# 中華民國高級心臟救命術聯合委員會

# Pediatric life support: Difference from adult


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# 授課摘要

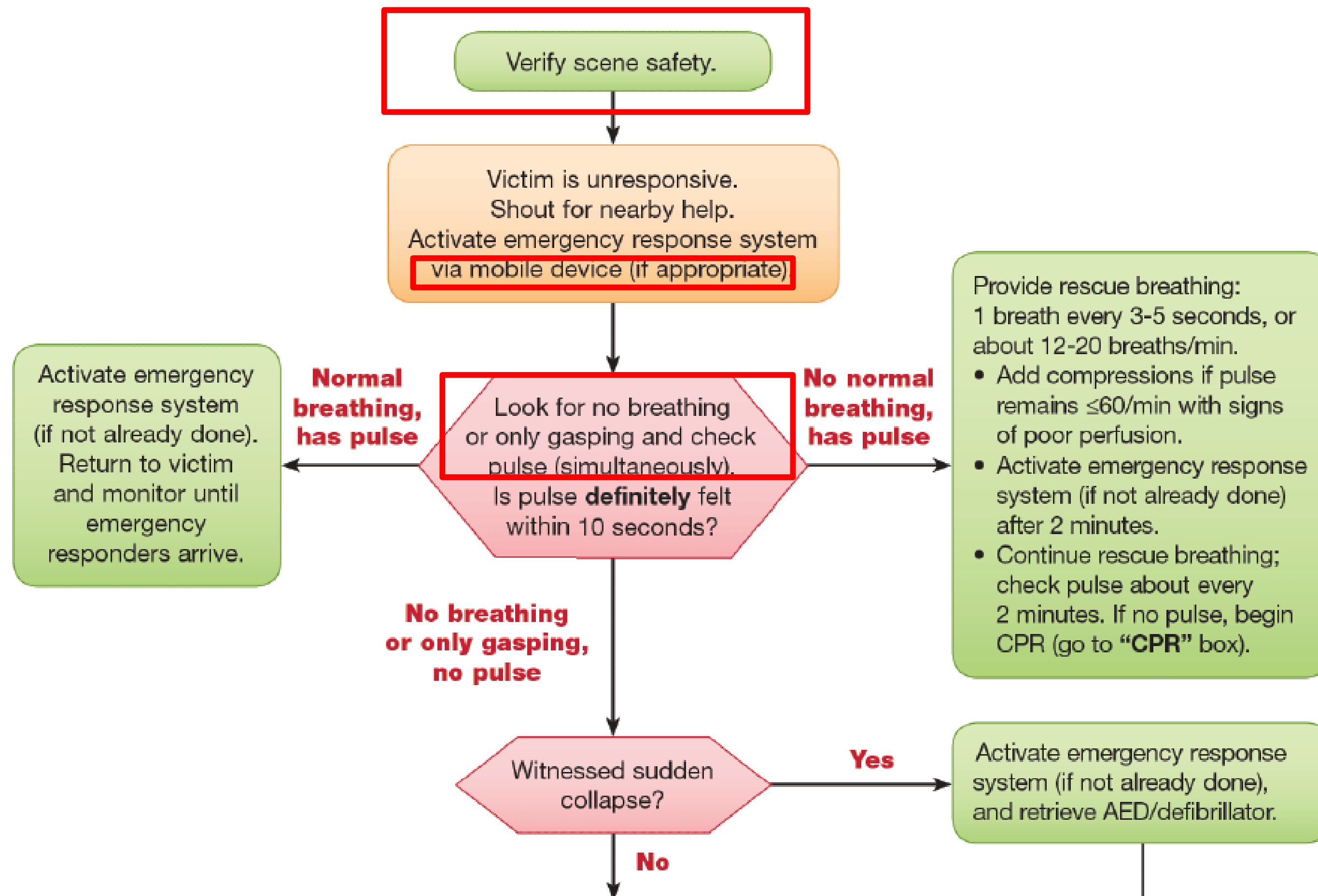
* BLS Healthcare Provider Pediatric Cardiac Arrest Algorithm for the Single rescuer and for 2 or more rescuers
* Pediatric Cardiac Arrest Algorithm: PALS
* Pediatric Bradycardia/Tachycardia with a Pulse and Poor perfusion Algorithm
* Post-cardiac arrest care
  * Management of Shock After ROSC

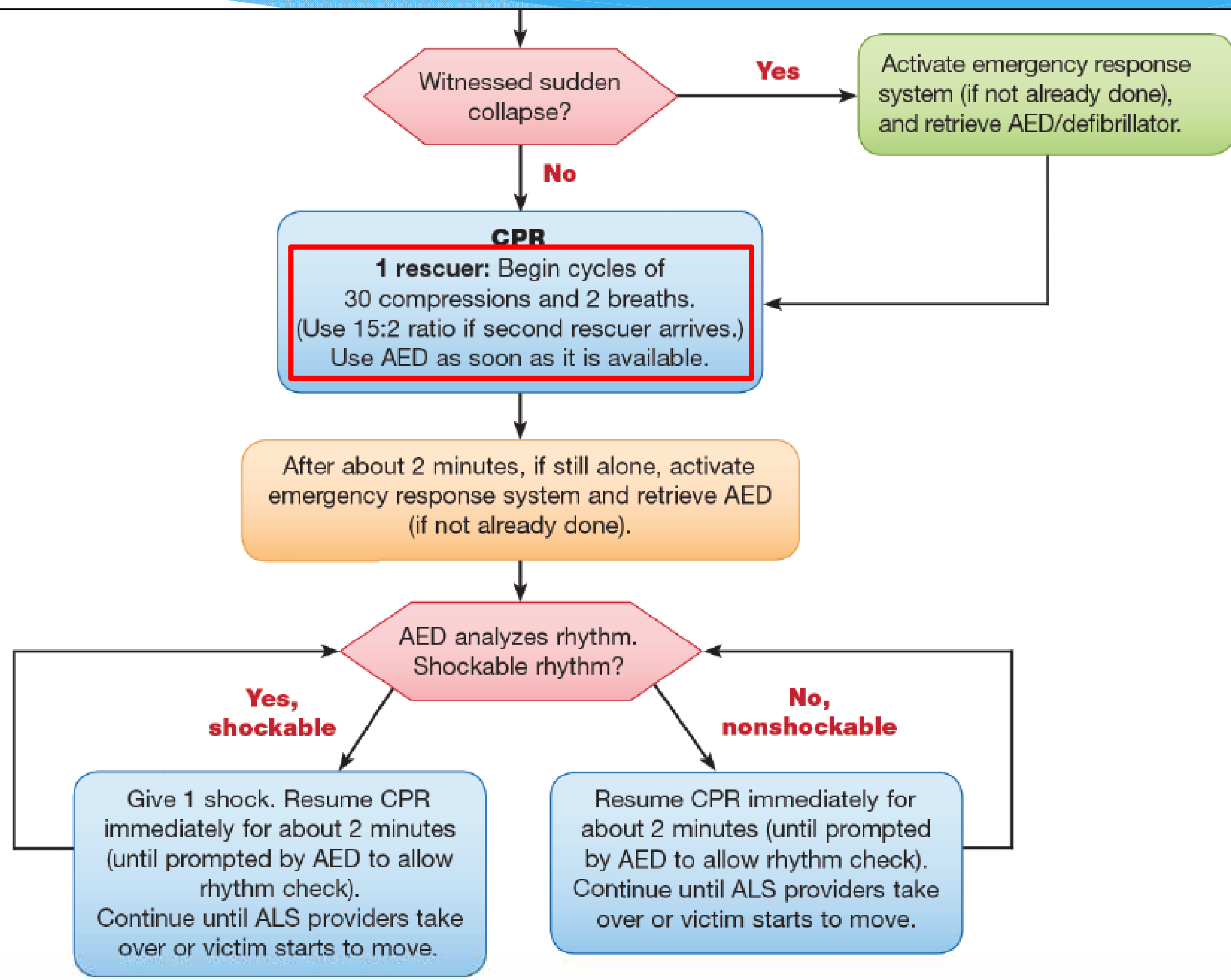
# Key Issues and Major Changes

* Reaffirming the **C-A-B** sequence as the preferred sequence for pediatric CPR
* New algorithms for **1-rescuer** and **multiple-rescuer** pediatric HCP CPR in the cell phone era
* Establishing an upper limit of **6 cm** for chest compression depth in an adolescent
* Mirroring the adult BLS recommended chest compression rate of **100 to 120/min**
* Strongly reaffirming that **compressions and ventilation** are needed for pediatric BLS

# BLS Healthcare Provider

## Pediatric Cardiac Arrest Algorithm for the **Single** rescuer




Witnessed sudden collapse?
Yes
Activate emergency response system (if not already done), and retrieve AED/defibrillator.
No
CPR
1 rescuer: Begin cycles of 30 compressions and 2 breaths. (Use 15:2 ratio if second rescuer arrives.) Use AED as soon as it is available.
After about 2 minutes, if still alone, activate emergency response system and retrieve AED (if not already done).
AED analyzes rhythm. Shockable rhythm?
Yes, shockable
No, nonshockable
Give 1 shock. Resume CPR immediately for about 2 minutes (until prompted by AED to allow rhythm check). Continue until ALS providers take over or victim starts to move.
Resume CPR immediately for about 2 minutes (until prompted by AED to allow rhythm check). Continue until ALS providers take over or victim starts to move.
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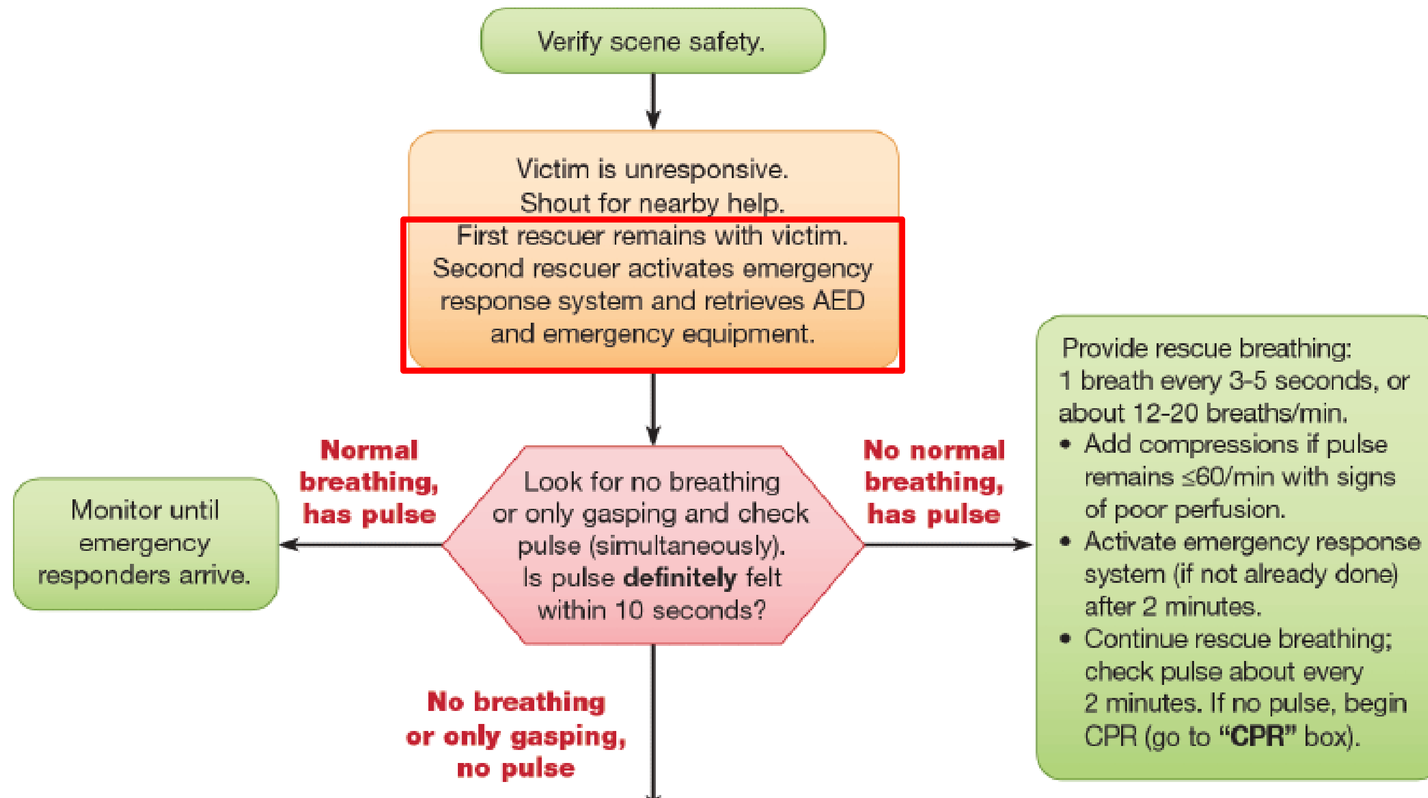
# BLS Healthcare Provider

## Pediatric Cardiac Arrest Algorithm for **2 or more** rescuers



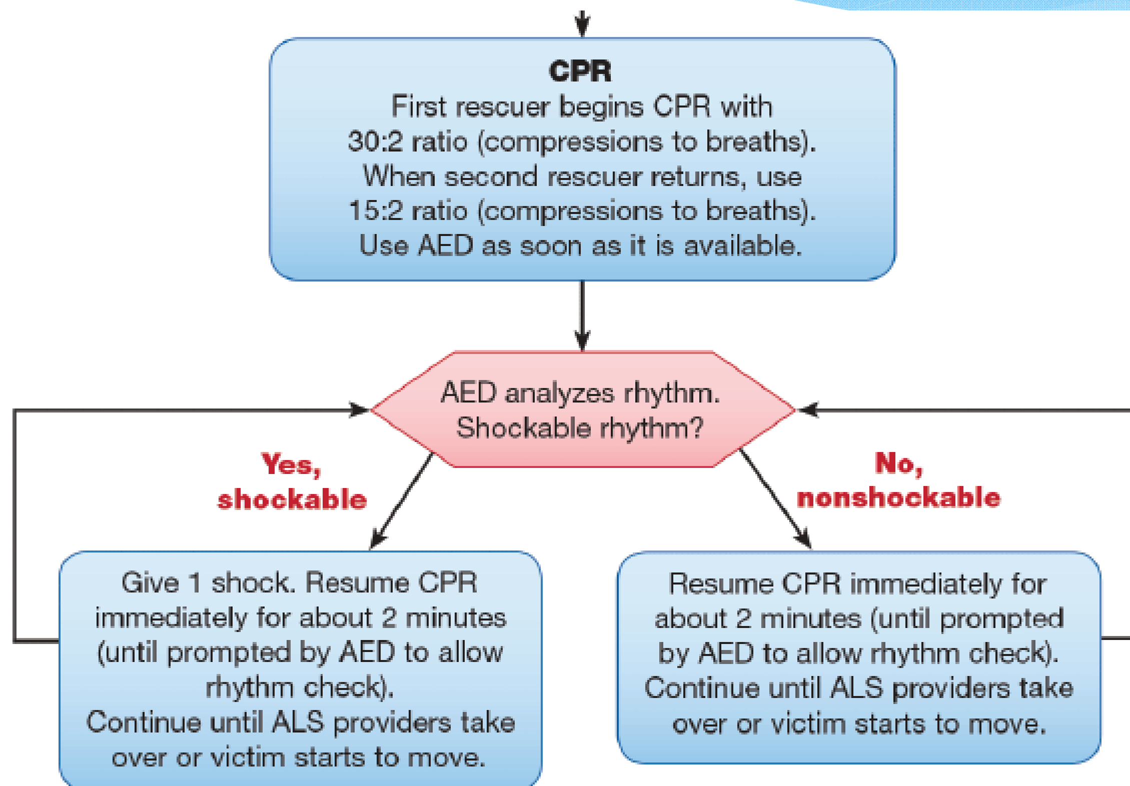

CPR
First rescuer begins CPR with
30:2 ratio (compressions to breaths).
When second rescuer returns, use
15:2 ratio (compressions to breaths).
Use AED as soon as it is available.
AED analyzes rhythm.
Shockable rhythm?
Yes,
shockable
No,
nonshockable
Give 1 shock. Resume CPR
immediately for about 2 minutes
(until prompted by AED to allow
rhythm check).
Continue until ALS providers take
over or victim starts to move.
Resume CPR immediately for
about 2 minutes (until prompted
by AED to allow rhythm check).
Continue until ALS providers take
over or victim starts to move.
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**Figure 3: Two thumb-encircling hands chest compression in infant (2 rescuers)**

## Two thumb-encircling hands chest compression in infant (2 rescuers).

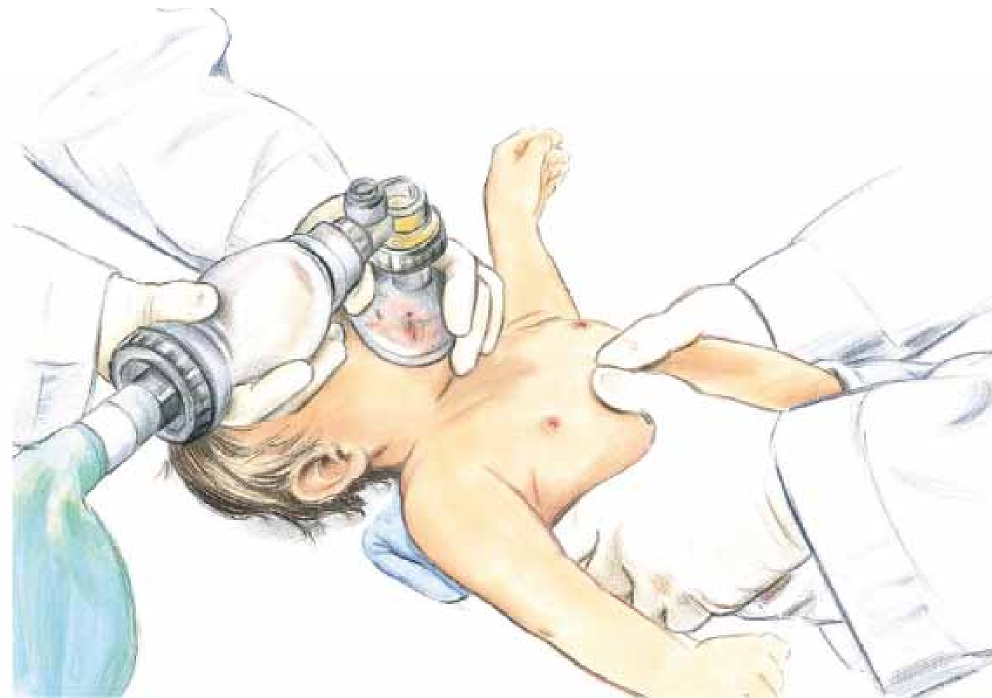
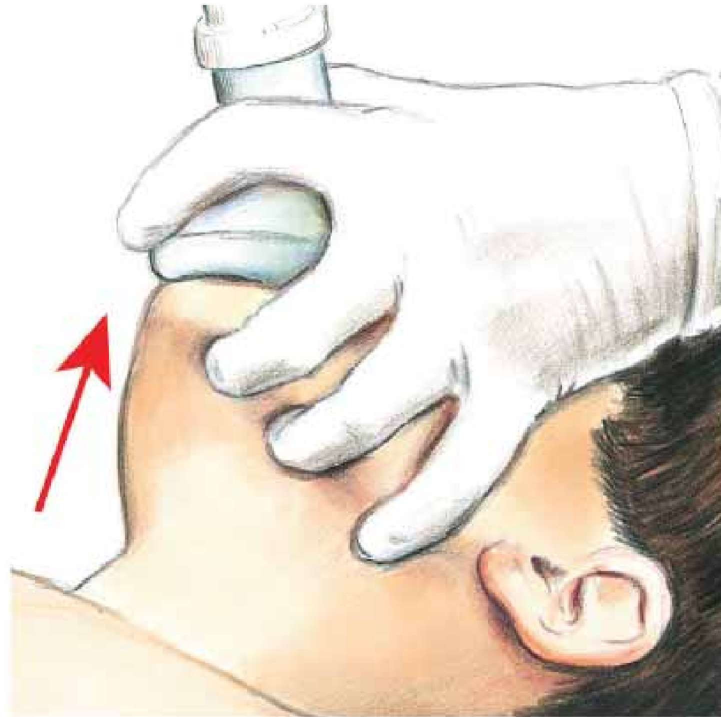


**Figure 4: The EC clamp technique of bag-mask ventilations.**

## The EC clamp technique of bag-mask ventilations



Three fingers of one hand lift the jaw (they form the "E") while the thumb and index finger hold the mask to the face (making a "C").

**Figure 5: Two-finger chest compression technique in infant (1 rescuer)**

## Two-finger chest compression technique in infant (1 rescuer)

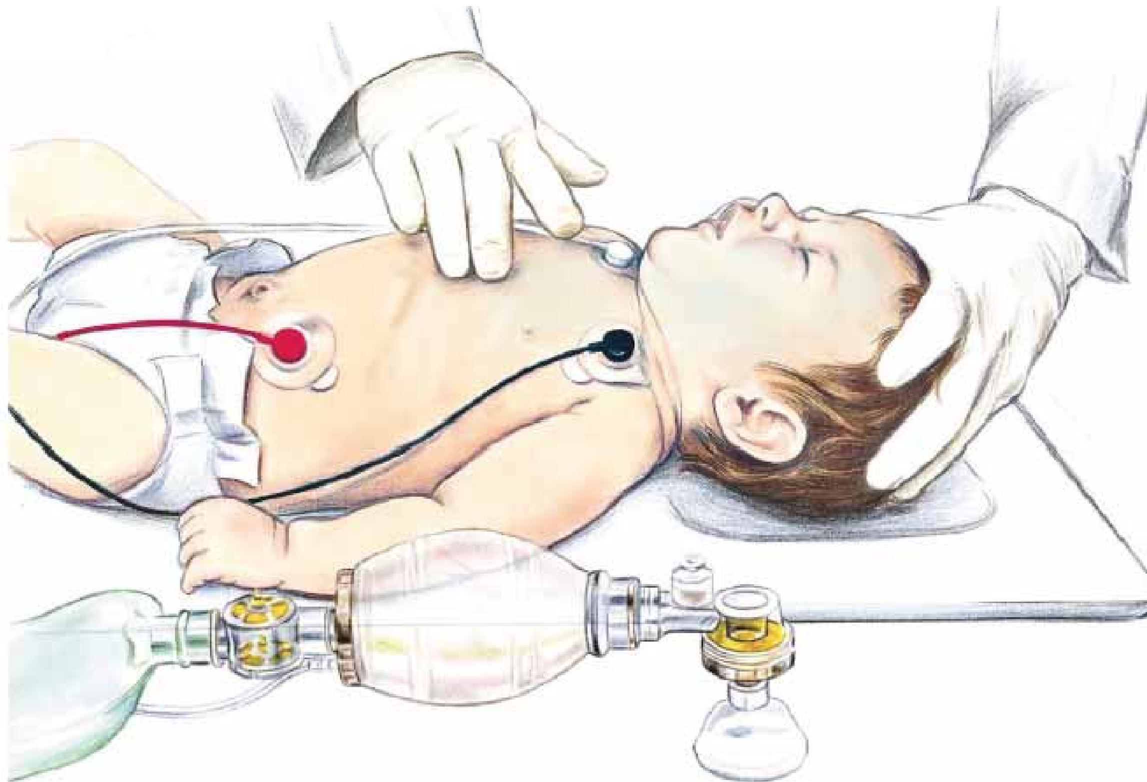


**表 2　BLS 實施人員之高品質 CPR 要素摘要**

| 要素 | 成人與青少年 | 兒童<br>(1 歲至青春期) | 嬰兒<br>(不滿 1 歲，新生兒除外) |
|---|---|---|---|
| 現場安全無虞 | 確認環境不會危及施救者和患者的安全 | | |
| 確認心臟停止 | 檢查有無反應<br>沒有呼吸或僅有喘息 (亦即沒有正常呼吸)<br>在 10 秒內沒有明顯摸到脈搏<br>(可在 10 秒內同時檢查呼吸和脈搏) | | |
| 啟動緊急應變系統 | 若您單獨一人而且沒有攜帶手機，請先離開患者去啟動緊急應變系統，並取得 AED，再開始 CPR<br>否則應派人啟動緊急應變系統和拿取 AED，並立即開始 CPR；在拿到 AED 時盡快使用 | ***有人目擊病患倒下***<br>按照左欄的成人和青少年處置步驟進行<br>***無人目擊病患倒下***<br>給予 2 分鐘的 CPR<br>離開患者去啟動緊急應變系統並取得 AED<br>回到兒童或嬰兒身邊，重新開始 CPR；在拿到 AED 時盡快使用 | |
| ***沒有高級呼吸道裝置*** **時的按壓通氣比率** | ***1 或 2 名施救者***<br>30:2 | ***1 位施救者***<br>30:2<br>***2 名以上的施救者***<br>15:2 | |

| 要素 | 成人與青少年 | 兒童<br>(1 歲至青春期) | 嬰兒<br>(不滿 1 歲，新生兒除外) |
|---|---|---|---|
| *有高級呼吸道裝置*<br>時的按壓通氣比率 | 持續按壓，速率為 100-120 次 / 分鐘<br>每 6 秒吹氣 1 次 (10 次呼吸 / 分鐘) | | |
| 按壓速率 | 100-120 次 / 分鐘 | | |
| 按壓深度 | 至少 2 英吋 (5 cm)* | 至少胸部前後徑尺寸的三分之一<br>約 2 英吋 (5 cm) | 至少胸部前後徑尺寸的三分之一<br>約 1½ 英吋 (4 cm) |
| 手部放置位置 | 將雙手放在胸骨下半部 | 將雙手或單手<br>(年幼的兒童適用放在胸骨下半部) | ***1 位施救者***<br>將 2 根手指擺放在胸部正中央，略低於乳頭連線處<br>***2 名以上的施救者***<br>雙手姆指環繞手法置於胸部正中央，略低於乳頭連線處 |
| 胸部回彈 | 每次按壓後讓胸部完全回彈；每次按壓後切勿依靠在胸部上 | | |
| 減少中斷 | 盡量讓胸部按壓的中斷時間少於 10 秒 | | |

* 按壓深度不應超過 2.4 英吋 (6 cm)。

縮寫：AED (Automated External Defibrillator，自動體外去顫器)；CPR (cardiopulmonary resuscitation，心肺復甦)。

# 5 components of high-quality CPR

* Ensuring chest compressions of **adequate rate**
* Ensuring chest compressions of **adequate depth**
* Allowing **full chest recoil** between compressions
* **Minimizing interruptions** in chest compressions
* **Avoiding** excessive ventilation

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# Pediatric Cardiac Arrest Algorithm: PALS

* VF/pVT
  * pulesless VT
  * Epinephrine, Amiodarone or Lidocaine
* Asystole/PEA
* Differential diagonsis
  * 6H+5T for pediatric
  * 6H+6T for ROSC
  * 5H+5T in adult

# Key Issues and Major Changes

* In specific settings, when treating pediatric patients with febrile illnesses, the use of **restrictive volumes** of isotonic **crystalloid** leads to improved survival.
* Routine use of **atropine** as a **premedication** for emergency tracheal intubation in non-neonates, specifically to prevent arrhythmias, is controversial. Also, there is **no minimum** dose required for this indication.
* If invasive **arterial blood pressure monitoring** is already in place, it may be used to adjust CPR to achieve specific blood pressure targets for children in cardiac arrest.

# Key Issues and Major Changes

* **Amiodarone** or **lidocaine** is an acceptable antiarrhythmic agent for shock-refractory pediatric VF and pVT in children.
* **Epinephrine** continues to be recommended as a vasopressor in pediatric cardiac arrest.
* For pediatric patients with **cardiac diagnoses** and **IHCA** in settings with existing extracorporeal membrane oxygenation protocols, **ECPR** may be considered.

# Key Issues and Major Changes

* **Fever should be avoided** when caring for comatose children with ROSC after OHCA.
* Use of **Targeted temperature management** to improve outcome. A large randomized trial of therapeutic hypothermia for children with OHCA showed no difference in outcomes whether a period of moderate therapeutic hypothermia (with temperature maintained at 32°C to 34°C) or the strict maintenance of normothermia (with temperature maintained 36°C to 37.5°C) was provided.

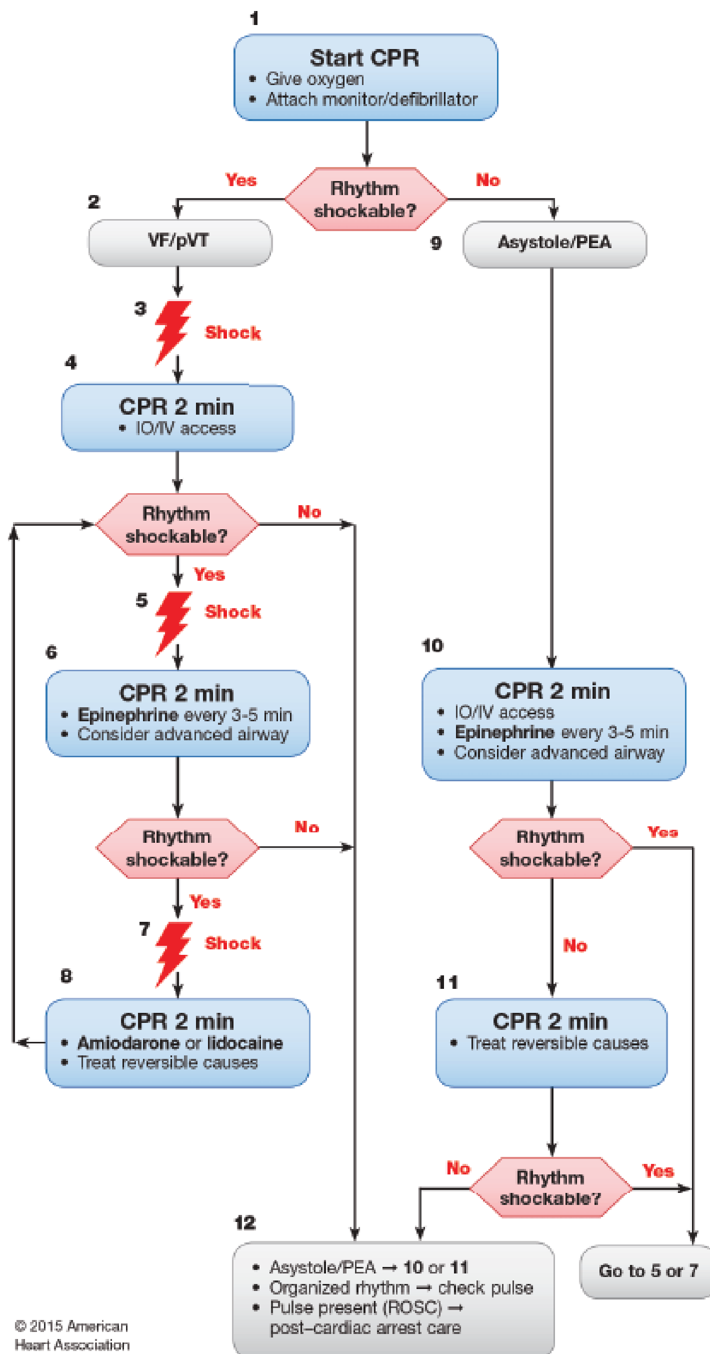
# Key Issues and Major Changes

* After ROSC, **fluids** and **vasoactive drugs** should be used to maintain a systolic blood pressure **above** the **fifth percentile for age.**
* **No single variable** was identified to be sufficiently reliable to predict outcomes. Therefore, caretakers should consider multiple factors in trying to predict outcomes during cardiac arrest and in the post-ROSC setting.

# Key Issues and Major Changes

- After ROSC, **normoxemia** should be targeted. When the necessary equipment is available, oxygen administration should be weaned to target an oxyhemoglobin saturation of **94% to 99%.** Hypoxemia should be strictly avoided.
- After ROSC, the child's **Paco2** should be targeted to a level appropriate to each patient's condition. Exposure to severe hypercapnia or hypocapnia should be avoided.

# Pediatric Cardiac Arrest Algorithm—2015 Update

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### CPR Quality

- Push hard (≥⅓ of anteroposterior diameter of chest) and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Rotate compressor every 2 minutes, or sooner if fatigued.
- If no advanced airway, 15:2 compression-ventilation ratio.

### Shock Energy for Defibrillation

First shock 2 J/kg, second shock 4 J/kg, subsequent shocks ≥4 J/kg, maximum 10 J/kg or adult dose

### Drug Therapy

- **Epinephrine IO/IV dose:** 0.01 mg/kg (0.1 mL/kg of 1:10 000 concentration). Repeat every 3-5 minutes. If no IO/IV access, may give endotracheal dose: 0.1 mg/kg (0.1 mL/kg of 1:1000 concentration).
- **Amiodarone IO/IV dose:** 5 mg/kg bolus during cardiac arrest. May repeat up to 2 times for refractory VF/pulseless VT.
- **Lidocaine IO/IV dose:** Initial: 1 mg/kg loading dose. Maintenance: 20-50 mcg/kg per minute infusion (repeat bolus dose if infusion initiated >15 minutes after initial bolus therapy).

### Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement
- Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

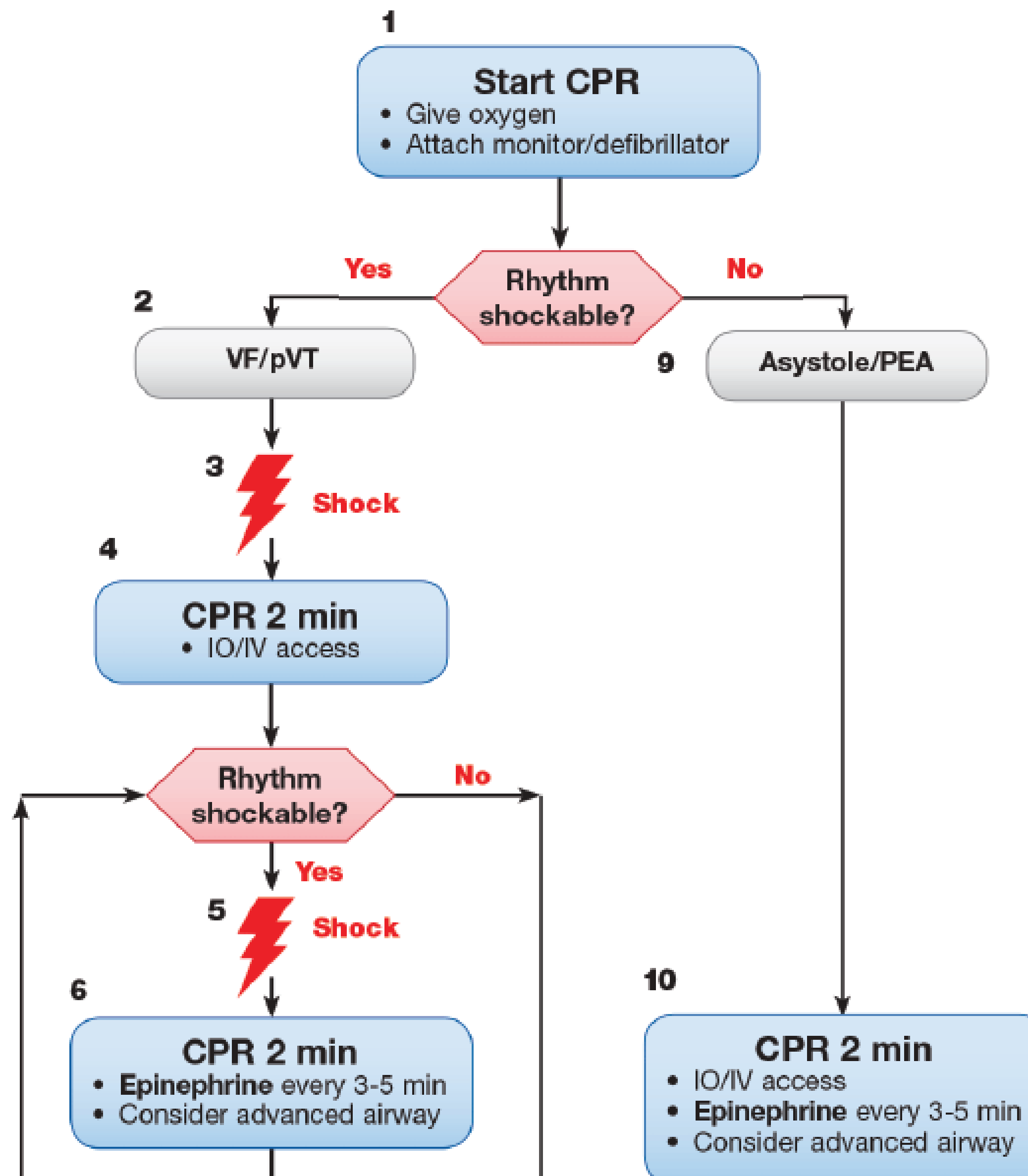
### Return of Spontaneous Circulation (ROSC)

- Pulse and blood pressure
- Spontaneous arterial pressure waves with intra-arterial monitoring

### Reversible Causes

- **H**ypovolemia
- **H**ypoxia
- **H**ydrogen ion (acidosis)
- **H**ypoglycemia
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **T**ension pneumothorax
- **T**amponade, cardiac
- **T**oxins
- **T**hrombosis, pulmonary
- **T**hrombosis, coronary

## Pediatric Cardiac Arrest Algorithm—2015 Update




**CPR Quality**

- Push hard (≥⅓ of anteroposterior diameter of chest) and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Rotate compressor every 2 minutes, or sooner if fatigued.
- If no advanced airway, 15:2 compression-ventilation ratio.

**Shock Energy for Defibrillation**

First shock 2 J/kg, second shock 4 J/kg, subsequent shocks ≥4 J/kg, maximum 10 J/kg or adult dose

**Drug Therapy**

- **Epinephrine IO/IV dose:** 0.01 mg/kg (0.1 mL/kg of 1:10 000 concentration). Repeat every 3-5 minutes.
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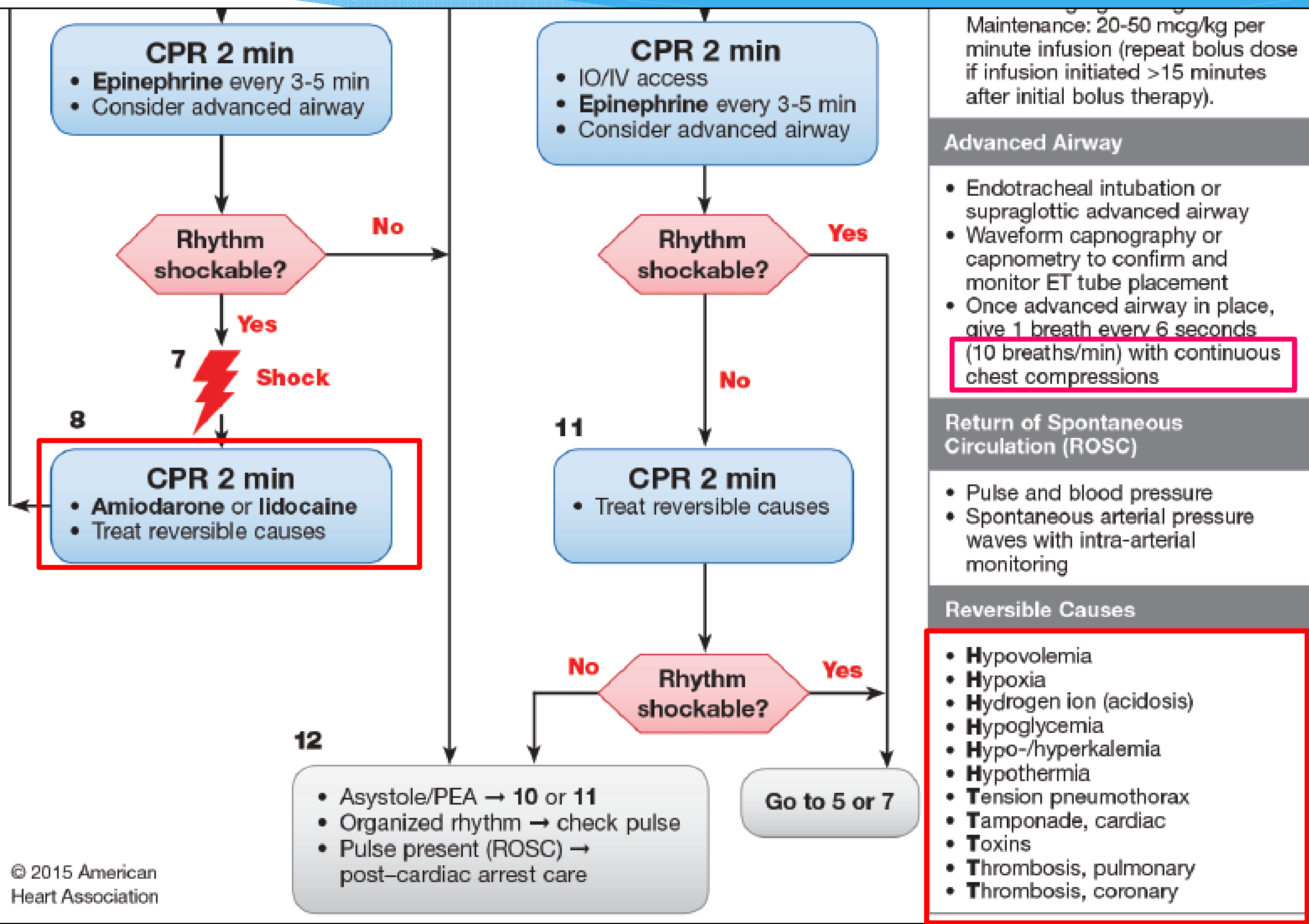
**Advanced Airway**


CPR 2 min
Epinephrine every 3-5 min
Consider advanced airway
Rhythm shockable?
No
Yes
7
Shock
8
CPR 2 min
Amiodarone or lidocaine
Treat reversible causes
CPR 2 min
IO/IV access
Epinephrine every 3-5 min
Consider advanced airway
Rhythm shockable?
Yes
No
11
CPR 2 min
Treat reversible causes
No
Rhythm shockable?
Yes
12
Asystole/PEA → 10 or 11
Organized rhythm → check pulse
Pulse present (ROSC) → post–cardiac arrest care
Go to 5 or 7
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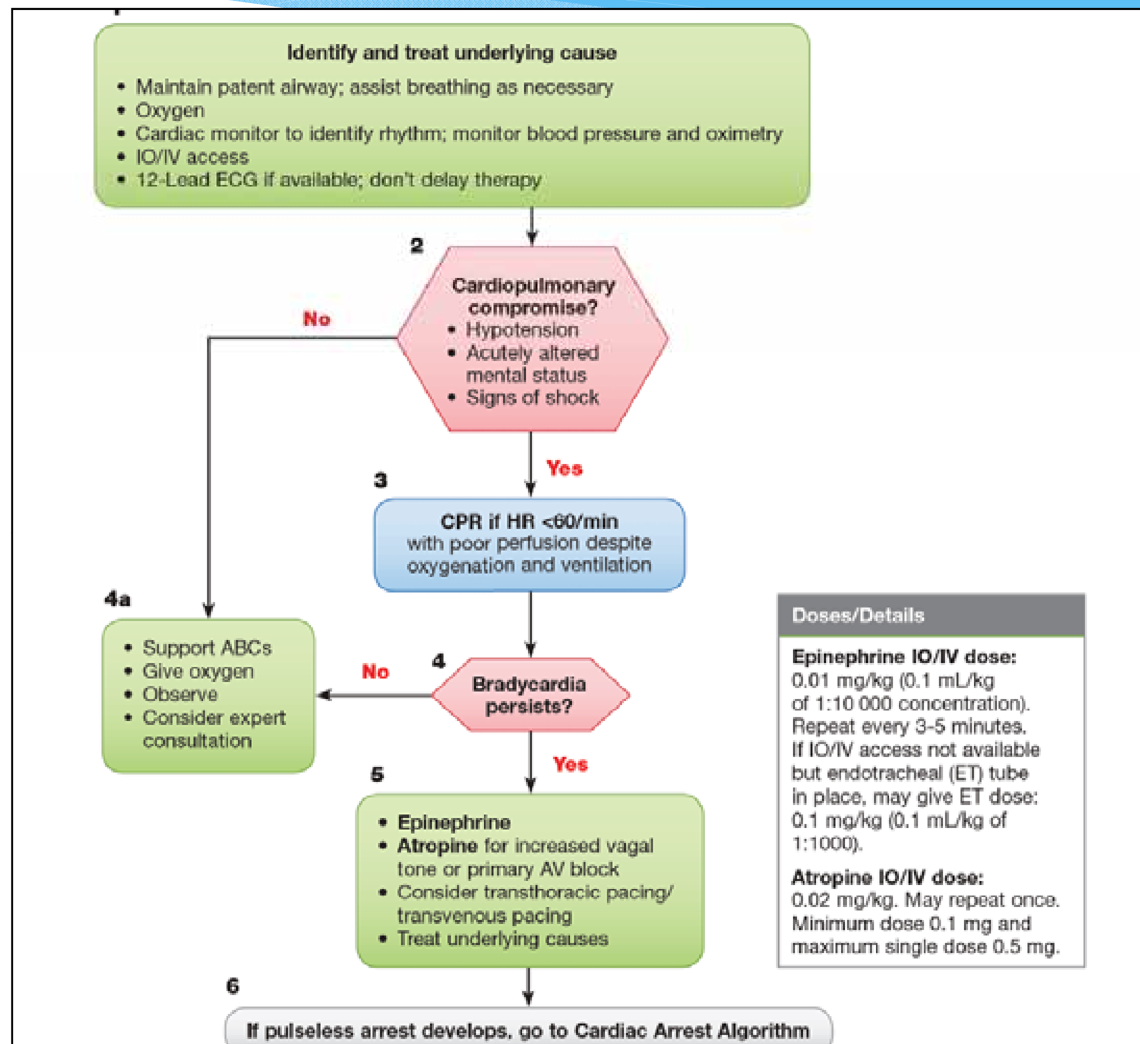
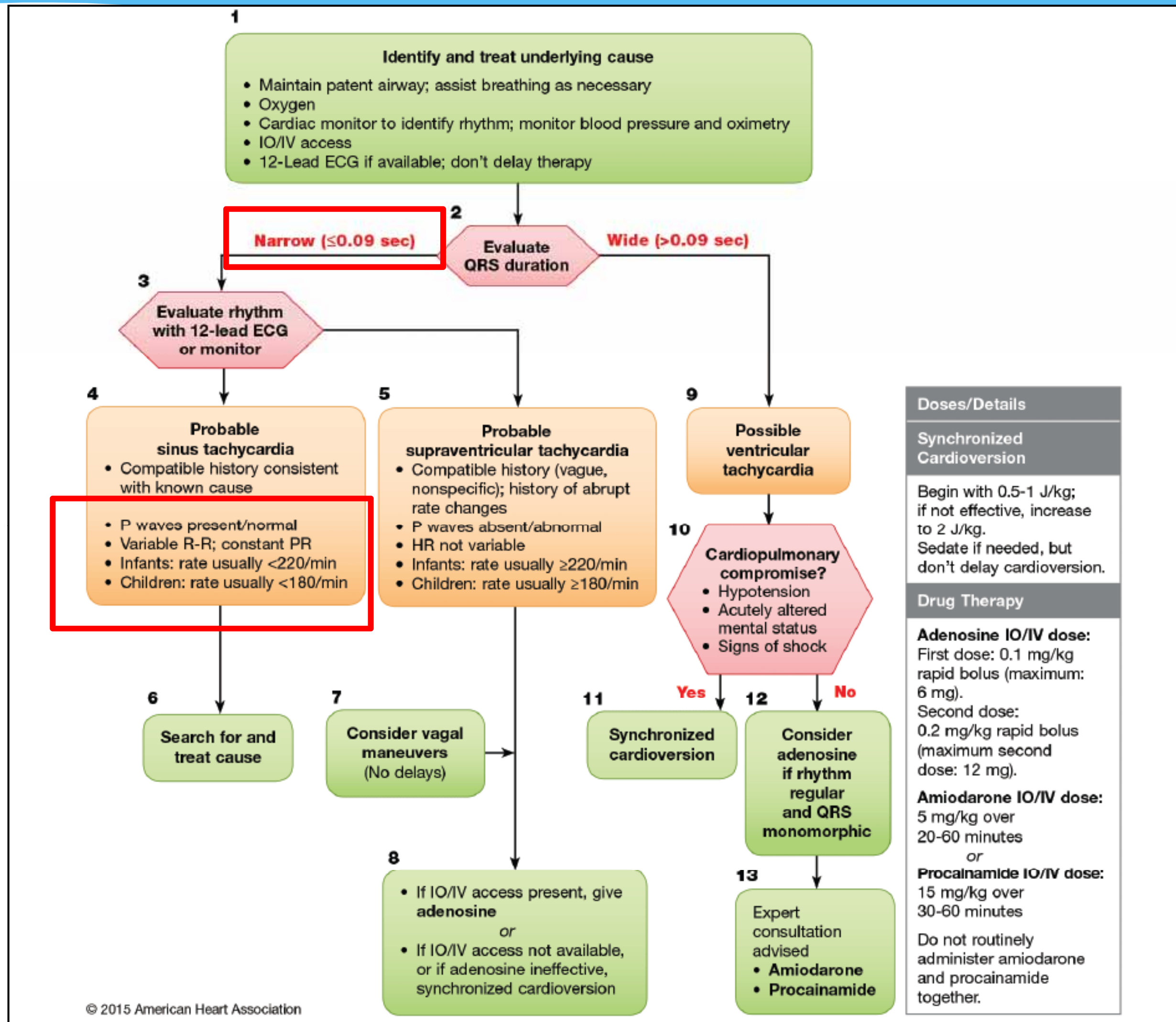
Maintenance: 20-50 mcg/kg per minute infusion (repeat bolus dose if infusion initiated >15 minutes after initial bolus therapy).
Advanced Airway
Endotracheal intubation or supraglottic advanced airway
Waveform capnography or capnometry to confirm and monitor ET tube placement
Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions
Return of Spontaneous Circulation (ROSC)
Pulse and blood pressure
Spontaneous arterial pressure waves with intra-arterial monitoring
Reversible Causes
Hypovolemia
Hypoxia
Hydrogen ion (acidosis)
Hypoglycemia
Hypo-/hyperkalemia
Hypothermia
Tension pneumothorax
Tamponade, cardiac
Toxins
Thrombosis, pulmonary
Thrombosis, coronary

# Pediatric **Bradycardia** with a Pulse and Poor perfusion Algorithm



# Pediatric **Tachycardia** with a Pulse and Poor perfusion Algorithm



# Medications

**Table 3: 2010 - Medications for Pediatric Resuscitation**

Open table in a new window

| Medications for Pediatric Resuscitation | | |
|---|---|---|
| **Medication** | **Dose** | **Remarks** |
| **Adenosine** | 0.1 mg/kg (maximum 6 mg) Second dose: 0.2 mg/kg (maximum 12 mg) | Monitor ECG Rapid IV/IO bolus with flush |

| Medication | Dose | Remarks |
| --- | --- | --- |
| Amiodarone | 5 mg/kg IV/IO; may repeat twice up to 15 mg/kg Maximum single dose 300 mg | Monitor ECG and blood pressure; adjust administration rate to urgency (IV push during cardiac arrest, more slowly–over 20–60 minutes with perfusing rhythm). Expert consultation strongly recommended prior to use when patient has a perfusing rhythmUse caution when administering with other drugs that prolong QT (obtain expert consultation) |
| Atropine | 0.02 mg/kg IV/IO 0.04–0.06 mg/kg ET* Repeat once if neededMaximum single dose: 0.5 mg | Higher doses may be used with organophosphate poisoning |
| Calcium Chloride (10%) | 20 mg/kg IV/IO (0.2 mL/kg) Maximum single dose 2 g | Administer slowly |
| Epinephrine | 0.01 mg/kg (0.1 mL/kg 1:10 000) IV/IO 0.1 mg/kg (0.1 mL/kg 1:1000) ET* Maximum dose 1 mg IV/IO; 2.5 mg ET | May repeat every 3–5 minutes |
| Glucose | 0.5–1 g/kg IV/IO | Newborn: 5–10 mL/kg $D_{10}W$ Infants and Children: 2–4 mL/kg $D_{25}W$ Adolescents: 1–2 mL/kg $D_{50}W$ |

| | | |
|---|---|---|
| Lidocaine | Bolus: 1 mg/kg IV/IO Infusion: 20–50 mcg/kg/minute | |
| Magnesium Sulfate | 25–50 mg/kg IV/IO over 10–20 minutes, faster in torsades de pointes Maximum dose 2 g | |
| Naloxone | Full Reversal: <5 y or ?20 kg: 0.1 mg/kg IV/IO/ET* ?5y or >20 kg: 2 mg IV/IO/ET* | Use lower doses to reverse respiratory depression associated with therapeutic opioid use (1–5 mcg/kg titrate to effect) |
| Procainamide | 15 mg/kg IV/IO Adult Dose: 20 mg/min IV infusion to total maximum dose of 17 mg/kg | Monitor ECG and blood pressure; Give slowly–over 30–60 minutes. Use caution when administering with other drugs that prolong QT (obtain expert consultation) |
| Sodium bicarbonate | 1 mEq/kg per dose IV/IO slowly | After adequate ventilation |

- IV indicates intravenous; IO, intraosseous; and ET, via endotracheal tube.
- ?* Flush with 5 mL of normal saline and follow with 5 ventilations.

# Medications

## 5.1.2.2 Drugs Used to Maintain Cardiac Output

**Table 4: 2010 - Medications to Maintain Cardiac Output and for Postresuscitation Stabilization**

Open table in a new window

| Medications to Maintain Cardiac Output and for Postresuscitation Stabilization | | |
|---|---|---|
| **Medication** | **Dose Range** | **Comment** |
| **Inamrinone** | 0.75–1 mg/kg IV/IO over 5 minutes; may repeat × 2 then: 5–10 mcg/kg per minute | Inodilator |
| Dobutamine | 2–20 mcg/kg per minute IV/IO | Inotrope; vasodilator |

| Medication | Dose Range | Comment |
|---|---|---|
| Dopamine | 2–20 mcg/kg per minute IV/IO | Inotrope; chronotrope; renal and splanchnic vasodilator in low doses; pressor in high doses |
| Epinephrine | 0.1–1 mcg/kg per minute IV/IO | Inotrope; chronotrope; vasodilator in low doses; pressor in higher doses |
| Milrinone | Loading dose: 50 mcg/kg IV/IO over 10–60 min then 0.25–0.75 mcg/kg per minute | Inodilator |
| Norepinephrine | 0.1–2 mcg/kg per minute | Vasopressor |
| Sodium nitroprusside | Initial: 0.5–1 mcg/kg per minute; titrate to effect up to 8 mcg/kg per minute | Vasodilator Prepare only in $D_5W$ |

- IV indicates intravenous; and IO, intraosseous.
- Alternative formula for verifying dose during continuous infusion:
- Infusion rate

$$(\text{mL/h}) = \frac{[\text{weight (kg)} \times \text{dose (mcg/kg per min)} \times 60 \text{ (min/hour)}]}{\text{concentration(mcg/mL)}}.$$

# Example

- A 10-kg boy, septic shock, dopamine 10 mcg/kg/min
- 10(kg)*10(mcg/kg/min)*60(min)=6000 mcg/h
- Dopamine bottle (600mg/200mL)
  - = 3 mg/mL= 3000 mcg/mL
- 6000 mcg/h ÷ 3000 mcg/mL = 2 mL/h

# Management of Shock After ROSC

## Management of Shock After ROSC

**Optimize Ventilation and Oxygenation**

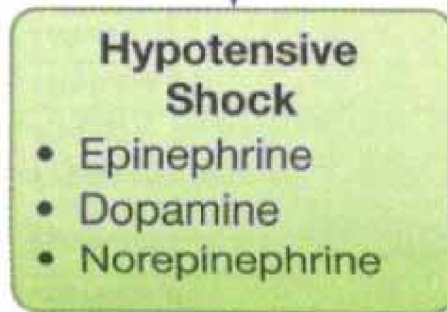
- Titrate $FIO_2$ to maintain oxyhemoglobin saturation 94%-99% (or as appropriate to the patient's condition); if possible, wean $FIO_2$ if saturation is 100%.
- Consider advanced airway placement and waveform capnography.
- If possible, target a $PCO_2$ that is appropriate for the patient's condition and limit exposure to severe hypercapnia or hypocapnia.

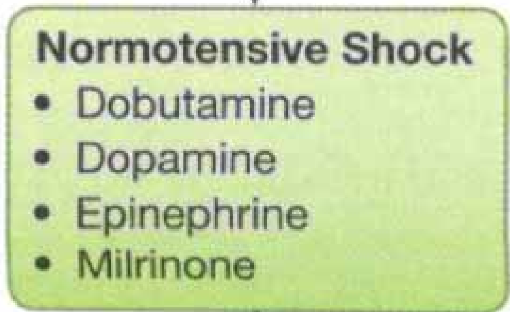
**Assess for and Treat Persistent Shock**

- Identify and treat contributing factors.*
- Consider 20 mL/kg IV/IO boluses of isotonic crystalloid. Consider smaller boluses (eg, 10 mL/kg) if poor cardiac function suspected.
- Consider the need for inotropic and/or vasopressor support for fluid-refractory shock.

***Possible Contributing Factors**

**H**ypovolemia
**H**ypoxia
**H**ydrogen ion (acidosis)
**H**ypoglycemia
**H**ypo-/hyperkalemia
**H**ypothermia
**T**ension pneumothorax
**T**amponade, cardiac
**T**oxins
**T**hrombosis, pulmonary
**T**hrombosis, coronary
Trauma




- Monitor for and treat agitation and seizures.
- Monitor for and treat hypoglycemia.
- Assess blood gas, serum electrolytes, and calcium.
- If patient remains comatose after resuscitation from cardiac arrest, maintain targeted temperature management, including aggressive treatment of fever.
- Consider consultation and patient transport to tertiary care center.

# Estimation of Maintenance Fluid Requirements

- **Infants <10 kg:** 4 mL/kg per hour

  *Example:* For an 8-kg infant, estimated maintenance fluid rate
  = 4 mL/kg per hour × 8 kg
  = 32 mL per hour

- **Children 10-20 kg:** 4 mL/kg per hour for the first 10 kg + 2 mL/kg per hour for each kg above 10 kg

  *Example:* For a 15-kg child, estimated maintenance fluid rate
  = (4 mL/kg per hour × 10 kg)
  + (2 mL/kg per hour × 5 kg)
  = 40 mL/hour + 10 mL/hour
  = 50 mL/hour

- **Children >20 kg:** 4 mL/kg per hour for the first 10 kg + 2 mL/kg per hour for kg 11-20 + 1 mL/kg per hour for each kg above 20 kg.

  *Example:* For a 28-kg child, estimated maintenance fluid rate
  = (4 mL/kg per hour × 10 kg)
  + (2 mL/kg per hour × 10 kg)
  + (1 mL/kg per hour × 8 kg)
  = 40 mL per hour + 20 mL per hour
  + 8 mL per hour
  = 68 mL per hour

After initial stabilization, adjust the rate and composition of intravenous fluids based on the patient's clinical condition and state of hydration. In general, provide a continuous infusion of a dextrose-containing solution for infants. Avoid hypotonic solutions in critically ill children; for most patients use isotonic fluid such as normal saline (0.9% NaCl) or lactated Ringer's solution with or without dextrose, based on the child's clinical status.

# Color-coded Resuscitation Tape

## Pediatric Resuscitation Supplies Based on Color-Coded Resuscitation Tape

PALS

| Equipment | GRAY* 3-5 kg | PINK Small Infant 6-7 kg | RED Infant 8-9 kg | PURPLE Toddler 10-11 kg | YELLOW Small Child 12-14 kg | WHITE Child 15-18 kg | BLUE Child 19-23 kg | ORANGE Large Child 24-29 kg | GREEN Adult 30-36 kg |
|---|---|---|---|---|---|---|---|---|---|
| Resuscitation bag | | Infant/child | Infant/child | Child | Child | Child | Child | Child | Adult |
| Oxygen mask (NRB) | | Pediatric | Pediatric | Pediatric | Pediatric | Pediatric | Pediatric | Pediatric | Pediatric/ adult |
| Oral airway (mm) | | 50 | 50 | 60 | 60 | 60 | 70 | 80 | 80 |
| Laryngoscope blade (size) | | 1 Straight | 1 Straight | 1 Straight | 2 Straight | 2 Straight | 2 Straight or curved | 2 Straight or curved | 3 Straight or curved |
| ET tube (mm)† | | 3.5 Uncuffed 3.0 Cuffed | 3.5 Uncuffed 3.0 Cuffed | 4.0 Uncuffed 3.5 Cuffed | 4.5 Uncuffed 4.0 Cuffed | 5.0 Uncuffed 4.5 Cuffed | 5.5 Uncuffed 5.0 Cuffed | 6.0 Cuffed | 6.5 Cuffed |
| ET tube insertion length (cm) | 3 kg 9-9.5<br>4 kg 9.5-10<br>5 kg 10-10.5 | 10.5-11 | 10.5-11 | 11-12 | 13.5 | 14-15 | 16.5 | 17-18 | 18.5-19.5 |
| Suction catheter (F) | | 8 | 8 | 10 | 10 | 10 | 10 | 10 | 10-12 |
| BP cuff | Neonatal #5/infant | Infant/child | Infant/child | Child | Child | Child | Child | Child | Small adult |
| IV catheter (ga) | | 22-24 | 22-24 | 20-24 | 18-22 | 18-22 | 18-20 | 18-20 | 16-20 |
| IO (ga) | | 18/15 | 18/15 | 15 | 15 | 15 | 15 | 15 | 15 |
| NG tube (F) | | 5-8 | 5-8 | 8-10 | 10 | 10 | 12-14 | 14-18 | 16-18 |
| Urinary catheter (F) | 5 | 8 | 8 | 8-10 | 10 | 10-12 | 10-12 | 12 | 12 |
| Chest tube (F) | | 10-12 | 10-12 | 16-20 | 20-24 | 20-24 | 24-32 | 28-32 | 32-38 |

Abbreviations: BP, blood pressure; ET, endotracheal; F, French; IO, intraosseous; IV, intravenous; NG, nasogastric; NRB, nonrebreathing.

*For Gray column, use Pink or Red equipment sizes if no size is listed.

†Per *2005 AHA Guidelines*, in the hospital cuffed or uncuffed tubes may be used (see below for sizing of cuffed tubes).

Adapted from Broselow™ *Pediatric Emergency Tape*. Distributed by Armstrong Medical Industries, Lincolnshire, IL. 2007 Vital Signs, Inc.

# ETT size and depth

## Estimating Endotracheal Tube Size and Depth of Insertion

### *Tube Size*

Several formulas, such as the ones below, allow estimation of proper endotracheal tube size (internal diameter [i.d.]) for children 2 to 10 years of age, based on the child's age:

**Uncuffed endotracheal tube size** (mm i.d.) = (age in years/4) + 4

During preparation for intubation, providers also should have ready at the bedside uncuffed endotracheal tubes 0.5 mm smaller and larger than that estimated from the above formula.

The formula for estimation of a cuffed endotracheal tube size is as follows:

**Cuffed endotracheal tube size** (mm i.d.) = (age in years/4) + 3.5

Typical cuffed inflation pressure should be <20 to 25 cm $H_2O$.

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### *Depth of Insertion*

The formula for estimation of depth of insertion (measured at the lip) can be estimated from the child's age or the tube size.

**Depth of insertion** (cm) for children >2 years of age = (age in years/2) + 12

*or*

**Depth of insertion** = tube i.d. (mm) × 3

**Confirm placement with both clinical assessment (eg, breath sounds, chest expansion) and device (eg, exhaled $CO_2$ detector). Watch for marker on endotracheal tube at vocal cords.**

# 問題？

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