

*Michigan*  
**Pediatric Cardiac Protocols**

Date: March, 2011

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PEDIATRIC ASYSTOLE/PEA

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***Pediatric Asystole / Pulseless Electrical Activity***

During CPR, consider reversible causes of Asystole/PEA and treat as indicated. Causes and efforts to correct them include but are not limited to:

- Hypovolemia – 20 ml/kg fluid bolus
- Hypoxia – reassess airway and ventilate with high flow oxygen
- Tension pneumothorax – see **Pleural Decompression Procedure**
- Hypothermia – follow **Hypothermia Cardiac Arrest Protocol**, consider rapid transport
- Hyperkalemia (history of renal failure) – Contact Medical Control, possible Calcium Chloride / Sodium Bicarbonate

**Pre-Medical Control**

**PARAMEDIC**

1. Follow the **Pediatric Cardiac Arrest - General Protocol**.
2. Confirm that patient is in asystole by evaluating more than one lead.
3. Administer Epinephrine 1:10,000, 0.01 mg/kg (0.1 ml/kg) IV/IO up to 1 mg (10 ml), repeat every 3-5 minutes.
4. Continue CPR for two minutes or 10 cycles and reassess rhythm.

**Post-Medical Control**

**PARAMEDIC**

1. In a dialysis patient hyperkalemia is likely. Administer Calcium Chloride 10 %, 20 mg/kg (0.2 ml/kg) IV/IO, maximum single dose 1 g, and Sodium Bicarbonate 1 mEq/kg IV/IO with 20 ml NS flush in between medications.

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PEDIATRIC BRADYCARDIA

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### ***Pediatric Bradycardia***

This protocol applies to pediatric patients with bradycardia, a pulse and poor perfusion. Identify and treat the underlying cause

- Maintain patent airway; assist breathing as necessary
- Oxygen
- Cardiac monitor to identify rhythm; monitor blood pressure and oximetry
- IV/IO access
- 12-lead ECG if available; don't delay therapy

### **Pre-Medical Control**

#### **PARAMEDIC**

1. Follow the **Pediatric Assessment & Treatment Protocol**.
2. If signs of Cardiorespiratory compromise are evident:
  - a. Perform chest compression/CPR.
  - b. If HR less than 60 despite oxygenation & ventilation, administer Epinephrine 1:10,000, 0.01 mg/kg (0.1 ml/kg) IV/IO up to 1 mg (10 ml), repeat every 3-5 minutes.
3. If suspected increased vagal tone or primary AV block:
  - a. Administer Atropine 0.02 mg/kg IV/IO (minimum dose 0.1 mg, maximum single dose 0.5 mg) may repeat once in 5 minutes.
  - b. Consider transcutaneous pacing at rate up to 100 bpm.
4. Sedation may be used to facilitate transcutaneous pacing per MCA selection.

#### **Sedation :**

#### **(Select Options)**

#### **(Titrate to minimum amount necessary)**

- Midazolam 0.05 mg/kg IV/IO titrated slowly, may repeat once in 5 minutes to a maximum of 0.1 mg/kg.
- Diazepam 0.1 mg/kg IV/IO titrated slowly, may repeat every 5 minutes to a maximum of 0.3 mg/kg.
- Lorazepam 0.1 mg/kg, max single dose 4 mg IV/IO titrated slowly, may repeat every 5 minutes to a maximum of 8 mg.
- Fentanyl 1 mcg/kg IV/IO titrated slowly, may repeat once in 5 minutes to a maximum of 2 mcg/kg.

### **Post-Medical Control**

5. Additional orders as appropriate.

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**Notes:**

1. Signs of cardiopulmonary compromise include:
  - a. Hypotension is SBP less than  $70 + (\text{age} \times 2)$ .
  - b. Acutely altered mental status.
  - c. Signs of shock - indicated by absent or weak peripheral pulses, increased capillary refill time, skin cool/mottled.
  - d. Respiratory difficulty (respiratory rate greater than 60/minute) indicated by increased work of breathing (retractions, nasal flaring, grunting), cyanosis, altered level of consciousness (unusual irritability, lethargy, failure to respond to parents), stridor, wheezing.

When CPR is required, a precise diagnosis of the specific bradyarrhythmia is not important. Perform chest compressions if, despite oxygenation and ventilation, the heart rate is less than 60/minute and associated with cardiopulmonary compromise in infant or child. If severe hypothermia, do not perform chest compressions and follow **Hypothermia Cardiac Arrest Protocol**.

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PEDIATRIC CARDIAC ARREST – GENERAL PROTOCOL

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***Pediatric Cardiac Arrest – General***

This protocol should be followed for all pediatric cardiac arrests.

- If an arrest is of a known traumatic origin refer to the **Dead on Scene Protocol**.
- If it is unknown whether the arrest is traumatic or medical, continue with this protocol.
- When an ALS unit is present, follow this general cardiac arrest protocol in conjunction with the protocol that addresses the identified rhythm.
- Once arrest is confirmed, emphasis should be on avoiding interruptions in CPR.
- CPR should be done in accordance with current guidelines established by the American Heart Association.

Note: Primary cardiac arrest in the pediatric patient is rare. Most arrests are secondary to respiratory failure. Consider maintaining basic airway management techniques if effective. Advanced airway insertion attempts should be performed in such a manner as to keep CPR interruptions to a minimum. Medications given during arrest are best given IV or IO. Avoid endotracheal administration unless IV or IO access is unavailable.

**Pre-Medical Control**

**MFR/EMT/SPECIALIST**

1. Confirm Arrest
  - a. Assess for signs of normal breathing.
  - b. Check a carotid or brachial pulse as age appropriate for not more than 10 seconds.
2. Initiate CPR or continue CPR if already in progress and apply and use AED as soon as available.
3. Ensure CPR quality
  - a. Compressions at least 1.5” in depth for infants, 2” in depth for children.
  - b. Compression rate at least 100 per minute.
  - c. Avoid excessive ventilation (volume and rate).
4. Continue CPR with minimal interruptions, changing the rescuer doing compressions every 2 minutes, when possible.
5. Initiate ALS response if available.
6. Establish a patent airway, maintaining C-Spine precautions if indicated, using appropriate airway adjuncts and high flow oxygen. Ventilations with BVM may be as effective as endotracheal intubation in Children. Any patient 8 years and under shall be ventilated via BVM or other basic maneuver.

**EMT**

7. If Return of Spontaneous Circulation (ROSC) has **not** been achieved after three, two minute cycles of CPR and ALS is not available or delayed, initiate transport.
8. If unable to ventilate or unable to maintain a patent airway, establish a patent airway with a supraglottic airway, when indicated. After insertion provide continuous CPR, without pauses for ventilation. Ventilations delivered at 8-10

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breaths per minute or 1 breath every 5 to 6 seconds. See **Emergency Airway Procedure**.

9. Verify CPR quality frequently and anytime rescuer providing compressions or ventilations change.

### **SPECIALIST**

10. If Return of Spontaneous Circulation (ROSC) has **not** been achieved after three, two minute cycles of CPR and ALS is not available or delayed, initiate transport.
11. Start an IV/IO NS KVO. If IV is unsuccessful after 2 attempts start an IO line per **Vascular Access Procedure**. IO may be first line choice.
12. If unable to ventilate or unable to maintain a patient airway, establish a patent airway, maintaining C-Spine precaution if indicated, using appropriate airway adjuncts and high flow oxygen. See **Emergency Airway Procedure**.
  - a. Minimize interruptions in compressions during airway placement to less than 10 seconds.
  - b. Supraglottic airways are an acceptable alternative for endotracheal intubation.

### **PARAMEDIC**

13. Confirm Arrest if not previously done.
  - a. Assess for signs of normal breathing.
  - b. Check a carotid or brachial pulse as age appropriate for not more than 10 seconds.
14. Initiate CPR, or continue CPR if already in progress and apply cardiac monitor.
15. Check rhythm, shock if indicated and continue CPR.
16. Ensure CPR quality
  - a. Compressions depress at least one third the anterior-posterior diameter of the chest or approximately 1.5” in infants and 2” in children.
  - b. Compression rate at least 100 per minute.
  - c. Avoid excessive ventilation (volume and rate).
  - d. Apply waveform capnography, if available.
17. Start an IV/IO NS KVO. If IV is attempted and is unsuccessful after 2 attempts start an IO line per **Vascular Access Procedure**. IO may be first line choice.
18. Administer Medications consistent with appropriate protocol.
19. If unable to ventilate or unable to maintain a patient airway, establish a patent airway, maintaining C-Spine precaution if indicated, using appropriate airway adjuncts and high flow oxygen. See **Emergency Airway Procedure**.
  - c. Minimize interruptions in compressions during airway placement to less than 10 seconds.
  - d. Supraglottic airways are an acceptable alternative for endotracheal intubation.
20. If quantitative waveform capnography is available and PETCO<sub>2</sub> is < 10 mm Hg attempt to improve CPR quality.

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21. Reassess ABC's as indicated by rhythm or patient condition change. Pulse checks should take no more than 10 seconds. If no pulse after 10 seconds, assume pulselessness, continue CPR.
22. After insertion of advanced airway, monitor capnography to confirm appropriate tube placement and deliver continuous CPR, without pauses for ventilation. Ventilations delivered at 8-10 breaths per minute or 1 breath every 6 - 8 seconds.

**Post-Medical Control**

**MFR/EMT/SPECIALIST/PARAMEDIC**

23. Additional basic and/or advanced life support care as appropriate.
24. Consider termination of resuscitation per **Termination of Resuscitation Protocol**

**Notes:**

1. **Excellent CPR is a priority:**
  - a. 15 compressions: 2 ventilations in groups of 10 cycles, over 2 minutes.
  - b. Push hard depress at least one third the anterior-posterior diameter of the chest or approximately 1.5" in infants and 2" in children and fast ( $\geq 100/\text{min}$ ) and allow full recoil of chest during compressions.
  - c. Change rescuer doing compressions every 2 minutes to avoid fatigue or utilize automated mechanical CPR devices, if available.
  - d. Restart CPR immediately after any defibrillation attempts.
  - e. Keep pauses in CPR to a minimum by checking rhythm when rotating rescuer doing compressions and by avoiding pauses in CPR during airway management and other interventions.
2. Brachial pulse check is used for infants. Carotid pulse check is used for ages 1 – 8 years.
3. If AED has been applied by BLS personnel, skip to appropriate place in protocol that incorporates previous care. ALS personnel should switch to manual defibrillator after initial AED shock or place AED in manual mode.
4. First shock 2 J/kg, second shock 4 J/kg, subsequent shocks greater than or equal to 4 J/kg, maximum 10 J/kg or adult dose.
5. Confirm and document tube placement by physical exam, measurement of exhaled CO<sub>2</sub> and/or use of other MCA approved secondary confirmation device.
6. If possible, contact medical control prior to moving or transporting patient.
7. Continue resuscitation attempts and initiate transport, unless field termination is ordered by Medical Control.
8. An impedance threshold device may be utilized during CPR, if available. Device should be discontinued immediately upon return of spontaneous circulation.
9. Ventilation with BVM may be as effective as endotracheal intubation in children. Any patient 8 years and under shall be ventilated via BVM or other basic maneuver. If unable to ventilate, or unable to maintain patient airway, then intubation shall be attempted. Refer to Broselow Pediatric Emergency Care tape or similar tape for proper pediatric airway equipment guidelines.
10. Treat reversible causes.

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PEDIATRIC NARROW COMPLEX TACHYCARDIA

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***Pediatric Narrow Complex Tachycardia***

Narrow complex tachycardia in pediatric patient with a pulse and poor circulation may represent:

**PROBABLE SVT OR PROBABLE SINUS TACHYCARDIA**

**Probable SVT if:**

- A. History of abrupt rate changes
- B. P waves are absent / abnormal
- C. HR not variable
- D. Infants: rate usually  $\geq 220$  bpm
- E. Children: rate usually  $\geq 180$  bpm

**Probable Sinus Tachycardia if:**

- A. Compatible history consistent with known cause
- B. P waves are present / normal
- C. Constant P-R; variable R-R
- D. Infants: rate usually  $< 220$  bpm
- E. Children: rate usually  $< 180$  bpm

If probable Sinus Tachycardia, evaluate and treat the cause, no cardioversion is indicated.

**SYNCHRONIZED CARDIOVERSION PRECEDES DRUG THERAPY FOR UNSTABLE PATIENTS.**

Unstable patients may be defined as those suffering a narrow complex tachycardia with: significant chest pain, shortness of breath, decreased level of consciousness, hypotension, shock, or pulmonary edema. Adenosine is only used for regular rhythm tachycardia.

**Pre-Medical Control**

**PARAMEDIC**

1. Follow the **Pediatric Assessment & Treatment Protocol**.
2. Consider 12-Lead ECG if available and patient is stable.

**PROBABLE SVT**

**STABLE**

1. Contact Medical Control early. Consider Vagal maneuver.
2. Start an IV NS KVO. A large bore antecubital IV should be secured whenever possible.
3. Administer Adenosine 0.1 mg/kg (maximum 6 mg) IV/IO, rapid IV push through the most proximal injection site. This should be followed immediately with a 5 -10 ml NS flush. May repeat adenosine 0.2 mg/kg (maximum 12mg) IV/IO and contact Medical Control.

**UNSTABLE**

1. If time and condition allow prior to cardioversion, sedate pre MCA selection.
2. In borderline unstable patients, adenosine may be tried. Administer Adenosine 0.1 mg/kg (maximum 6 mg), IV/IO. May repeat with 0.2 mg/kg (maximum 12mg) IV/IO.
  - If HR greater than 180, consider Synchronized Cardioversion 0.5 – 1 J/kg. If no conversion repeat at 2 J/kg, then at 4 J/kg.
  - Contact Medical Control.

**PROBABLE SINUS TACHYCARDIA**

1. Assess for cause of sinus tachycardia.
2. Follow other appropriate protocol.

**Sedation : (Select Options)**  
**(Titrate to minimum amount necessary)**

- Midazolam 0.05 mg/kg IV/IO titrated slowly, may repeat once in 5 minutes to a maximum of 0.1 mg/kg.
- Diazepam 0.1 mg/kg IV/IO titrated slowly, may repeat every 5 minutes to a maximum of 0.3 mg/kg.
- Lorazepam 0.1 mg/kg, max single dose 4 mg IV/IO titrated slowly, may repeat every 5 minutes to a maximum of 8 mg.
- Fentanyl 1 mcg/kg IV/IO titrated slowly, may repeat once in 5 minutes to a maximum of 2 mcg/kg.

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PEDIATRIC VENTRICULAR FIBRILLATION/PULSELESS VENTRICULAR  
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***Pediatric Ventricular Fibrillation/Pulseless Ventricular Tachycardia***

If AED is applied prior to ALS arrival, perform CPR and reassess the rhythm as indicated. After each intervention resume CPR immediately and reassess the rhythm after each 2 minute or 5 cycle interval.

For Biphasic devices shock with energy levels following manufacturers' recommendations.

**Pre-Medical Control**

**PARAMEDIC**

1. Follow the **Pediatric Cardiac Arrest – General Protocol**.
2. Defibrillate at 2 J/kg\* and then continue CPR for 2 minutes.
3. Repeat defibrillation at 4 J/kg\* every 2 minutes as indicated with immediate resumption of compressions. If rhythm changes go to appropriate protocol.
4. Start an IV/IO NS KVO. If IV is unsuccessful after 2 attempts, start an IO line per **Vascular Access Procedure**. IO may be first line choice.
5. Administer Epinephrine 1:10,000, 0.01 mg/kg (0.1 ml/kg) IV/IO, maximum dose 1 mg (10 ml). Repeat every 3-5 minutes. May be administered before or after defibrillation.
6. If unable to ventilate or unable to maintain a patient airway, establish a patent airway, maintaining C-Spine precaution if indicated, using appropriate airway adjuncts & high flow oxygen. See **Emergency Airway Procedure**.
7. For persistent or recurrent Ventricular Fibrillation / Pulseless Ventricular Tachycardia, administer Amiodarone 5 mg/kg IV/IO, maximum dose 300 mg. May be administered before or after defibrillation.
8. Repeat defibrillation at 4 joules/kg\*. Continue CPR and repeat defibrillations as indicated.
9. For persistent or recurrent VF / Pulseless VT, may repeat Amiodarone 5 mg/kg IV/IO twice up to a maximum of 15 mg/kg or a maximum dose of 450 mg. May be administered before or after defibrillation.

\*If calculated energy is less than the lowest available setting, use the lowest available setting.

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**PEDIATRIC WIDE COMPLEX TACHYCARDIA**

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***Pediatric Wide Complex Tachycardia***

**Pre-Medical Control**

**PARAMEDIC**

1. Follow the **Pediatric Assessment and Treatment Protocol**.

**STABLE**

1. Consider 12-Lead ECG, if available.

**Post-Medical Control**

1. Per MCA Selection Administer Lidocaine OR Amiodorone.

<p><b>Medication Options:</b> <b>(choose one)</b></p> <p><input type="checkbox"/> Lidocaine, 1 mg/kg IV/IO</p> <p><b>OR</b></p> <p><input checked="" type="checkbox"/> Amiodorone, 5 mg/kg IV/IO over 20-60 minutes</p>
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**UNSTABLE**

1. If Cardiopulmonary compromise is present as evidenced by hypotension, acutely altered mental status or signs of shock, contact medical control.

**Post-Medical Control**

2. If time and condition allow prior to cardioversion, sedate per MCA selection.
3. Synchronized Cardioversion – 0.5 - 1 J/kg. If no conversion, repeat at 2 J/kg and then at 4 J/kg.
4. In borderline unstable patients, adenosine may be tried. If IV/IO is readily available administer Adenosine 0.1 mg/kg (maximum 6 mg) IV/IO, rapid IV push through the most proximal injection site. This should be followed immediately with a 5 – 10 ml NS flush. May repeat with 0.2 mg/kg IV/IO; maximum 12 mg.

<p><b>Sedation :</b> <b>(Select Options)</b> <b>(Titrate to minimum amount necessary)</b></p> <p><input checked="" type="checkbox"/> Midazolam 0.05 mg/kg IV/IO titrated slowly, may repeat once in 5 minutes to a maximum of 0.1 mg/kg.</p> <p><input type="checkbox"/> Diazepam 0.1 mg/kg IV/IO titrated slowly, may repeat every 5 minutes to a maximum of 0.3 mg/kg.</p> <p><input type="checkbox"/> Lorazepam 0.1 mg/kg, max single dose 4 mg IV/IO titrated slowly, may repeat every 5 minutes to a maximum of 8 mg.</p> <p><input checked="" type="checkbox"/> Fentanyl 1 mcg/kg IV/IO titrated slowly, may repeat once in 5 minutes to a maximum of 2 mcg/kg.</p>
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