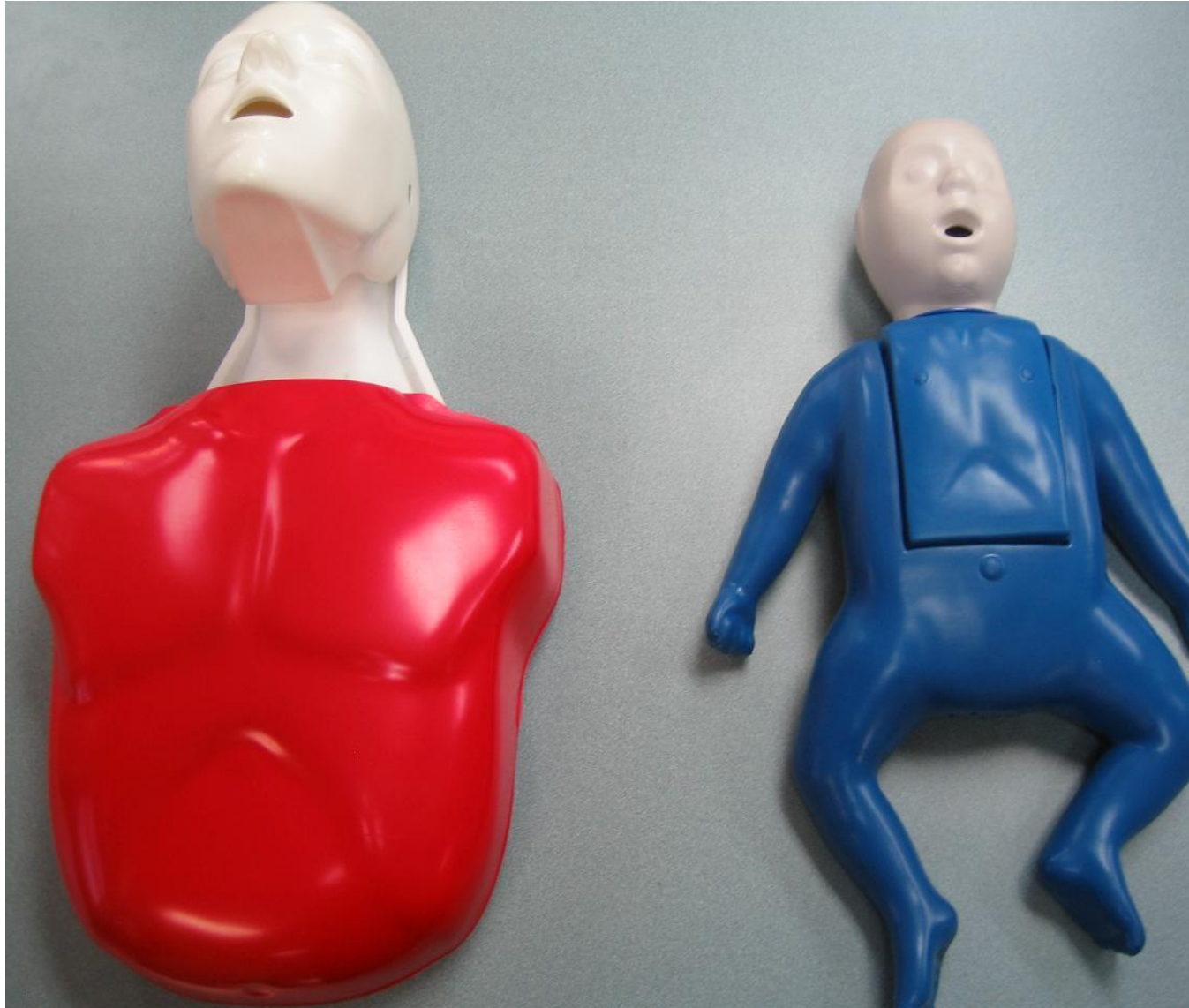






Pediatric CPR

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What are the differences ?



Normal limits

	Infant(< 1 yr) 	1-3 yr 	4-5 yr 	6-8 yr 	Adult
<u>Respiratory Rate</u> /min	30-60	24-40	22-34	18-30	12-20
<u>Pulse Rate</u> /min	100-160	90-150	80-140	70-120	60-100
<u>Systolic BP</u> (lower L)	60>	70>	75>	80>	90>

CARDIOPULMONARY ARREST CAUSES

ADULT

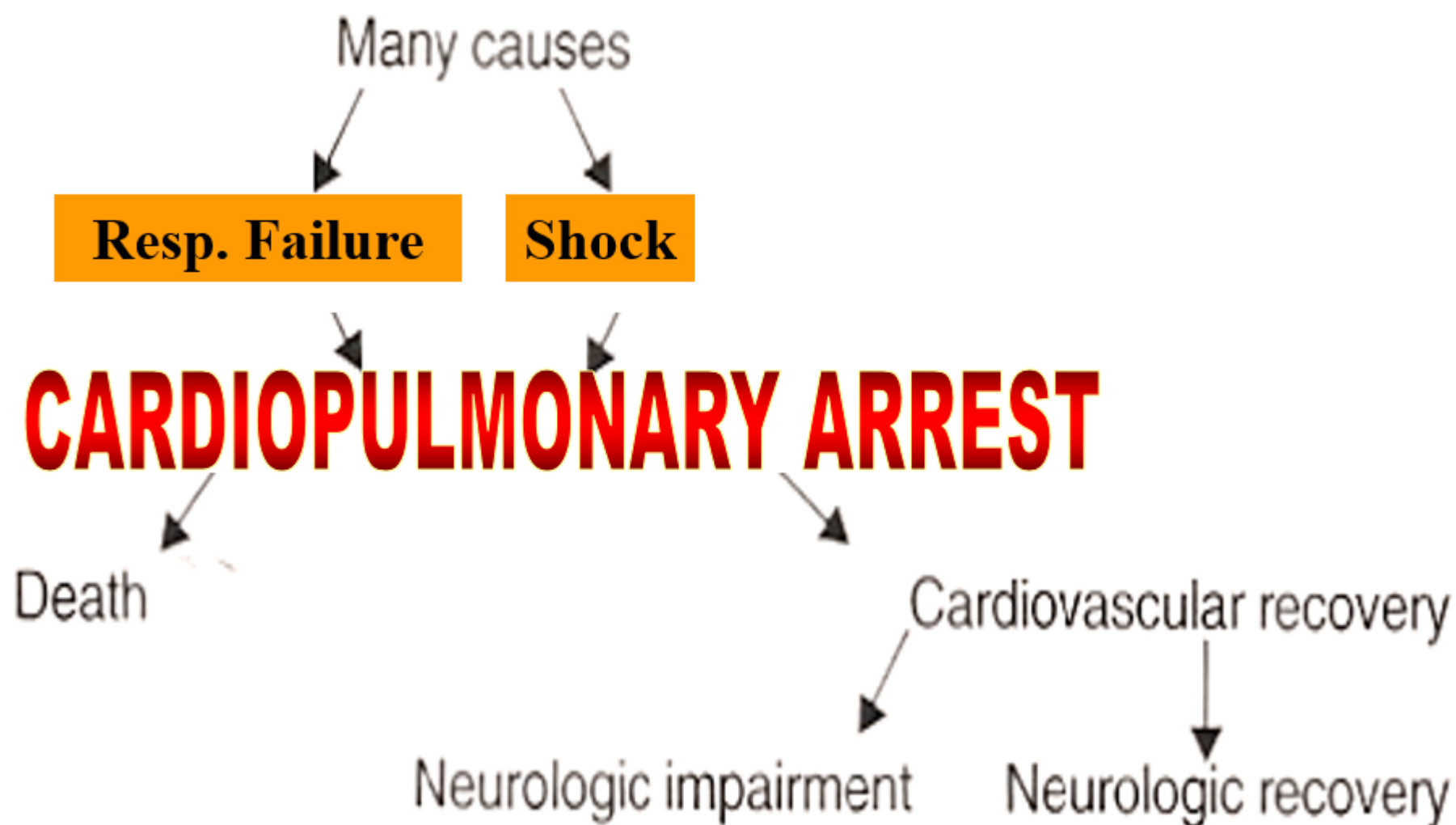


**Ischemic
cardiovascular
disease**

INFANTS AND CHILDREN



**Respiratory
failure and/or
shock**



Cardiogenic pulmonary edema

Atelectasis

Pneumonia

Post surgery
changes

pulmonary
ARDS

Hypoxic Respiratory Failure

Trauma

extra pulmonary
ARDS

Pulmonary
fibrosis

Infiltrates in
immunosuppression

Aspiration

Common causes of cardiac arrest in children

- Bronchospasm / Respiratory infection
- Burns
- Drowning
- Dysrhythmias
- Foreign Body Aspiration
- Gastroenteritis (vomiting and diarrhea)
- Sepsis
- Seizures
- Trauma

Successful resuscitation

Receive early CPR

initial cardiac arrest rhythm of VF-
pVT

successful resuscitation

- early recognition of cardiopulmonary arrest
- prompt initiation

Pediatric Assessment Triangle (PAT)

- The triangle is designed to be a quick and simple approach to evaluating a child based on visual and auditory clues.



- Tone
- Interactivity
- Consolability
- Look/gaze
- Speech/cry




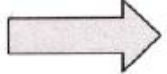
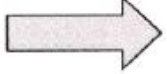


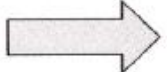



- Abnormal breath sounds
- Abnormal positioning
- Retractions
- Flaring

- Pallor
- Mottling
- Cyanosis
- Bleeding

Pediatric Advanced Life Support

Identification of Respiratory Problems by Severity

Respiratory Distress 		Respiratory Failure
A	Open and maintainable 	Not maintainable
B	Tachypnea 	Bradypnea to apnea
	Work of breathing (nasal flaring/retractions) Increased effort 	Decreased effort  Apnea
	Good air movement 	Poor to absent air movement
C	Tachycardia 	Bradycardia
	Pallor 	Cyanosis
D	Anxiety, agitation 	Lethargy to unresponsiveness
E	Variable temperature	

Out-of-hospital

- pediatric prehospital medical arrest
- examined cohort of 147 children
- boys 58%
- 69% arrests occurred at home
- 4% survived to hospital discharge
-

Foltin GL, et al. [Pediatric prehospital evaluation of NYC cardiac arrest survival \(PHENYCS\)](#).
Pediatr Emerg Care. 2012 Sep;28(9):864-8.

Out-of-hospital (trauma)

- pediatric traumatic arrest
- examined cohort of 118 children
- age 13<
- 5% survived

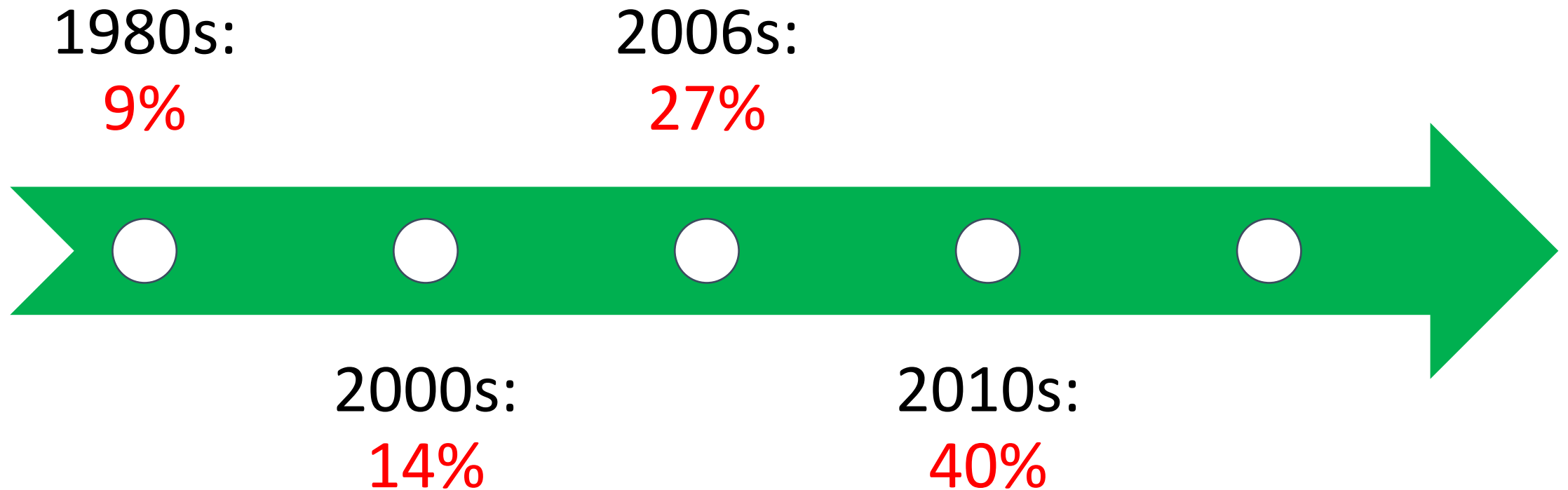
Brindis SL, et al. [Universally poor outcomes of pediatric traumatic arrest: a prospective case series and review of the literature](#). Pediatr Emerg Care. 2011 Jul;27(7):616-21.

In-hospital

- In one multicenter observational study
- academic pediatric hospitals
- 1031 children.....in-hospital cardiopulmonary arrests
- over a 10 year period (2000 to 2009)
- discharge increased from 14 to 43 %
- the rates of significant neurologic disability remained stable

[Girotra S, Spertus JA, Li Y, et al. Survival trends in pediatric in-hospital cardiac arrests: an analysis from Get With the Guidelines-Resuscitation. Circ Cardiovasc Qual Outcomes 2013; 6:42.](#)

in-hospitalsurvival rates



What did change in the hospital ?

1. Earlier recognition of clinical deterioration
2. More aggressive implementation of resuscitation guidelines
3. Rapid response teams (RRT) effect

Cardiopulmonary arrest rates < 72%

Mortality rates < 35%

What is rapid response teams (RRT) ?

- A team designed for early intervention for potentially unstable patients
- A proactive approach to patient care
- Who are the members ?
 - ☐ Nurses
 - ☐ Paramedic
 - ☐ Physicians



Respiratory arrest vs Cardiopulmonary arrest

- observational study of 95 children
- out-of-hospital arrest
- 82 % of children with respiratory arrest were alive at one year
- 14%cardiopulmonary arrest
- If no cardiopulmonary arrest.... results are better

[Herce J, García C, Domínguez P, et al. Outcome of out-of-hospital cardiorespiratory arrest in children. Pediatr Emerg Care 2005; 21:807.](#)

CAB instead of ABC

- Compressions prior to airway and breathing for infants and children in cardiac arrest

Part 13: Pediatric Basic Life Support
**2010 American Heart Association Guidelines for Cardiopulmonary
Resuscitation and Emergency Cardiovascular Care**

Marc D. Berg, Chair; Stephen M. Schexnayder; Leon Chameides; Mark Terry; Aaron Donoghue;
Robert W. Hickey; Robert A. Berg; Robert M. Sutton; Mary Fran Hazinski

Key points 2010 Guidelines

- Compressions should be started immediately while second rescuer prepares to start ventilations
- If the child is not intubated30 compressions /2 ventilations
....15 compressions/2 ventilations
- New evidence documents the important role of ventilations in CPR for infants and children
- For unwilling rescuers...Hand only CPR

[Part 10: Pediatric basic and advanced life support: 2010 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations.](#)

Kleinman ME, de Caen AR, Chameides L, Atkins DL, Berg RA, Berg MD, Bhanji F, Biarent D, Bingham R, Coovadia AH, Hazinski MF, Hickey RW, Nadkarni VM, Reis AG, Rodriguez-Nunez A, Tibballs J, Zaritsky AL, Zideman D; Pediatric Basic and Advanced Life Support Chapter Collaborators *Circulation*. 2010 Oct 19;122(16 Suppl 2):S466-515. doi: 10.1161/CIRCULATIONAHA.110.971093. No abstract

Effective chest compressions

- At least 1/3 the anterior-posterior dimension of the chest
- 4 cm in most infants
- 5 cm in most children
- Heart rate > 100 /min

[Part 10: Pediatric basic and advanced life support: 2010 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations.](#)

Kleinman ME, de Caen AR, Chameides L, Atkins DL, Berg RA, Berg MD, Bhanji F, Biarent D, Bingham R, Coovadia AH, Hazinski MF, Hickey RW, Nadkarni VM, Reis AG, Rodriguez-Nunez A, Tibballs J, Zaritsky AL, Zideman D; Pediatric Basic and Advanced Life Support Chapter Collaborators *Circulation*. 2010 Oct 19;122(16 Suppl 2):S466-515. doi: 10.1161/CIRCULATIONAHA.110.971093. No abstract

Palpation of pulse

- If there is no pulse or it is not definitively identified within 10 seconds, then start compressions BEFORE performing airway or breathing maneuvers
- Not reliable as the sole determinant of cardiac arrest
- If the victim is unresponsive, not breathing normally and without signs of life.
CPR should be started
- Healthcare providers accurately determine the presence or absence of a pulse in infants and children about 80%

intubating

- Both uncuffed and cuffed endotracheal tubes are acceptable for intubating infants and children
- Formula for uncuffed tubes: $\text{Age (year)} / 4 + 4$
- Formula for cuffed tubes
 - Infants < 12 month 3.0 cuffed
 - Infants 12 -24 month 3.5 cuffed
 - Children 24 > month $\text{Age (year)} / 4 + 3,5$
- Attention to inflation pressure for cuffed tubes
- Avoid excessive pressure !

Respiratory support

- Intubated infants and children should be ventilated at a rate of 8 to 10 breaths per minute without any interruption of chest compressions

Defibrillation

- If initial cardiac arrest rhythm of VF or pVTIncreased survival rates
- For VF or pVT.....initial energy dose 2-4 J/kg
- If a manual defibrillator is not available, an automated defibrillator (AED) should be used as soon as possible for all infants and children with a witnessed arrest.

Differences related with age

- Endotracheal tube diameters
- Medication doses
- Tidal volume
- Cardiac compression style (one hand, two hand, two fingers)
- Respiration rates

Broselow Pediatric Emergency Tape



Color	Estimated Weight (in kilograms)	Estimated Weight (in pounds)
Grey	3-5 kg	6-11 lbs
Pink	6-7 kg	13-15 lbs
Red	8-9 kg	17-20 lbs
Purple	10-11 kg	22-24 lbs
Yellow	12-14 kg	26-30 lbs
White	15-18 kg	33-40 lbs
Blue	19-23 kg	42-50 lbs
Orange	24-29 kg	53-64 lbs
Green	30-36 kg	66-80 lbs

- Pre-prepared packages set you free to account for dosages and other things

Blade

- Under 4 years of age, miller blades should be used.



Miller

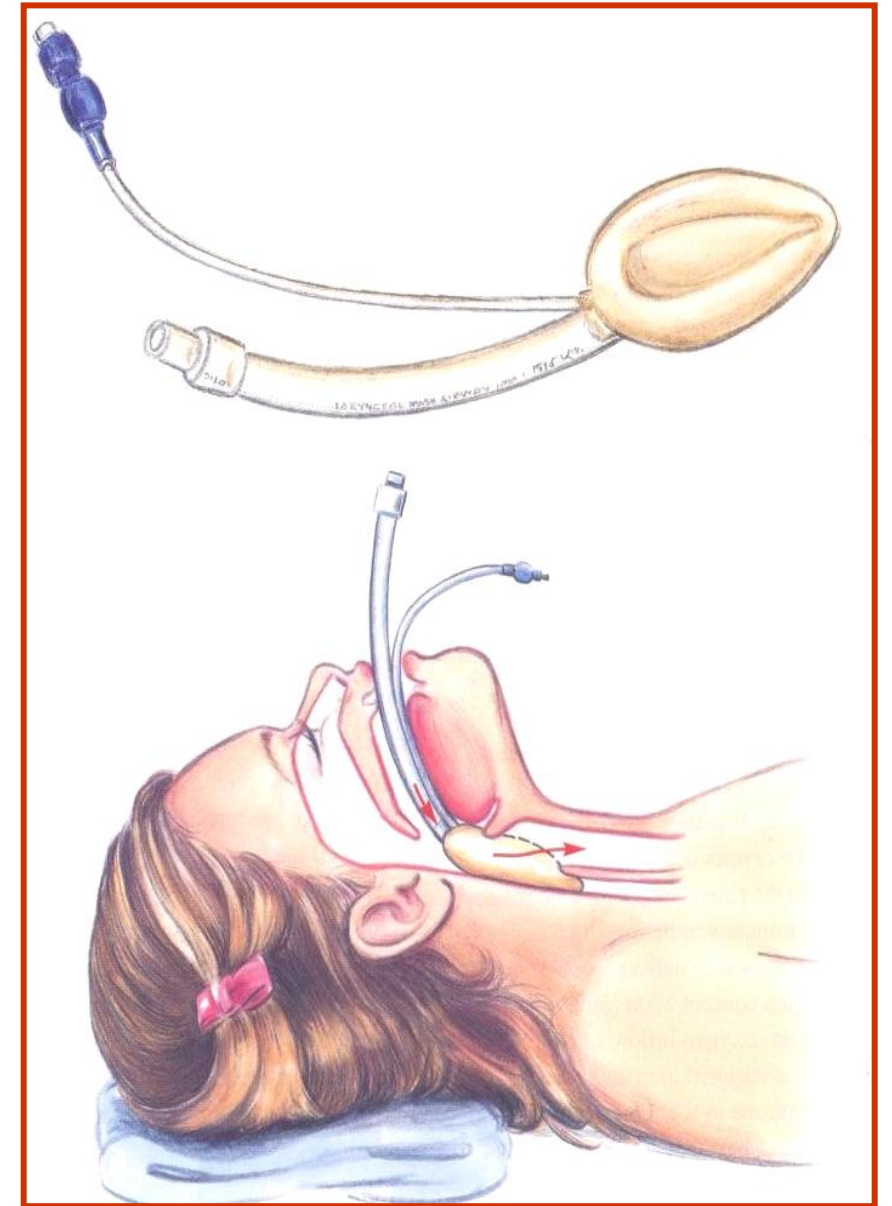


Macintosh



Laryngeal Mask

- Higher success rate
- Does NOT protect from aspiration
- Difficult to maintain during transport



Appropriate material



Oxygen concentration %



16

21

45

85





Intraosseous line (IO)

- a rapid and safe alternative
- when peripheral venous access is difficult.
- If a peripheral IV cannot be quickly
- should be placed by a trained provider !



EZ-IO

- Study period (January 2009-December 2011)
- 348 patients
- Overall success rate was 99.6%
- First attempt success rate of 85.9%
- Time: 10 seconds or less

Resuscitation. 2015 Mar;88:43-7. doi: 10.1016/j.resuscitation.2014.12.015. Epub 2014 Dec 30.

EZ-IO® intraosseous device implementation in German Helicopter Emergency Medical Service.

Helm M¹, Haunstein B², Schlechtriemen T³, Ruppert M⁴, LampI L², Gäßler M⁴.



Endotracheal drug administration

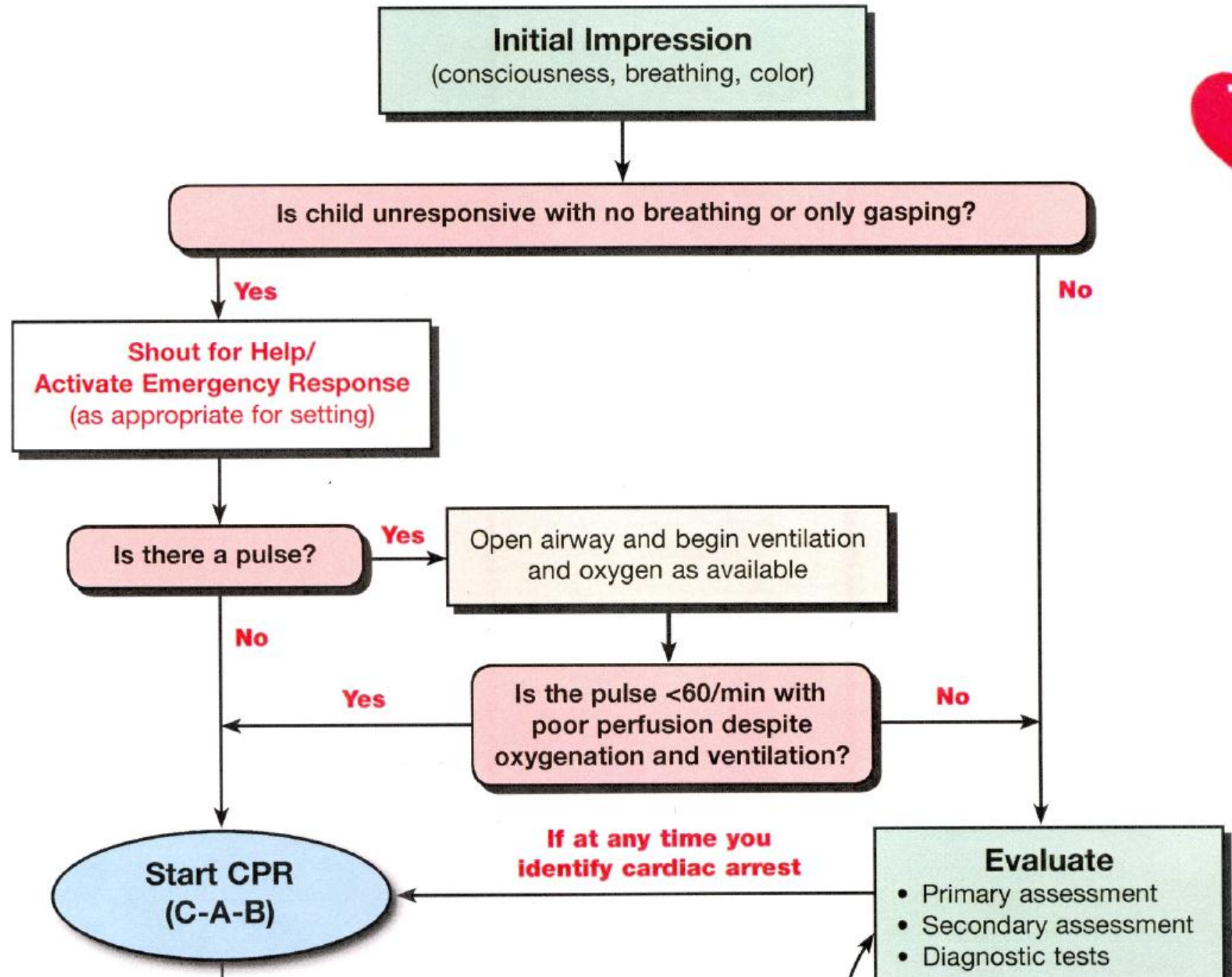
➤ If no form of vascular access can be obtained in a timely manner, then endotracheal drug administration is possible.

➤ Endotracheal (LANE)

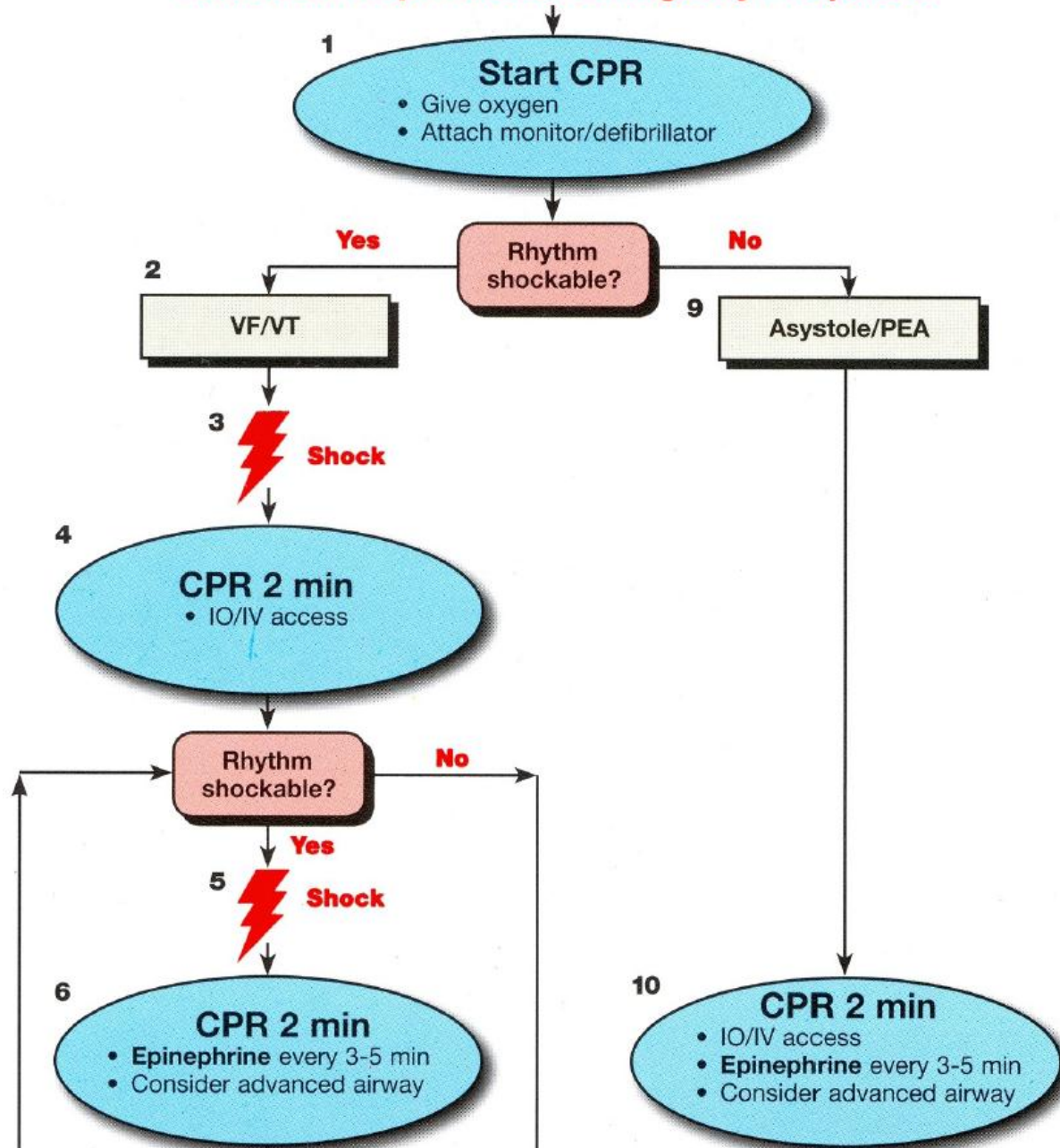
- LIDOCAINE
- ATROPINE
- NALOXONE
- EPINEPHRINE

Note: flush each medication with 3-5 ml of NS

➤ This route of administration is not preferred because absorption varies widely.



Shout for Help/Activate Emergency Response

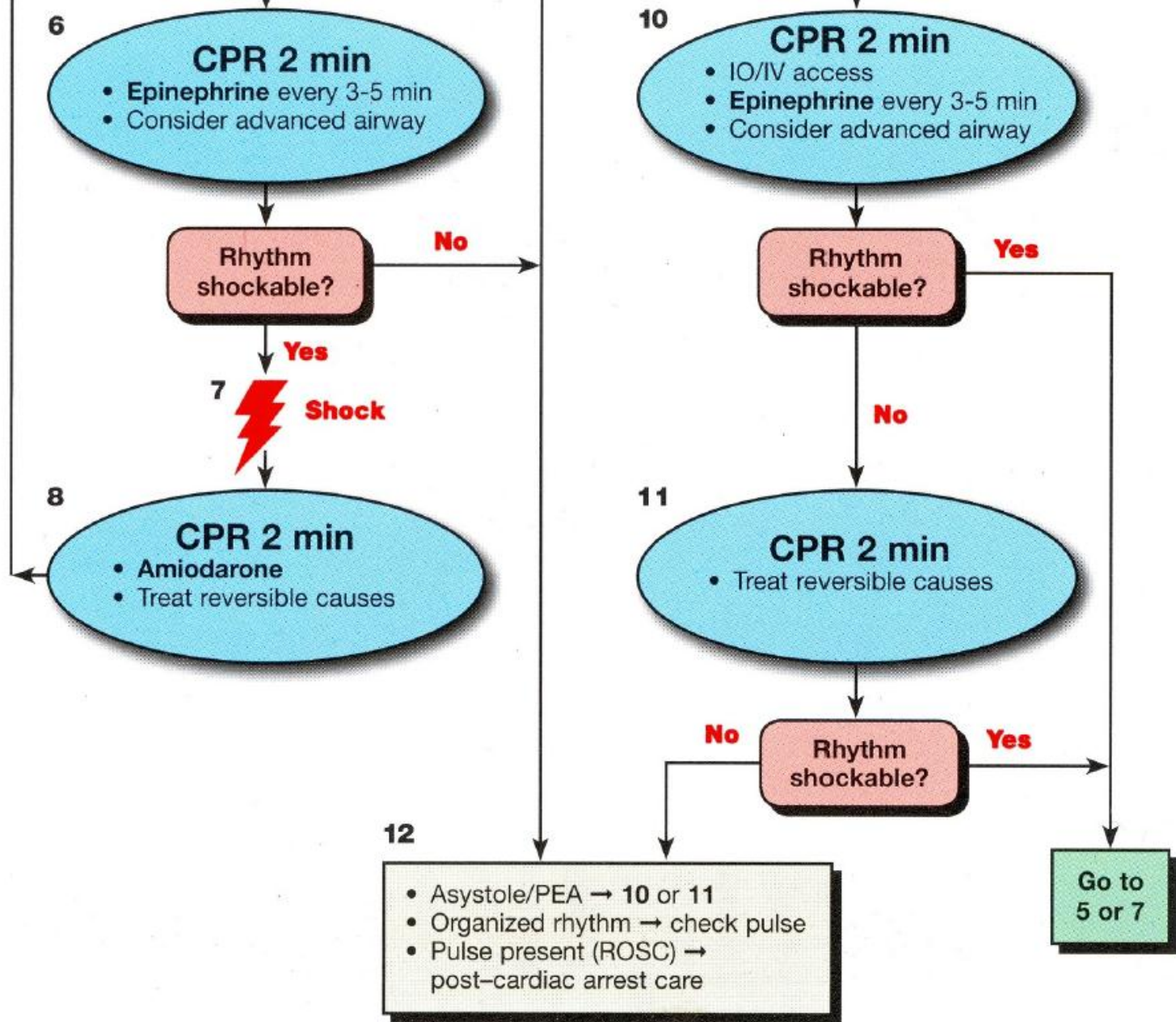


Shock Energy for Defibrillation

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

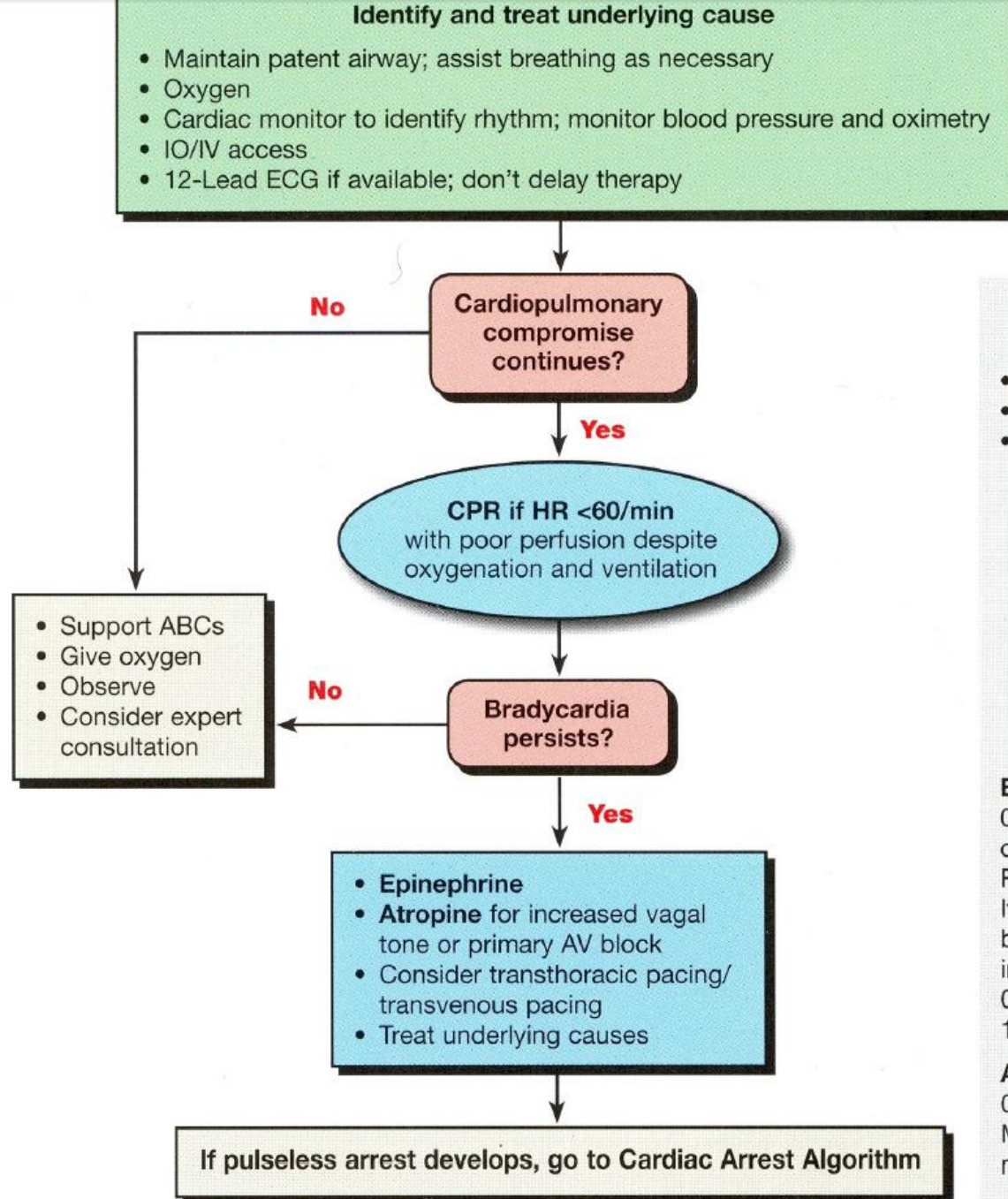
Drug Therapy

- **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.



Pediatric Bradycardia With a Pulse and Poor Perfusion Algorithm

Pediatric Advanced Life Support



Cardiopulmonary Compromise

- Hypotension
- Acutely altered mental status
- Signs of shock

Doses/Details

Epinephrine IO/IV Dose:

0.01 mg/kg (0.1 mL/kg of 1:10 000 concentration). Repeat every 3-5 minutes. If IO/IV access not available but endotracheal (ET) tube in place, may give ET dose: 0.1 mg/kg (0.1 mL/kg of 1:1000).

Atropine IO/IV Dose:

0.02 mg/kg. May repeat once. Minimum dose 0.1 mg and maximum single dose 0.5 mg.

Pulse with poor perfusion+bradycardia

- Among the children who needs resuscitation Children which have a pulse with poor perfusion and bradycardia have the highest discharge rates, 64%

Part 13: Pediatric Basic Life Support

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- Check for alertness.**

- Shake or tap the child gently.
- See if the child moves or makes a noise.
- Shout, "Are you OK?"

- If there is no response, shout for help.**

- Tell someone to call ambulance

- Perform chest compressions:**

- fast and hard with no pausing.
- "1,2,3,4,5,6.....25,26,27,28,29,30, off."

- Open the airway.**

- Look, listen, and feel for breathing.**

- If the child is not breathing:**

- Give 2 rescue breaths. Each breath should take about a second and make the chest rise.

- Continue CPR** (30 compressions / 2 breaths) for about 2 minutes.



The National Motorcycle Museum

- ✓ Guidelines 2015
- ✓ The science behind the changes
- ✓ Hot topics



Save the date!