PALS *Study Guide* 2025

Bulletin: **New resuscitation science and American Heart Association treatment guidelines were released October 25, 2025!**

The new AHA Handbook of Emergency Cardiac Care (ECC) contains these 2025 Guidelines and is required study for this course. The 2025 PALS Provider Manual is available. This study guide will provide you with additional study information.

Website: https://elearning.heart.org/course/427
www.phsinstitute.com (study info. For class for rhythm review)

What is required to successfully complete PALS?

♥ Completed **PALS Self Assessment is required for admission** to the course. All students must complete the Pre-course Self-Assessment and achieve a score of at least 70% before taking the PALS Course.

- Students must print their scoring report and bring it with them to class.

♥ Score **84% on the multiple-choice post-test**.
It is a timed test and you may be allowed to **use your ECC Handbook**.

♥ You **must be able to demonstrate**:

- The PALS rapid cardiopulmonary assessment
- Effective infant and child CPR
- using an AED on a child
- Safe defibrillation with a manual defibrillator
- maintaining an open airway
- Confirmation of effective ventilation
- addressing vascular access
- stating rhythm appropriate drugs, route and dose
- Consideration of treatable causes

What happens if I do not do well in the course?

The Course Director or Instructor will first "remediate" **(tutor)** you and you may be allowed to continue in the course. If it is decided you need more time to study, you will be placed into the next course.

Where do I start?

- **CPR/AED: You will be tested with no coaching**. **If you cannot perform these skills well without coaching**, you can/may be directed to take the course at another time.
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- **Arrhythmias: Before you come be sure you can identify** Sinus Rhythm **(SR)**, Sinus Bradycardia **(SB)**, Sinus Tachycardia **(ST)**, Supraventricular Tachycardia **(SVT)**, Ventricular Tachycardia **(VT)**, Ventricular Fibrillation **(VF)**, Torsade's de Pointes, Pulseless Electrical Activity **(PEA)** and Asystole.

You will need to know:

* **Respiratory Rate**

Age	Rate
Infant	30 - 53
Toddler	22 - 37
Preschooler	20 - 28
School-age child	18 - 25
Adolescent	12 - 20

Heart Rate

Age	Sleeping - Awake
1- 12 months	90 - 205
12 months - 2 years	90 - 180
2 – 5 years	80 - 140
5 - 10 years	58 - 118
10-15 years	50 - 100

* **Hypotension by Systolic Blood Pressure (SBP)**

Age	SBP
< 1 month	< 60
1 month – 1 year	< 70
1 – 10 years	< 70 **+ (2 x age in years)**
10 + years	< 90

Hypotension + signs of poor perfusion = Decompensated shock.

* **Treat Possible Causes**

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5 Hs	5 Ts
H ypoxia	**T** amponade
H ypo-volemia	**T** ension pneumothorax
H ypo-thermia	**T** oxins – poisons, drugs
Hypo /hyper kalemia	**T** hrombosis – coronary **(AMI)**
Hydro gen ion **(acidosis)**	**T** hrombosis – pulmonary **(PE)**
Hydro- Glycemia	**T** rauma

Spacing separations may help as a memory aid.

Rapid Cardiopulmonary Assessment *and* Algorithms

This is a systematic head-to-toe assessment used to identify infants and children in respiratory distress and failure, shock and pulseless arrest. **Algorithms** are "menus" that guide you through recommended treatment interventions.

Know the following assessment because it begins all PALS case scenarios. The information you gather during the assessment will determine which algorithm you choose for the patient's treatment. **After each intervention** you will reassess the patient again using the head-to-toe assessment.

‹***Start with child's general appearance:***

Is the level of consciousness: **A**= awake **V**= responds to verbal **P**= responds to pain **U**= unresponsive **Is the overall color:** good or bad?
Is the muscle tone: good or floppy?

‹***Then assess CABs:*** **(stop and give immediate support when needed, then continue with assessment)**

Circulation: **Is central pulse** present or absent?
Is the rate normal or too slow or too fast?
Is the rhythm regular or irregular?
Is the QRS narrow or wide?

Airway: **Open and hold** with head tilt-chin lift

Breathing: **Is it** present or absent?
Is the rate normal or too slow or too fast?
Is the pattern regular or irregular or gasping?
Is the depth normal or shallow or deep?
Is there nasal flaring or sternal retractions or accessory muscle use?
Is there stridor or grunting or wheezing?

‹***Next look at perfusion:***

Is the central pulse versus peripheral pulse strength equal or unequal?
Is skin color, pattern and temperature normal or abnormal?
Is capillary refill normal or abnormal **(greater than 2 seconds)**?
Is the liver edge palpated at the costal margin **(normal or dry)** or below the costal margin **(fluid overload)**?

‹***And check:***

Is systolic BP acceptable for age **(normal or compensated)** or hypotensive?
Is urine output adequate for: infants and children **(1– 2cc/kg/hr)** or adolescents **(30cc/hr)**?

‹***Now classify the physiologic status:***

Stable: needs little support; **reassess frequently**

Unstable: needs **immediate support** and intervention

Respiratory distress: increased rate, effort and noise of breathing; requires much energy **Respiratory failure:** slow or absent rate, weak or no effort and is **very quiet**

Compensated shock: SBP is acceptable but perfusion is poor: central vs. peripheral pulse strength is unequal peripheral color is poor and skin is cool capillary refill is prolonged

Decompensated shock: Systolic hypotension with poor or absent pulses, poor color, weak compensatory effort.

‹***Apply the appropriate treatment algorithm:***

- Bradycardia with a Pulse
- Tachycardia with Adequate Perfusion
- Tachycardia with Poor Perfusion
- Pulseless Arrest: VF/VT and Asystole/PEA

Advanced Airway

A **cuffed or uncuffed E**ndotracheal **T**ube **(ET)** may be used on Infants and children.

To estimate tube size: ECC Handbook p. 94

Uncuffed = **(Age** in years ÷ **4) + 4** Example: (**4** years ÷ 4) = **1 + 4** = **5**

Cuffed = **(Age** in years ÷ **4) + 3**.5 Example: (**4** years ÷ 4) = **1 + 3.5** = **4.5**

Depth = (Age in years ÷ **2) + 12** Example: (**4** years ÷ 2) = **2 + 12** = **14**

Immediately confirm tube placement **by clinical assessment and a device**:

▶ **Clinical assessment:**

- Look for bilateral chest rise.
- Listen for breath sounds over stomach and the 4 lung fields **(left and right anterior and midaxillary)**. • Look for water vapor in the tube **(if seen this is helpful but not definitive).**

▶ **Devices:**

- **End-Tidal CO_2 Detector** (**ETD**): if weight > 2 kg ƒ Attaches between the ET and Ambu bag; give 6 breaths with the Ambu bag:
  - Litmus paper center should change color with **each inhalation** and **each exhalation**.
  - **Original color** on inhalation = **Okay Color** **O_2 is being inhaled:** expected. **Tube**
  - **change** on exhalation = **CO_2!!** **is in** trachea.

- **Original color on exhalation** = **Oh-OH!!** **Litmus paper is wet**: replace ETD.
  Tube is not in trachea: remove ET.
  Cardiac output is low during CPR.

- **Esophageal Detector** (**EDD**): if weight > 20 kg and in a perfusing rhythm * Resembles a turkey baster:
  - Compress the bulb and attach to end of ET.
  - Bulb **inflates quickly!** Tube is in the trachea.
  - Bulb **inflates poorly?** Tube is **in the esophagus**. * No recommendation for its use in cardiac arrest.

▶ **When sudden deterioration of an intubated patient occurs, immediately check:**

Displaced	= tube is not in trachea	or has moved into a bronchus **(right main stem most common)**	
Obstruction	= consider secretions	or kinking of the tube	
Pneumothorax	= consider chest trauma	or barotraumas	or non-compliant lung disease
Equipment	= check oxygen source	and Ambu bag	and ventilator

****The 2025 updates to Pediatric Advanced Life Support (PALS), released by the American Heart Association (AHA) and the American Academy of Pediatrics (AAP) in October 2025, represent a comprehensive shift toward physiology-directed resuscitation and more precise hemodynamic targets.**

Key Resuscitation Updates

- Physiology-Directed Resuscitation: Resuscitation now emphasizes real-time hemodynamic monitoring over purely algorithmic approaches.
- Blood Pressure Targets during CPR: For the first time, specific diastolic blood pressure (DBP) targets are recommended when invasive arterial monitoring is available:
  - Infants: DBP ≥ 25 mm Hg.
  - Children: DBP ≥ 30 mm Hg.
- Tachyarrhythmia Management:
  - IV Sotalol: Newly endorsed as an antiarrhythmic option for infants and children with SVT and cardiopulmonary compromise if other treatments fail and expert consultation is unavailable.
  - Adenosine: Remains the first-line treatment for stable wide-complex tachyarrhythmias due to the high frequency of SVT with aberrancy in children.
- Ventilation Rates: For pediatric patients with a pulse but inadequate breathing (or during CPR with an advanced airway), the rate is now 1 breath every 2 to 3 seconds (20–30 breaths/min), an increase from previous guidance.

Basic Life Support (BLS) & Choking Refinements

- Single Chain of Survival: A unified Chain of Survival now covers both adult and pediatric, in-hospital and out-of-hospital cardiac arrest.
- Choking (Foreign Body Airway Obstruction):
  - Infants: Use repeated cycles of 5 back blows followed by 5 chest thrusts.
  - Children: Use repeated cycles of 5 back blows followed by 5 abdominal thrusts.
- Infant Compressions: The 2-finger technique is eliminated for being ineffective at achieving proper depth; only the 1-hand or 2 thumb-encircling hands techniques are recommended.

Post-Cardiac Arrest & Special Conditions

- Septic Shock: New guidance suggests initial fluid aliquots of 10–20 mL/kg (previously 20 mL/kg), reflecting a more cautious approach to fluid administration.
- Neurologic Prognostication: The 2025 guidelines now include specific information for predicting favorable versus unfavorable neurologic outcomes after arrest.
- Post-ROSC Care: It is recommended to maintain systolic and mean arterial blood pressure above the 10th percentile for the patient's age.

PALS Drugs

In Arrest:

Epinephrine: catecholamine ECC Handbook

Increases heart rate, peripheral vascular resistance and cardiac output; **during CPR** increases myocardial and cerebral blood flow.

IV/IO: 0.01 mg/kg of 1:10 000 solution (equals 0.1 mL/kg of the 1:10 000 solution); repeat q. 3–5 min ET: 0.1 mg/kg of 1:1000 solution (equals 0.1 mL/kg of the 1:1000 solution); repeat q. 3–5 min

Anti-arrhythmic Drugs:

Amiodarone: atrial and ventricular antiarrhythmic ECC Handbook

Slows AV nodal and ventricular conduction, increases the QT interval and may cause vasodilation.

Refractory VF/PVT: IV/IO: 5 mg/kg bolus (may repeat up to 2 times)
Perfusing VT: IV/IO: 5 mg/kg over 20-60 min
Perfusing SVT: IV/IO: 5 mg/kg over 20-60 min
Max: 15 mg/kg per 24 hours – Max single dose 300mg Caution: hypotension, Torsade; half-life is up to 40 days

Lidocaine: ventricular antiarrhythmic to consider when amiodarone is unavailable ECC Handbook

Decreases ventricular automaticity, conduction and repolarization.

VF/PVT: IV/IO: 1 mg/kg bolus repeat >15 min
ET: 2 -3 mg/kg
Perfusing VT: IV/IO: 1 mg/kg bolus repeat >15 min
Infusion: 20-50 mcg/kg/min
Caution: neuro toxicity → seizures

Magnesium: ventricular antiarrhythmic for Torsade and hypomagnesemia ECC Handbook

Shortens ventricular depolarization and repolarization **(decreases the QT interval)**. IV/IO:

25-50 mg/kg over 10–20 min; give faster in Torsade
Max: 2 gm
Caution: hypotension, bradycardia

Procainamide: atrial and ventricular antiarrhythmic to consider for perfusing rhythms ECC Handbook p. 96

Slows conduction speed and prolongs ventricular de- and repolarization **(increases the QT interval)**.

Perfusing recurrent VT: IV/IO: 15 mg/kg infused over 30–60 min Recurrent
SVT: IV/IO: 15 mg/kg infused over 30–60 min

Caution: hypotension; use it with extreme caution with amiodarone as it can cause AV block or Torsade

Increase heart rate:

Epinephrine: drug of choice for pediatric bradycardia after oxygen and ventilation ECC Handbook

Increases heart rate, peripheral vascular resistance and cardiac output; **during CPR** increases myocardial and cerebral blood flow.

IV/IO: 0.01 mg/kg of 1:10 000 solution (equals 0.1 mL/kg of the 1:10 000 solution); repeat q. 3–5 min ET: 0.1 mg/kg of 1:1000 solution (equals 0.1 mL/kg of the 1:1000 solution); repeat q. 3–5 min

Atropine: vagolytic to consider after oxygen, ventilation and epinephrine ECC Handbook

Blocks vagal input therefore increases SA node activity and improves AV conduction.

IV/IO: 0.02 mg/kg; (max dose 0.5mg)

Caution: **do not give less than 0.1 mg** or may worsen the bradycardia

Atropine is not recommended for routine use in the management of PEA/asystole and has been removed from the PALS Cardiac Arrest Algorithm. The treatment of PEA/asystole is now consistent in the PALS

Decrease heart rate:

Adenosine: drug of choice for symptomatic SVT & Wide Complex Monomorphic VT See ECC Handbook

Blocks AV node conduction for a few seconds to interrupt AV node re-entry.

IV/IO: first dose: 0.1 mg/kg max: 6 mg

second dose: 0.2 mg/kg max: 12 mg

Caution: transient AV block or asystole; has very short half-life

Increase blood pressure:

Dobutamine: synthetic catecholamine ECC Handbook p. 92

Increases force of contraction and heart rate; causes mild peripheral dilation; may be used to treat shock.

IV/IO infusion: 2- 20 mcg/kg/min infusion

Caution: tachycardia

Dopamine: catecholamine ECC Handbook p. 92

May be used to treat shock; effects are dose dependent.

Low dose: increases force of contraction and cardiac output.

Moderate: increases peripheral vascular resistance, BP and cardiac output.

High dose: higher increase in peripheral vascular resistance, BP, cardiac work and oxygen demand.

IV/IO infusion: 2–20 mcg/kg/min

Caution: tachycardia

Miscellaneous:

Glucose: ECC Handbook p. 93

Increases blood glucose in hypoglycemia; prevents hypoglycemia when insulin is used to treat hyperkalemia.

IV/IO: 0.5–1 g/kg; this equals: 2–4 mL/kg of D25 **or** 5–10 mL/kg of D10 **or** 10–20 mL/kg of D5

Caution: maximum recommended concentration should not exceed D25%; hyperglycemia may worsen neuro outcome

Naloxone: opiate antagonist ECC Handbook p. 95 Reverses respiratory depression effects of narcotics.

< 5 yr or 20 kg: IV/IO: 0.1 mg/kg
> 5 yr or 20 kg: IV/IO: up to 2 mg

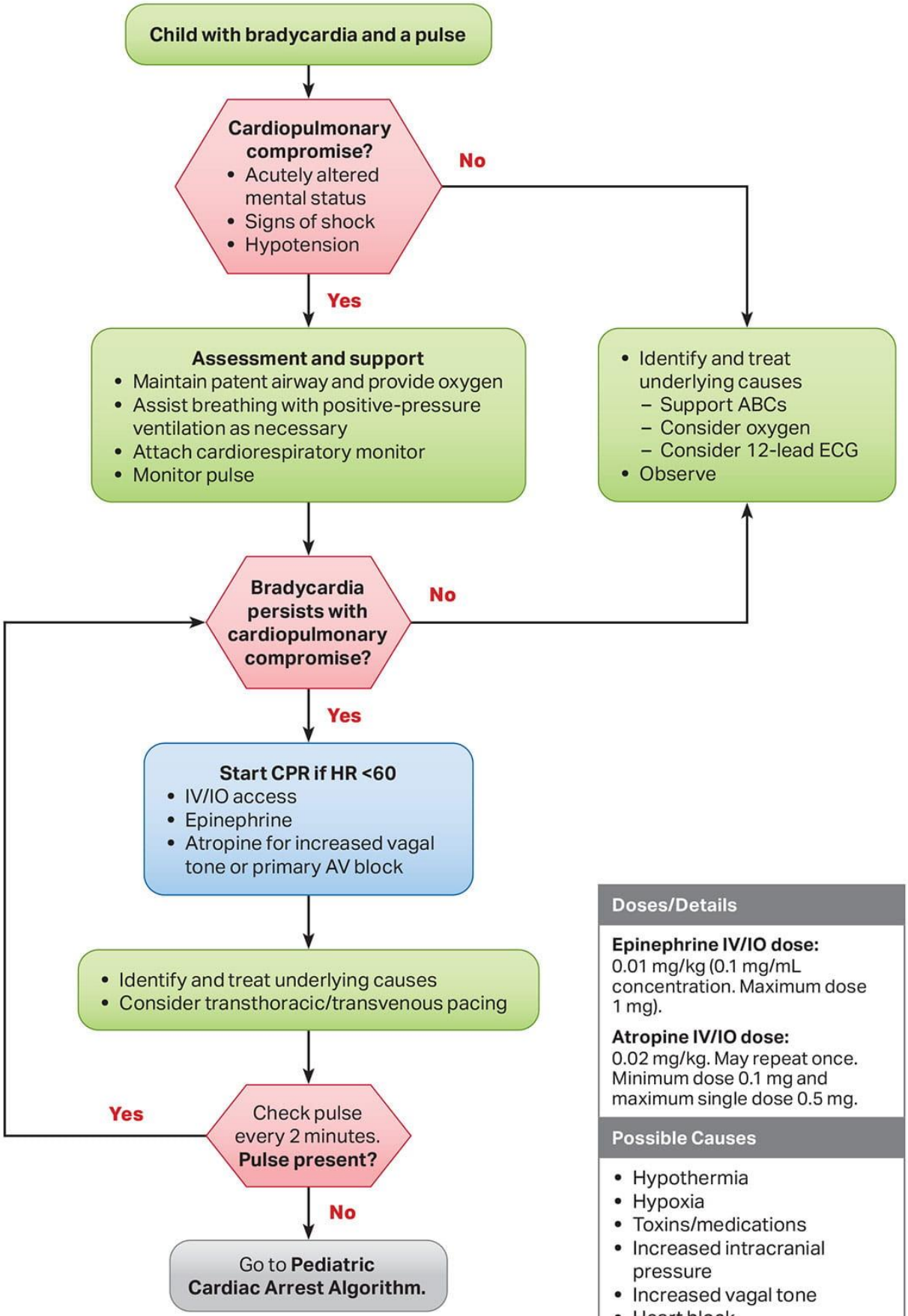
Caution: half-life is usually less than the half-life of narcotic, so repeat dosing is often required; ÆET dose can be given but is **not preferred**; can also give IM or SQ.

Sodium bicarbonate: pH buffer for prolonged arrest, hyperkalemia, tricyclic overdose: ECC Handbook p. 97
Increases blood pH helping to correct metabolic acidosis.

IV/IO: 1mEq/kg slow bolus; give **only** after effective ventilation is established Caution: causes other drugs to precipitate so flush IV tubing before and after

ET drug administration: distribution is unpredictable as is the resulting blood level of the drug; **if there is no IV/IO** access, give the drug down the ET and flush with 5 mL NS then give 5 ventilations to disperse the drug.

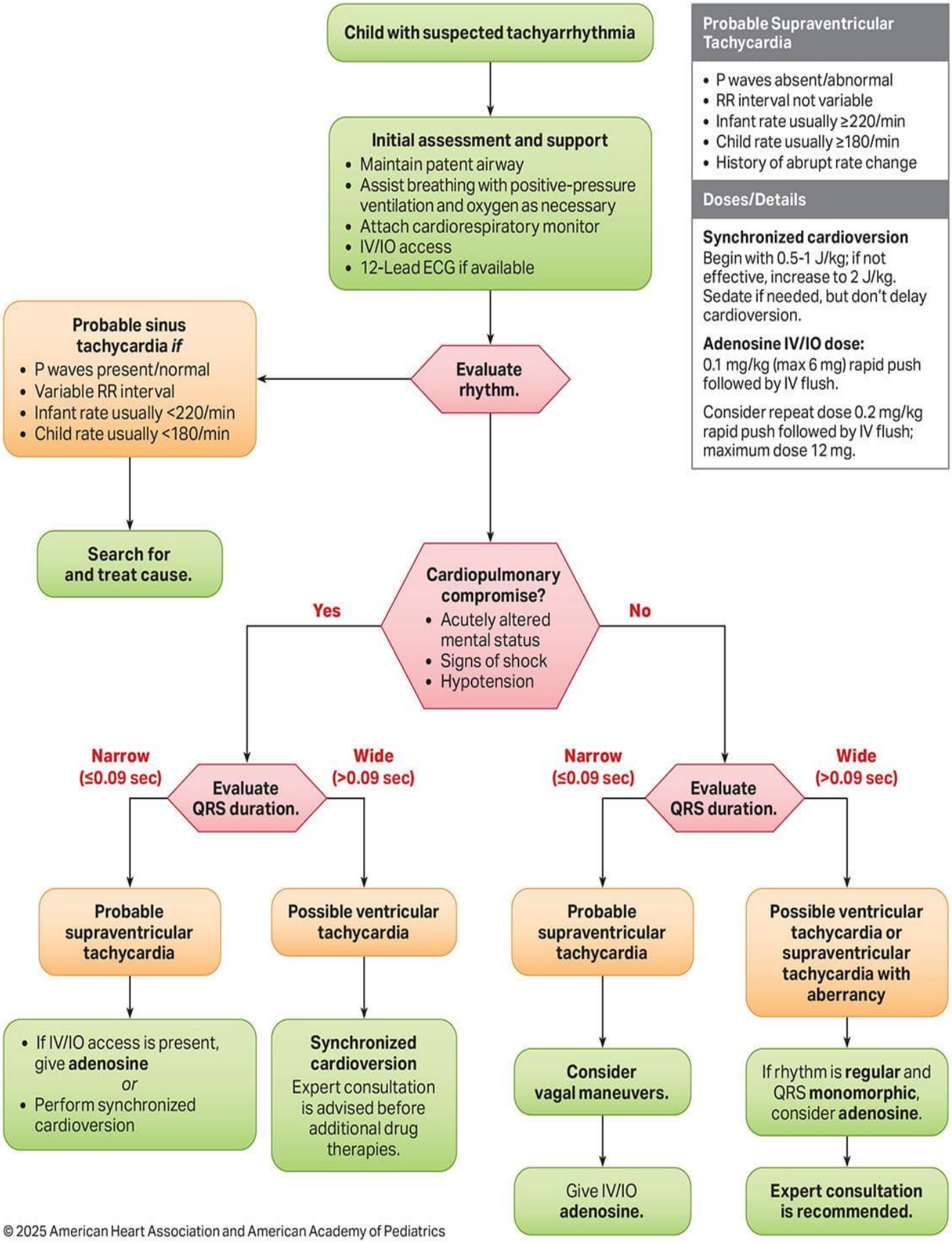
Pediatric Bradycardia With a Pulse Algorithm



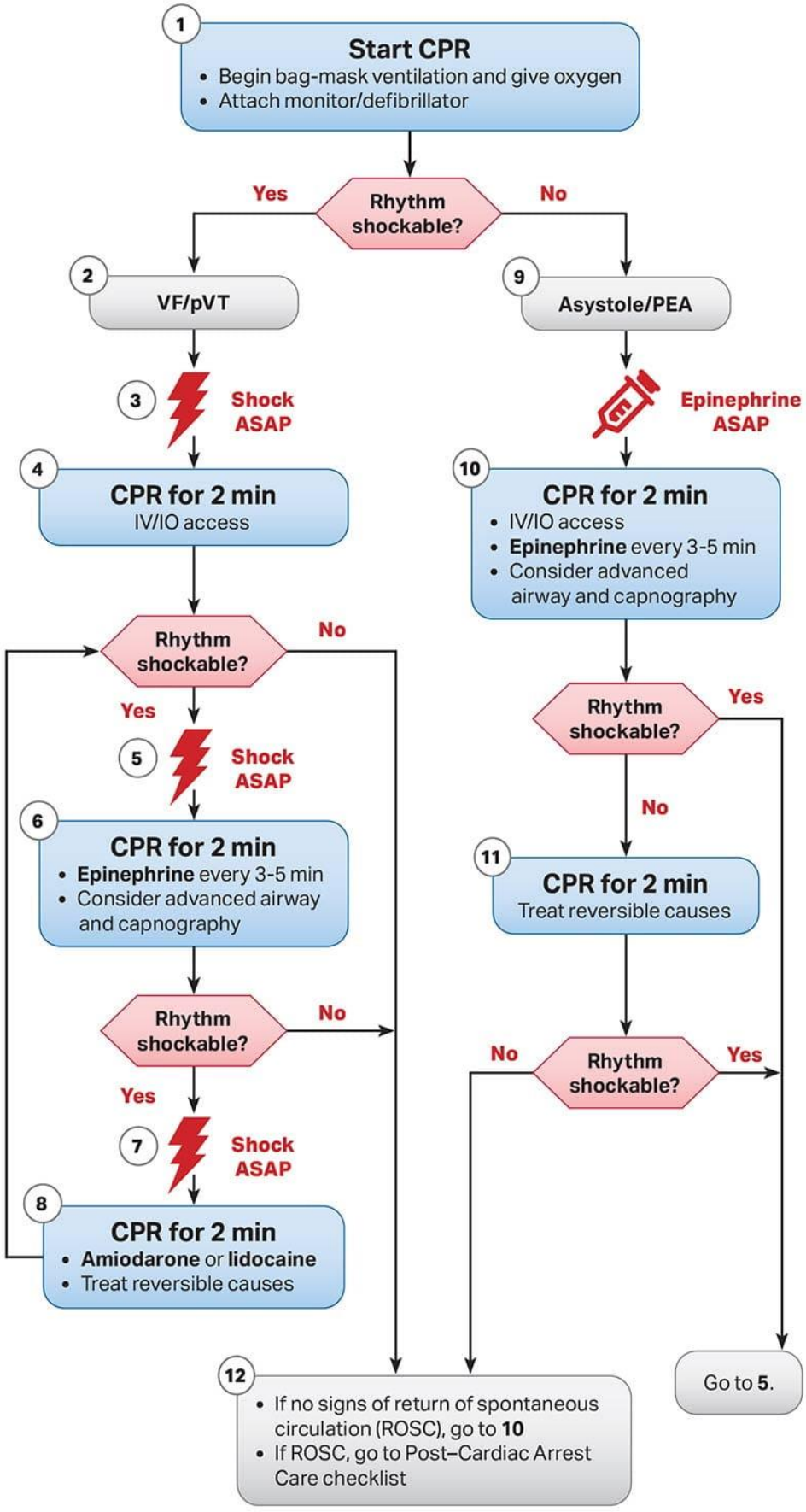
Doses/Details
Epinephrine IV/IO dose: 0.01 mg/kg (0.1 mg/mL concentration. Maximum dose 1 mg).
Atropine IV/IO dose: 0.02 mg/kg. May repeat once. Minimum dose 0.1 mg and maximum single dose 0.5 mg.

Possible Causes
• Hypothermia • Hypoxia • Toxins/medications • Increased intracranial pressure • Increased vagal tone • Heart block • Physiologic/appropriate

Pediatric Tachyarrhythmia With a Pulse Algorithm



Pediatric Cardiac Arrest Algorithm



High-Quality CPR

- Push hard (≥⅓ AP diameter of the chest)
- Push fast: 100-120/min
- Allow complete chest recoil
- Minimize interruptions in compressions
- Change compressor every 2 min, sooner if fatigued
- If no advanced airway, use compression-ventilation ratio of
  - 15:2 if 2 rescuers (prepuberty)
  - 30:2 if 2 rescuers (postpuberty onset)
  - 30:2 if 1 rescuer (any age)
- If advanced airway, provide continuous compressions and give a breath every 2-3 seconds
- Monitor $ETCO_2$ and, when available, invasive diastolic BP

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 IV/IO dose:** 0.01 mg/kg (0.1 mg/mL concentration). Max dose 1 mg.
- **Amiodarone IV/IO dose:** 5 mg/kg bolus (max 300 mg). May repeat up to 3 doses (max 150 mg subsequent doses).
  or
  Lidocaine IV/IO dose: 1 mg/kg

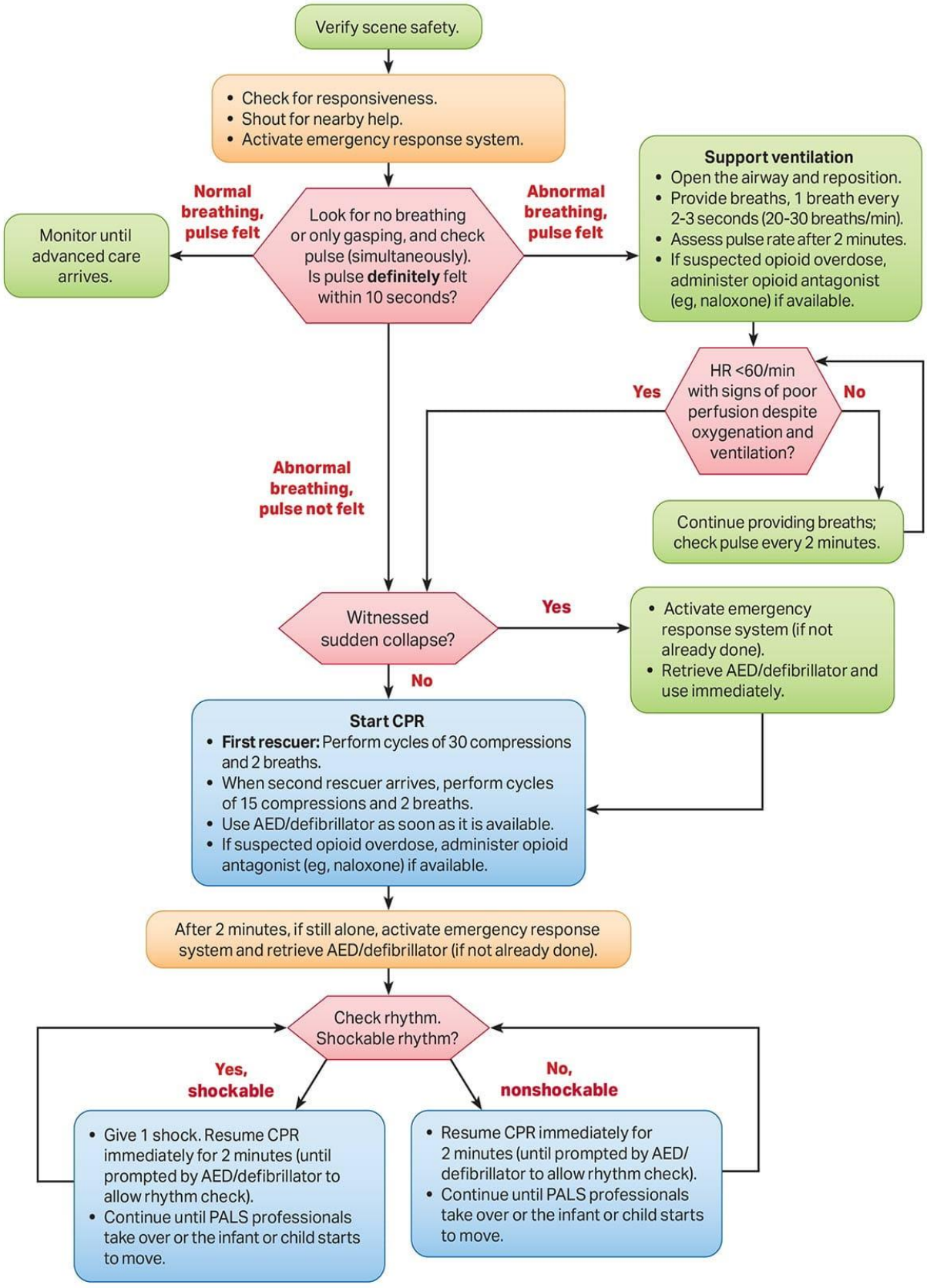
Advanced Airway

- ET intubation or supraglottic airway
- $ETCO_2$ to confirm and monitor ET tube placement

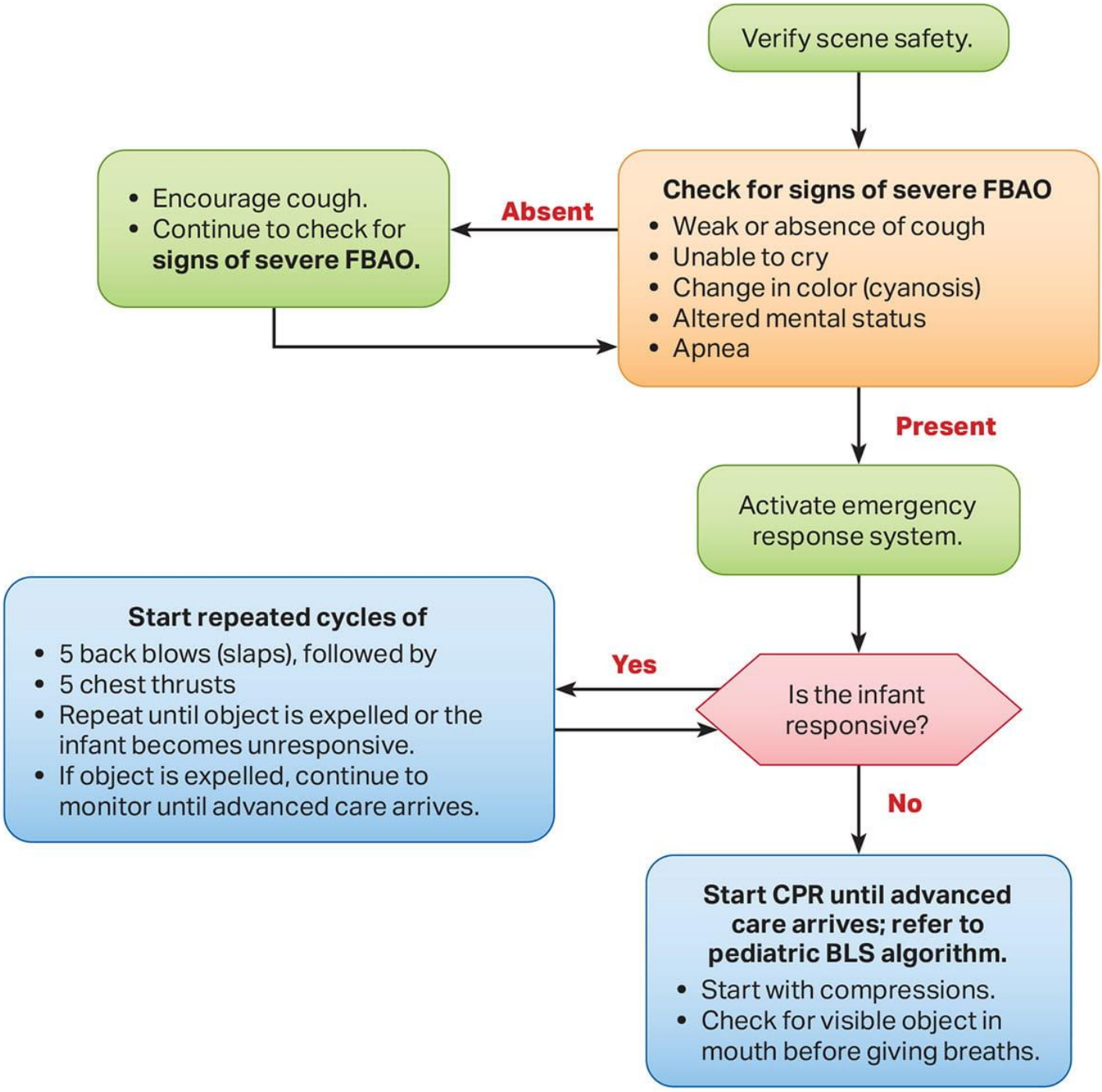
Reversible Causes

- **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

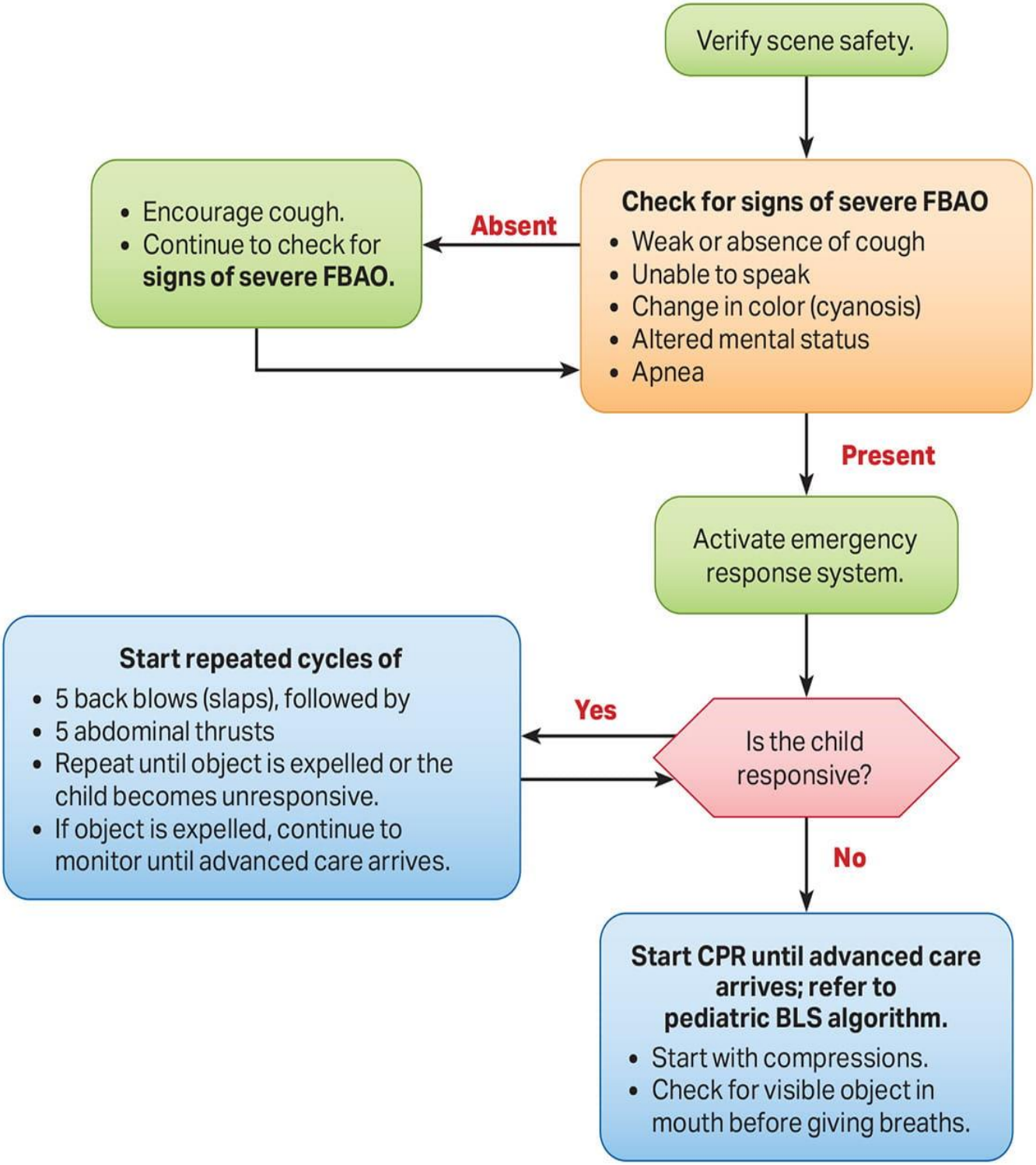
Pediatric Basic Life Support Algorithm (Infants to Puberty) for Health Care Professionals—Single Rescuer



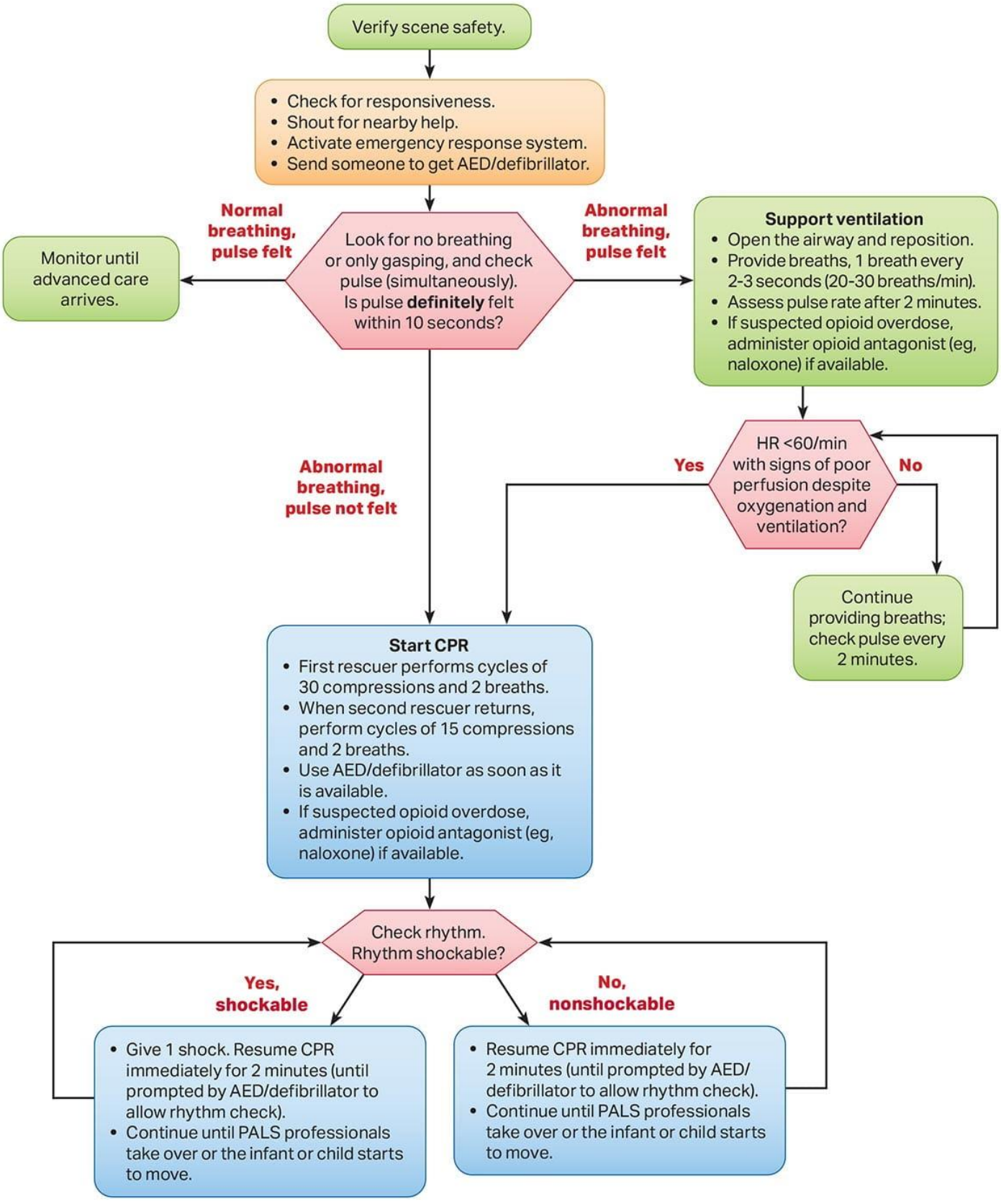
Infant Foreign-Body Airway Obstruction Algorithm



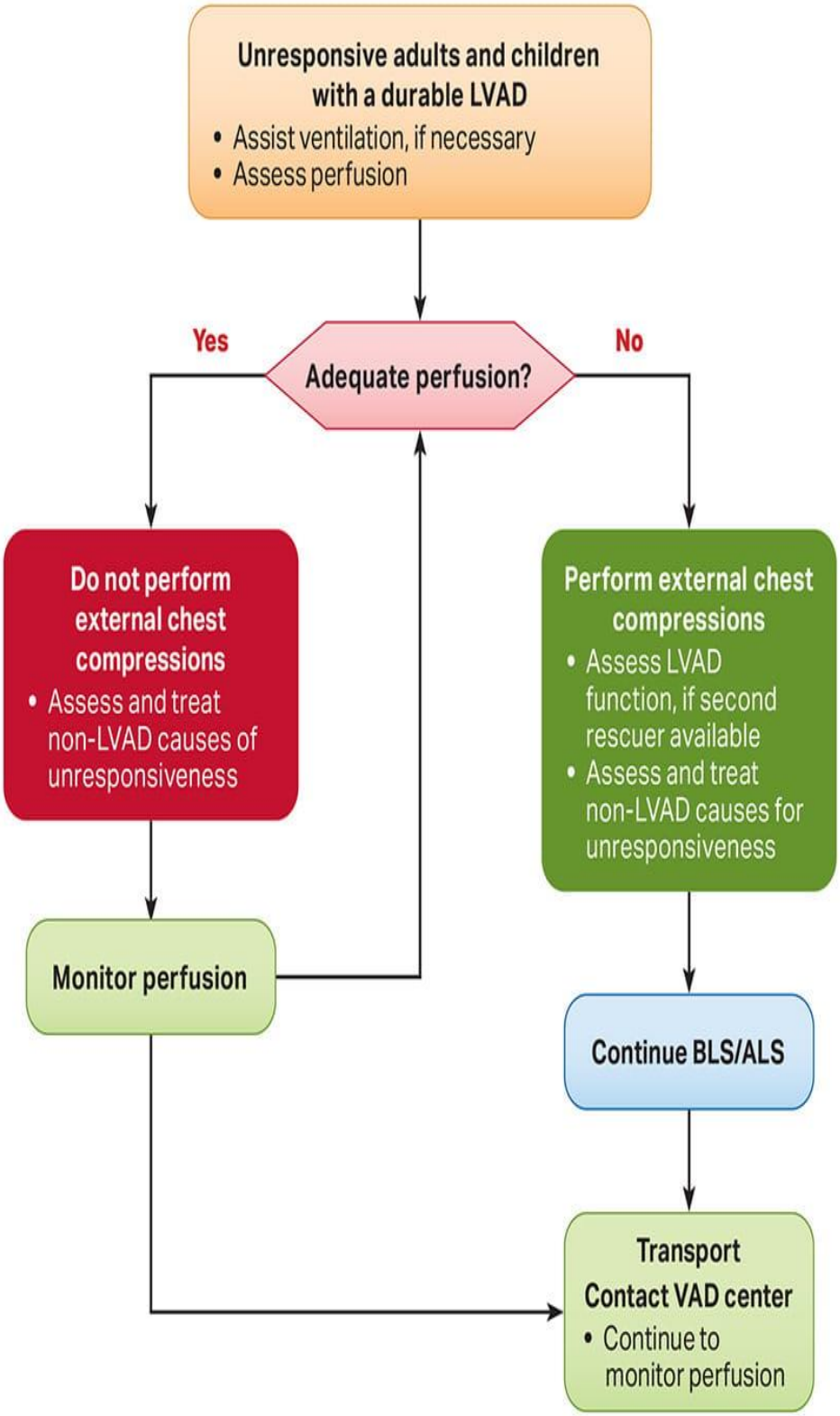
Child Foreign-Body Airway Obstruction Algorithm



Pediatric Basic Life Support Algorithm (Infants to Puberty) for Health Care Professionals—2 or More Rescuers



Adult and Pediatric Durable Left Ventricular Assist Device Algorithm



Assessing Perfusion

Adequate perfusion* if any of the following present:

- Normal skin color and temperature
- Normal capillary refill
- MAP >50 mm Hg (if noninvasive BP cuff nonfunctional, use doppler or arterial line, if available)
- $PETCO_2$ >20 mm Hg

**Patients may not have palpable pulse*

Non-LVAD Causes of Unresponsiveness

- Dysrhythmia
- Hemorrhage/hypovolemia
- Hypoglycemia
- Hypoxia
- Overdose
- Right ventricular failure
- Sepsis
- Stroke

Assess and Attempt to Restart LVAD Function

- Look/listen for alarms
- Listen for LVAD hum
- Driveline connected?
- Power source connected?
- Need to replace system controller?