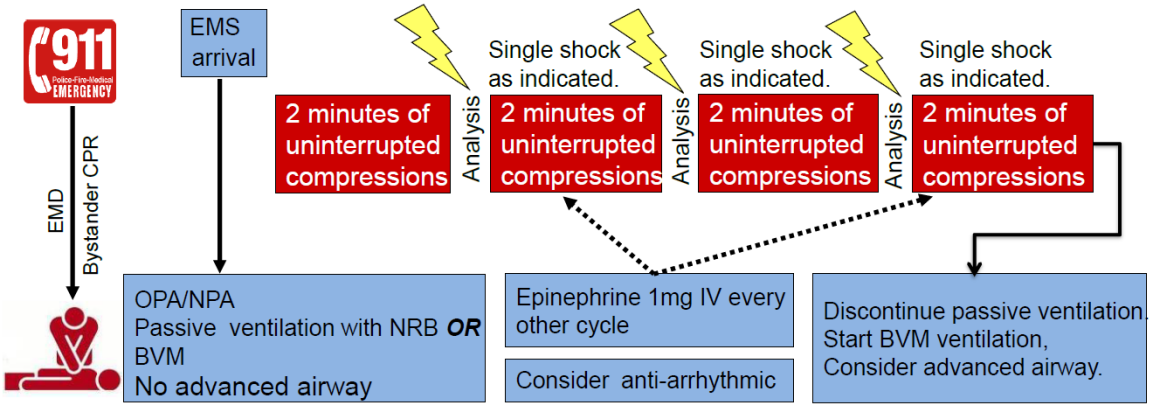
A. Age delineation: Infant CPR guidelines apply to victims less than one year of age; Child CPR guidelines apply to victims one year of age to the onset of adolescence or puberty (about 12-14 years of age) and Adult guidelines apply to those older than adolescence / puberty.

B. High quality CPR should be initiated immediately and should not be interrupted for more than 10 seconds until a spontaneous pulse is established. High quality CPR includes: Minimizing interruptions in chest compressions, ensuring full chest recoil, pushing hard and fast (100-120 compressions per minute) and avoiding hyperventilation.

C. Rotate compressors every 2 minutes to prevent fatigue.

D. In cases of ADULT cardiac arrest of suspected CARDIAC origin (i.e. arrests not secondary to trauma, respiratory causes, drowning, drug overdose, etc), then CardioCerebral Resuscitation (CCR) should be performed for the first 8 minutes. When unsure, default to CCR, as most arrests are cardiac in origin. Unless high-quality bystander CPR is being performed as you arrive on-scene (in which case go straight to analyzing for defibrillation), start with 2 minutes of uninterrupted chest compressions, with a non-rebreather mask or bag-valve mask in place for oxygenation. Do NOT interrupt chest compressions to ventilate patient. If necessary, an OPA or NPA can be inserted. Advanced airway insertion is unnecessary. After 2 minutes, analyze the patient for a shockable rhythm and shock as indicated. Afterward, return to uninterrupted CPR with passive oxygenation and administer antiarrhythmics (epinephrine or amiodarone) as indicated. Do this for a total of 8 minutes (4 cycles of CCR). Then, if unsuccessful, revert to standard 30:2 ACLS and consider an advanced airway, delivering 1 breath every 6 seconds (10 breaths/minute).

CardioCerebral Resuscitation (CCR)



E. In order to minimize interruptions in chest compressions early in resuscitation, patients should not be moved until at least 4 cycles (2 minutes each) of CCR have been performed. If the situation allows, consider continuing resuscitation on scene until return of spontaneous circulation (ROSC) or termination of resuscitation.

F. Patient care should be managed in an organized fashion, rotating treatment and therapies around CCR/CPR rounds. Team members should be assigned roles to limit confusion and enhance the chance of a successful resuscitation.

G. The evidence does not demonstrate a benefit with the use of mechanical piston devices for chest compressions versus manual chest compressions in patients with cardiac arrest. Manual chest compressions remain the standard of care for the treatment of cardiac arrest. However, such a device may be a reasonable alternative to conventional CPR in specific settings where the delivery of high-quality manual compressions may be challenging or dangerous for the provider. If device is used, follow manufacturer recommendations.

H. If an advanced airway is placed, rescuers no longer deliver "cycles" of CPR. Give continuous chest compressions at a rate of 100-120 compressions/min without pausing for breaths. Deliver 10 breaths per minute (one breath every 6 seconds), asynchronous with chest compressions. Each breath is delivered over one second with enough volume to cause chest rise. Check rhythm every two minutes. Quantitative waveform capnography should be used to confirm airway placement and monitor quality of CPR.

I. The ideal defibrillation dose using a biphasic defibrillator is the dose at which the device waveform has been shown to be effective in terminating Ventricular Fibrillation (VF). Use manufacturer's recommendations for defibrillation energy level. If unknown, use the maximum level (200J on a biphasic device, 360J on a monophasic device).

J. Each IV/IO push medication should be followed by a 20 ml NS flush for adults and 5-10 ml NS flush for pediatrics. If IV/IO cannot be established, epinephrine and atropine may be administered through the endotracheal tube. Drugs given through the ET tube are double the IV dose.

K. Pulse checks only need to be performed during rhythm analysis when an organized rhythm is present (i.e., PEA).

L. If patient has ROSC, provide treatment per the Post-Cardiac Arrest Care Protocol.

M. **If there is no response to an adequate trial of BLS or ACLS on scene, termination of resuscitation should be considered. See Terminating Resuscitative Efforts for the Adult Patient Protocol.**

Basic EMT

A. Assess patient for responsiveness, respiratory status and pulse. Pulse and respiratory status check should last no longer than 10 seconds, begin CPR immediately and contact ALS unit.
    1. Compression rate: 100-120 compressions/min.
    2. Compression depth:
        a. Adults –at least 2"
        b. Child – at least 1/3 the AP diameter; about 2"
        c. Infant – at least 1/3 the AP diameter; about 1 ½"
    3. Compression-to-Ventilation Ratio (until advanced airway is placed):
        a. Adult – CCR for first 8 minutes, then 30:2 for one or two rescuers
        b. Infant and Child – 30:2 for single rescuer; 15:2 for two rescuers
    4. Ventilations with advanced airway: one breath every 6 seconds (10 breaths per minute). Delivered asynchronously with chest compressions.

B. Apply AED and activate device. Pediatric attenuating system / pediatric pads are preferred for infant and child <8 years. If not available, use adult AED pads.
    1. **"Shock Advised"**
        a. Deliver shock

b. Resume CCR/CPR immediately after shock, for two minutes before next rhythm check
c. Manage airway with NRB, BVM, supplemental oxygen, and airway adjunct such as NPA or OPA
d. After 2 minutes of chest compressions – Activate AED to assess rhythm and deliver single shock if indicated.
e. Resume CPR immediately beginning with chest compressions.
f. Continue cycles of chest compressions and AED analysis with shock delivery as indicated
g. Transport and Contact Medical Control and advise of cardiac arrest. Consider ALS intercept.
h. If Return of Spontaneous Circulation at any time – Contact Medical Control and Transport. Consider ALS intercept.

2. **"No Shock Advised"**
   a. Resume CCR/CPR for two minutes before next rhythm check
   b. Manage airway with NRB, BVM, supplemental oxygen, and airway adjunct such as NPA or OPA
   c. After 2 minutes of chest compressions – Activate AED to assess rhythm and deliver single shock if indicated.
   d. Continue cycles of chest compressions and AED analysis with shock delivery, as indicated
   e. Contact Medical Control and Transport Infant / Child victim. Consider ALS Intercept. For Adult victim – Consider if candidate for Termination of Resuscitation protocol on-scene.
   f. If Return of Spontaneous Circulation at any time – Contact Medical Control and Transport. Consider ALS intercept.

Advanced EMT

A. Apply cardiac monitor and check rhythm:

1. **Ventricular Fibrillation / Pulseless Ventricular Tachycardia:**
   a. Deliver single shock:
      - **Initial Adult dose**: energy level is device-specific for biphasic defibrillators (if unknown use 200 J); 360 J for monophasic defibrillators
      - **Subsequent Adult dose**: should be equivalent to initial dose and higher energy levels may be considered if available
      - **Initial Infant / Child dose**: 2 J/kg
      - **Subsequent Infant / Child dose**: 4 J/kg and higher energy levels may be considered, not the exceed 10 J/kg or the adult maximum (360 J)
   b. Resume CCR/CPR as above, while other team members are completing steps c & d.
   c. Manage airway with BVM, supplemental oxygen, or an airway adjunct (e.g. NPA or OPA). Consider an advanced airway after 8 minutes of CCR are complete.
   d. Start IV/IO normal saline
   e. After 2 minutes of compressions, check rhythm – **no change** - deliver single shock
   f. Continue cycles of CPR and rhythm analysis with shock delivery
   g. Contact medical control and advise of cardiac arrest. Consider ALS intercept.
   h. If Return of Spontaneous Circulation at any time – Contact Medical Control and Transport. Consider ALS intercept.

2. **Asystole / Pulseless Electrical Activity (PEA)**
   a. Resume CCR/CPR as above, while other team members are completing steps b & c.
   b. Manage airway with BVM, supplemental oxygen, or an airway adjunct (e.g. NPA or OPA). Consider an advanced airway after 8 minutes of CCR are complete.
   c. Start IV/IO normal saline
   d. After 2 minutes of compressions, check rhythm
   e. Continue cycles of CPR and rhythm analysis with shock delivery as indicated
   f. Consider treatable causes:
      - Hypovolemia – give fluid boluses (250-500 ml for adults; 20 ml/kg for infant / child)
      - Hypoxia – adequate airway management
      - Tension pneumothorax – perform needle decompression
      - Hypoglycemia – administer glucose IV/IO
   g. Contact Medical Control and Transport Infant / Child victim. Consider ALS Intercept. For Adult victim – Consider if candidate for Termination of Resuscitation protocol.
   h. If Return of Spontaneous Circulation at any time – Contact Medical Control and Transport. Consider ALS intercept.

Paramedic

A. Apply cardiac monitor and check rhythm:

1. **Ventricular Fibrillation / Pulseless Ventricular Tachycardia:**
    a. Deliver single shock:
        - **Initial Adult dose**: energy level is device-specific for biphasic defibrillators (if unknown use 200 J); 360 J for monophasic defibrillators
        - **Subsequent Adult dose**: should be equivalent to initial dose and higher energy levels may be considered if available
        - **Initial Infant / Child dose**: 2 J/kg
        - **Subsequent Infant / Child dose**: 4 J/kg and higher energy levels may be considered, not the exceed 10 J/kg or the adult maximum (360 J)

    b. Resume CCR/CPR as above, while other team members are completing steps c through e
    c. Manage airway with BVM, supplemental oxygen, or an airway adjunct (e.g. NPA or OPA). Consider an advanced airway after 8 minutes of CCR are complete.
    d. Start IV/IO normal saline
    e. Administer Epinephrine 1:10,000 IVP every 3-5 minutes
        - **Adult dose** – 1 mg
        - **Infant / Child dose** – 0.01 mg/kg (0.1 ml/kg)
    f. After 2 minutes of compressions, check rhythm – **no change** - deliver single shock
    g. Resume compressions for 2 minutes while team members are completing step h.
    h. Administer antiarrhythmic:
        - Amiodarone
            - **Adult dose**: 300 mg IV/IO diluted in 20-30 ml NS (second dose 150 mg IV/IO diluted in 20-30 ml NS)
            - **Infant / Child dose**: 5 mg/kg IV/IO; may be repeated up to two times to a maximum of 15 mg/kg
        - Magnesium (for Torsades de pointes)
            - **Adult dose**: 1-2 grams IV/IO
            - **Infant / Child dose**: 25-50 mg/kg IV/IO (max dose is 2 grams)
    i. Continue cycles of CCR/CPR and rhythm analysis with shock delivery as indicated in addition to medication administration
    j. Contact medical control and advise of cardiac arrest.
    k. Return of Spontaneous Circulation at any time – Contact Medical Control and Transport.

2. **Asystole / PEA**
    a. Resume CCR/CPR as above, while other team members are completing steps b through e.
    b. Manage airway with BVM, supplemental oxygen, or an airway adjunct (e.g. NPA or OPA). Consider an advanced airway after 8 minutes of CCR are complete.
    c. Start IV/IO normal saline
    d. Administer Epinephrine 1:10,000 IV/IO every 3-5 minutes
        - **Adult dose** – 1 mg
        - **Infant / Child dose** – 0.01 mg/kg (0.1 ml/kg)

e. Consider treatable causes:
    - Hypovolemia – give fluid boluses (250-500 ml for adults; 20 ml/kg for infant / child)
    - Hypoxia – adequate airway management
    - Hyperkalemia – consider sodium bicarbonate / calcium
    - Tension pneumothorax – perform needle decompression
    - Tricyclic overdose – consider sodium bicarbonate
    - Hypoglycemia – administer glucose IV/IO
f. After 2 minutes of compressions, check rhythm
g. Continue cycles of CCR/CPR and rhythm analysis with shock delivery as indicated in addition to medication administration
h. Contact Medical Control and Transport Infant / Child victim. For Adult victim – Consider if candidate for Termination of Resuscitation protocol.
i. If Return of Spontaneous Circulation at any time – Contact Medical Control and Transport.

A. Special Considerations:
1. In some special resuscitation situations, such as preexisting metabolic acidosis, hyperkalemia, or tricyclic antidepressant overdose sodium bicarbonate can be beneficial. However, routine use of sodium bicarbonate is not recommended for patients in cardiac arrest. When it is used for special situations, administer 1 mEq/kg IV/IO.
2. For dialysis patient / Hyperkalemic patient in cardiac arrest administer:
    a. Calcium gluconate (10%) 15-30 ml IV/IO over 2-5 minutes, flush line vigorously with normal saline, then administer:
    b. Sodium Bicarbonate 50 mEq IV/IO over 5 minutes.
3. If there is a high index of suspicion of narcotic overdose administer naloxone (Narcan), 4 mg IN. May repeat dose one time in 2-3 minutes if there is no improvement.

POST-CARDIAC ARREST CARE

Basic EMT

A. Stabilize first, dont feel compelled to "load and go" just yet. Optimize the patient before transporting them.

B. Continuous monitoring of pulse oximeter, capnography and q5 minute vital signs

C. Maintain airway management. Supplemental oxygen to keep $SpO_2 \geq 94\%$. Ventilate at rate of 10 breaths per minute and titrated to achieve $PETCO_2$ of 35-40 mm Hg.

D. Assist AEMT or Paramedic with obtaining a 12-lead ECG and transmit

E. If patient remains unconscious, start external cooling with ice packs to the groin and axillae. Chilled IV fluids are not used in EMS.

F. Elevate head 30° if tolerated.

G. Transport. Consider ALS intercept.

Advanced EMT / Paramedic

A. Treat hypotension (SBP < 90 mmHg in adults and age-specific for pediatrics)
   1. Adult dose – 250 ml bolus of normal saline. May repeat as needed.
   2. Infant / child – 20 ml/kg
   3. Consider treatable causes
   4. **PARAMEDIC ONLY** Consider starting an Epinephrine drip (see “Dirty Epi drip” formulation in drug boxes) if IV fluids do not correct hypotension

B. Treat dysrhythmia per protocol.

C. Obtain a 12-lead ECG and transmit. Activate STEMI alert if ECG is positive for a STEMI.

TERMINATING RESUSCITATIVE EFFORTS FOR ADULT PATIENTS

GENERAL CONSIDERATIONS

A. Field termination of resuscitation reduces unnecessary transport reducing associated road hazards, reduces the risk of exposing providers to illness and injury, and the cost to the family of pronouncement in the Emergency Department. While it is always important to "read the room" and maintain situational awareness, in general the transport of dead patients should be avoided.

B. CPR that is performed during transport is demonstrably inferior to CPR performed in a flat, controlled, stationary environment (e.g. living room). Survival is linked to optimizing patient care early while on-scene during the electrical phase of cardiac arrest, rather than rushing to the hospital.

C. This protocol should only be considered for adult patients.
   1. No predictors of neonatal or pediatric out-of-hospital resuscitation success or failure have been established. No validated clinical decision rules have been derived and evaluated. Further research in this area is needed.
   2. Follow Pediatric BLS and PALS guidelines, contact Medical Control and transport the pediatric patient to the most appropriate facility.

D. Notifying family members of the death of a loved one is an important aspect of resuscitation and should be performed compassionately, with care taken to consider the family's culture, religious beliefs and preconceptions surrounding death, and any guilt they may feel associated with the event or circumstances preceding the event.

Basic EMT / Advanced EMT

A. Rescuers who start BLS should continue resuscitation until one of the following occurs:
   1. Restoration of effective, spontaneous circulation
   2. Care is transferred to a team providing advanced life support
   3. The rescuer is unable to continue because of exhaustion, the presence of dangerous environmental hazards, or because continuation of the resuscitative efforts places others in jeopardy
   4. Reliable and valid criteria for indicating irreversible death are met, criteria for obvious death are identified, or criteria for termination of resuscitation are met.

B. "BLS Termination of Resuscitation Rule". All three of the following criteria must be present before terminating BLS resuscitative efforts for the adult patient:
   1. Cardiac arrest was not witnessed by the EMT or first responder;
   2. No return of spontaneous circulation (ROSC) despite maximal intervention
   3. No AED shocks were delivered
   4. ETCO2 is < 10 mmHg when no CPR is being performed (no cellular respiration)

      - OR -

      Total time elapsed from the time the patient was first found down/911 was activated has exceeded 30 minutes.

C. When the above criteria are met, the team continues CPR per AHA guidelines while the EMT in charge contacts Medical Control and requests permission to terminate resuscitation.
   1. Once resuscitative efforts are terminated follow the DOA Protocol.
   2. Documentation should be completed and forwarded to your Medical Control EMS Office within 48 hours of the call.

CI. If any of the above criteria are missing or Medical Control does not authorize terminating resuscitation, continue resuscitation and transport to most appropriate facility.

Paramedic

A. Consider earlier termination of resuscitation efforts for the adult cardiac arrest patient that does not respond to at least 20 minutes of ALS care or 30 minutes of total downtime starting when the patient was first found down/911 was activated.

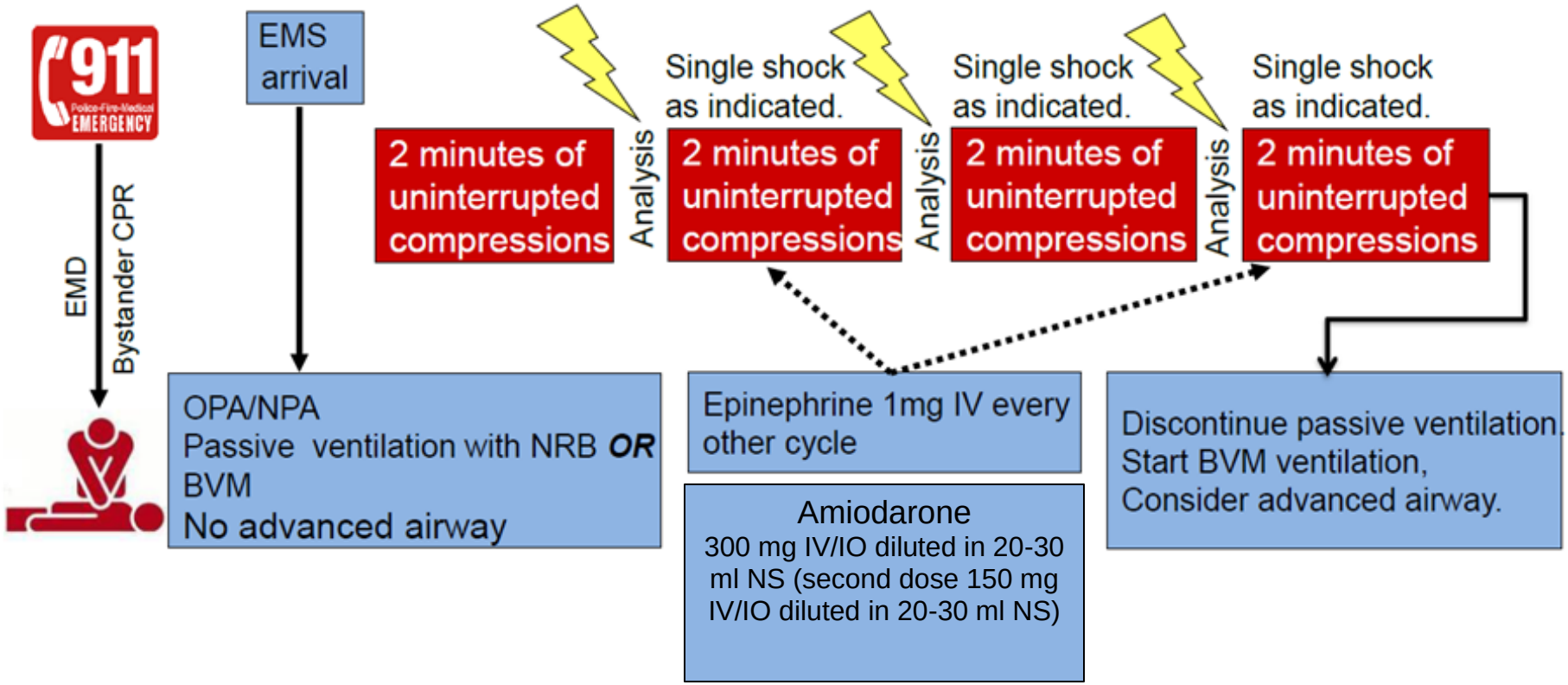
B. "ALS Termination of Resuscitation Rule". All of the following criteria must be met before terminating ALS resuscitative efforts for the adult patient:
   1. The cardiac arrest was not witnessed;
   2. No bystander CPR was provided
   3. No ROSC after full ALS care
   4. No AED shocks were delivered
   5. ETCO2 is < 10 mmHg when no CPR is being performed (no cellular respiration)

      - OR –
      Total time elapsed from the time the patient was first found down/911 was activated has exceeded 30 minutes.

C. When the above criteria are met, the team continues CPR per AHA guidelines while the Paramedic in charge contacts Medical Control and requests permission to terminate resuscitation.
   1. Once resuscitative efforts are terminated follow the DOA Protocol.
   2. Documentation should be completed and forwarded to your Medical Control EMS Office within 48 hours of the call.

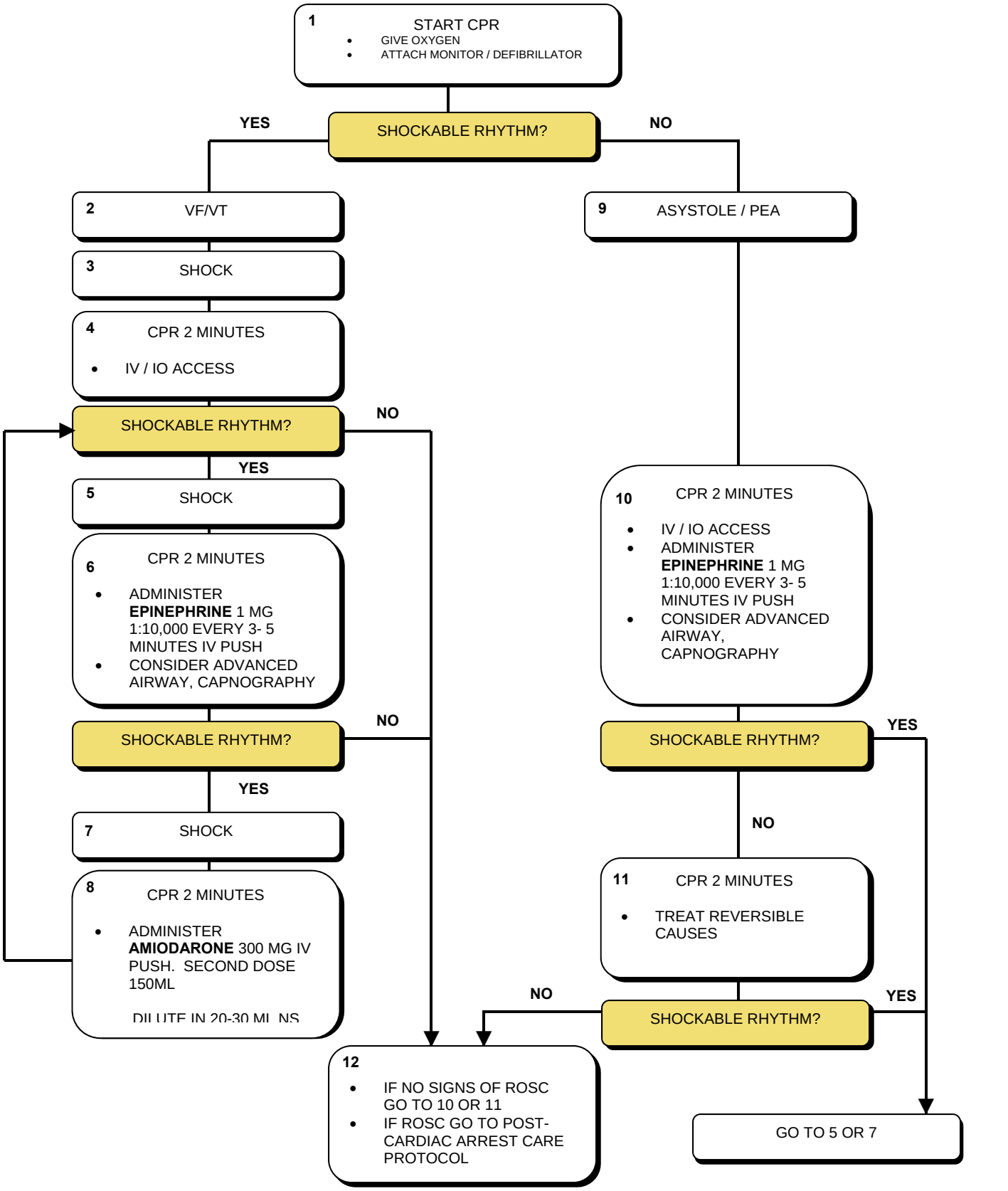
D. If any of the above criteria are missing or Medical Control does not authorize terminating resuscitation, continue resuscitation and transport to most appropriate facility.

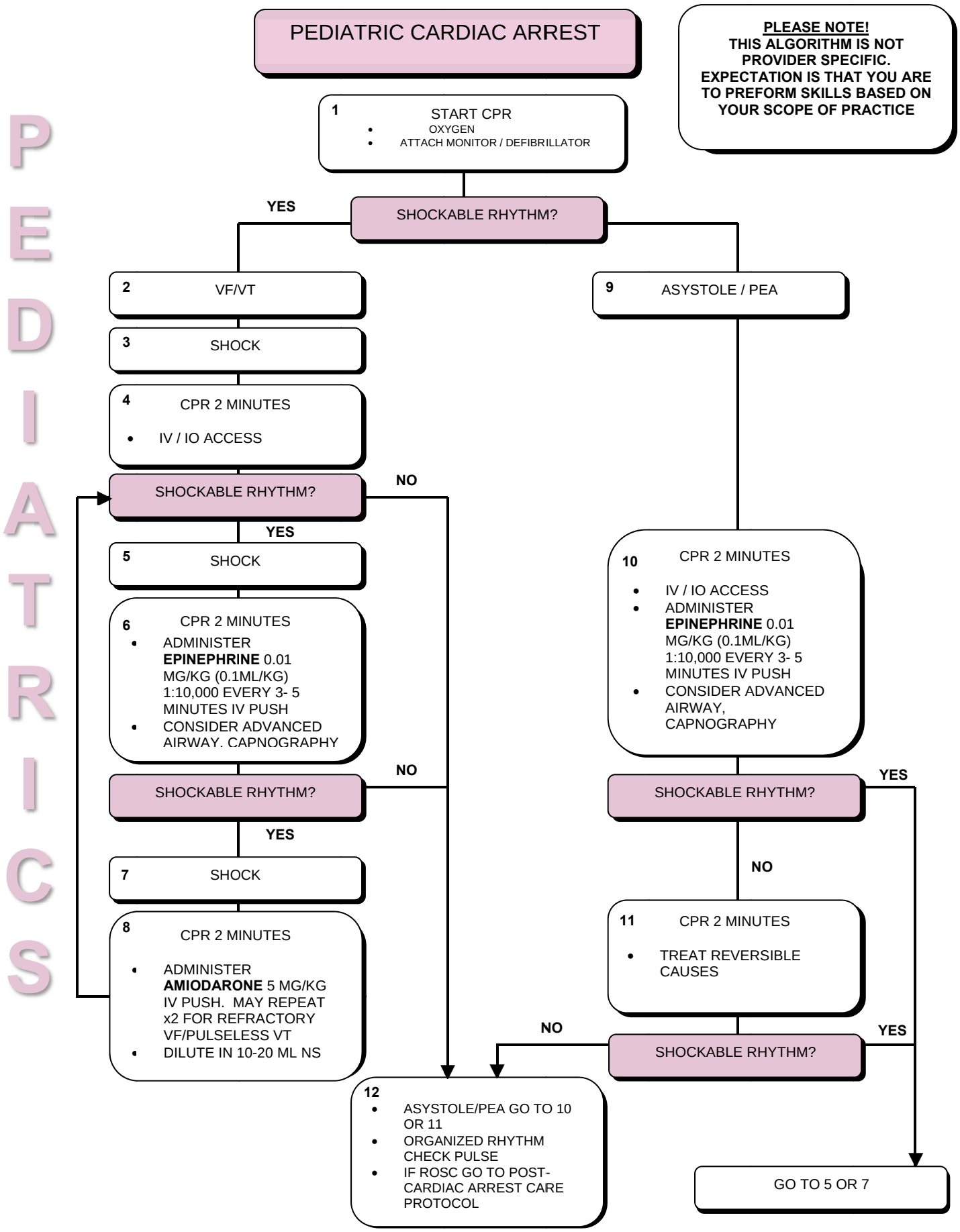
CARDIOCEREBRAL RESUSCITAION
CCR



ADULT CARDIAC ARREST CPR/ACLS

PLEASE NOTE!
THIS ALGORITHM IS NOT PROVIDER SPECIFIC. EXPECTATION IS THAT YOU ARE TO PREFORM SKILLS BASED ON YOUR SCOPE OF PRACTICE




PEDIATRIC CARDIAC ARREST
PEDIATRICS
PLEASE NOTE!
THIS ALGORITHM IS NOT PROVIDER SPECIFIC. EXPECTATION IS THAT YOU ARE TO PREFORM SKILLS BASED ON YOUR SCOPE OF PRACTICE
1
START CPR
OXYGEN
ATTACH MONITOR / DEFIBRILLATOR
SHOCKABLE RHYTHM?
YES
NO
2
VF/VT
3
SHOCK
4
CPR 2 MINUTES
IV / IO ACCESS
SHOCKABLE RHYTHM?
YES
NO
5
SHOCK
6
CPR 2 MINUTES
ADMINISTER EPINEPHRINE 0.01 MG/KG (0.1ML/KG) 1:10,000 EVERY 3- 5 MINUTES IV PUSH
CONSIDER ADVANCED AIRWAY, CAPNOGRAPHY
SHOCKABLE RHYTHM?
YES
NO
7
SHOCK
8
CPR 2 MINUTES
ADMINISTER AMIODARONE 5 MG/KG IV PUSH. MAY REPEAT x2 FOR REFRACTORY VF/PULSELESS VT
DILUTE IN 10-20 ML NS
9
ASYSTOLE / PEA
10
CPR 2 MINUTES
IV / IO ACCESS
ADMINISTER EPINEPHRINE 0.01 MG/KG (0.1ML/KG) 1:10,000 EVERY 3- 5 MINUTES IV PUSH
CONSIDER ADVANCED AIRWAY, CAPNOGRAPHY
SHOCKABLE RHYTHM?
YES
NO
11
CPR 2 MINUTES
TREAT REVERSIBLE CAUSES
SHOCKABLE RHYTHM?
YES
NO
12
ASYSTOLE/PEA GO TO 10 OR 11
ORGANIZED RHYTHM CHECK PULSE
IF ROSC GO TO POST-CARDIAC ARREST CARE PROTOCOL
GO TO 5 OR 7

POST ARREST CARE

KEY

- BASIC EMT
- ADVANCED EMT
- PARAMEDIC
- MED CONTROL

- CONTINUOUS MONITORING OF PULSE OXIMETER, CAPNOGRAPHY, AND VITALS
  - MAINTAIN O2 SATS ≥ 94%
  - MAINTAIN END TIDAL CO_2 35-40 MMHG
- MAINTAIN AIRWAY MANAGEMENT
  - VENTILATE 10 BREATHS PER MINUTE
- PERFORM 12 LEAD ECG AND TRANSMIT
- ELVATE HEAD OF PATIENT 30° IF TOLERATED
- TRANSPORT. CONSIDER ALS INTERCEPT

- TREAT HYPOTENSION
  - ADULTS 1-2 LITERS OF **NORMAL SALINE**
  - INFANT / CHILD 20 ML/KG
  - CONSIDER TREATABLE CAUSES
- TREAT DYSRHYTHMIA PER PROTOCOL

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