

PEDIATRIC LIFE SUPPORT UPDATES 2020

EDITED & COLLECTED BY

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OUR MENTOR AND GREAT LEADER
IN EMERGENCY MEDICINE
IN EGTPT AND UK

PROF ADEL ABDELAZIZ
MAY GOD REST HIS SOUL

CLASS (STRENGTH) OF RECOMMENDATION

CLASS 1 (STRONG)

Benefit >>> Risk

Suggested phrases for writing recommendations:

- Is recommended
- Is indicated/useful/effective/beneficial
- Should be performed/administered/other
- Comparative-Effectiveness Phrases†:
 - Treatment/strategy A is recommended/indicated in preference to treatment B
 - Treatment A should be chosen over treatment B

CLASS 2a (MODERATE)

Benefit >> Risk

Suggested phrases for writing recommendations:

- Is reasonable
- Can be useful/effective/beneficial
- Comparative-Effectiveness Phrases†:
 - Treatment/strategy A is probably recommended/indicated in preference to treatment B
 - It is reasonable to choose treatment A over treatment B

CLASS 2b (WEAK)

Benefit > Risk

Suggested phrases for writing recommendations:

- May/might be reasonable
- May/might be considered
- Usefulness/effectiveness is unknown/unclear/uncertain or not well established

CLASS 3: No Benefit (WEAK)

Benefit = Risk

Suggested phrases for writing recommendations:

- Is not recommended
- Is not indicated/useful/effective/beneficial
- Should not be performed/administered/other

CLASS III: Harm (STRONG)

Risk > Benefit

Suggested phrases for writing recommendations:

- Potentially harmful
- Causes harm
- Associated with excess morbidity/mortality
- Should not be performed/administered/other

LEVEL (QUALITY) OF EVIDENCE

LEVEL A

- High-quality evidence‡ from more than 1 RCT
- Meta-analyses of high-quality RCTs
- One or more RCTs corroborated by high-quality registry studies

LEVEL B-R

(Randomized)

- Moderate-quality evidence‡ from 1 or more RCTs
- Meta-analyses of moderate-quality RCTs

LEVEL B-NR

(Nonrandomized)

- Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies
- Meta-analyses of such studies

LEVEL C-LD

(Limited Data)

- Randomized or nonrandomized observational or registry studies with limitations of design or execution
- Meta-analyses of such studies
- Physiological or mechanistic studies in human subjects

LEVEL C-EO

(Expert Opinion)

- Consensus of expert opinion based on clinical experience

COR and LOE are determined independently (any COR may be paired with any LOE).

A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

* The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information).

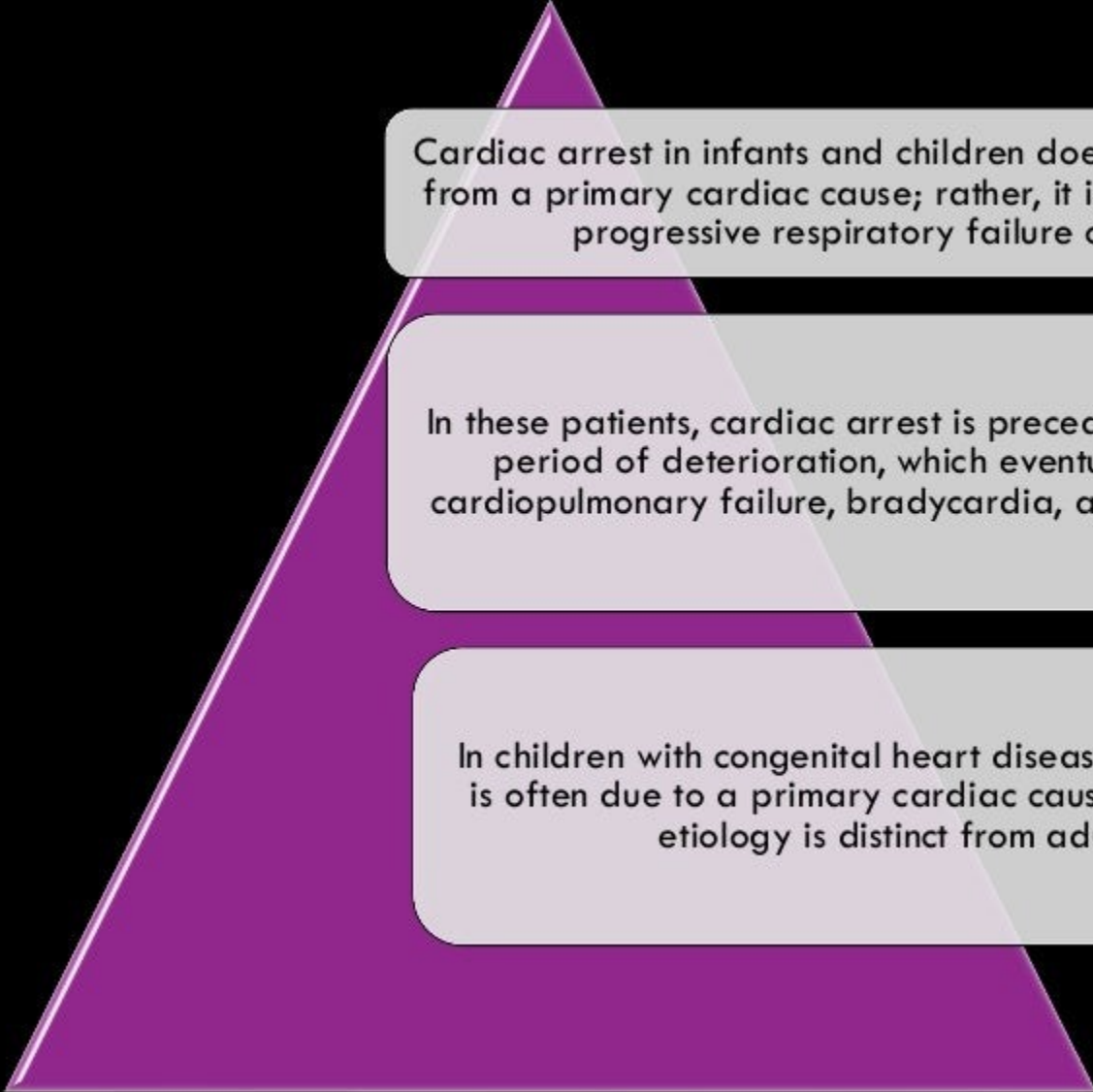
† For comparative-effectiveness recommendations (COR I and 2a; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

‡ The method of assessing quality is evolving, including the application of standardized, widely used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

A Venn diagram consisting of two overlapping circles. The left circle is dark blue and contains text about infant guidelines. The right circle is a lighter blue and contains text about child guidelines. The overlapping area is a medium blue color.

Infant
guidelines
apply to
infants
younger than
approximately
1 year of age.

Child
guidelines
apply to
children
approximately
1 year of age
until puberty



Cardiac arrest in infants and children does not usually result from a primary cardiac cause; rather, it is the end result of progressive respiratory failure or shock.

In these patients, cardiac arrest is preceded by a variable period of deterioration, which eventually results in cardiopulmonary failure, bradycardia, and cardiac arrest

In children with congenital heart disease, cardiac arrest is often due to a primary cardiac cause, although the etiology is distinct from adults.

High quality CPR

(1) adequate chest compression depth

(2) optimal chest compression rate

(3) minimizing interruptions in CPR (ie, maximizing chest compression fraction or the proportion of time that chest compressions are provided for cardiac arrest)

(4) allowing full chest recoil between compressions

(5) avoiding excessive ventilation.

Components of high quality CPR

Recommendations for Components of High-Quality CPR

COR	LOE	Recommendations
1	B-NR	1. CPR using chest compressions with rescue breaths should be provided to infants and children in cardiac arrest. ²⁵⁻²⁹
1	B-NR	2. For infants and children, if bystanders are unwilling or unable to deliver rescue breaths, it is recommended that rescuers should provide chest compressions only. ^{27,28}
1	C-EO	3. After each compression, rescuers should allow the chest to recoil completely. ^{2,3,30}
2a	C-LD	4. It is reasonable to use a chest compression rate of ≈ 100 –120/min for infants and children. ^{31,32}
2a	C-LD	5. For infants and children, it is reasonable for rescuers to provide chest compressions that depress the chest at least one third the anterior-posterior diameter of the chest, which equates to approximately 1.5 inches (4 cm) in infants to 2 inches (5 cm) in children. Once children have reached puberty, it is reasonable to use the adult compression depth of at least 5 cm but no more than 6 cm. ³³⁻³⁶
2a	C-EO	6. For healthcare providers, it is reasonable to perform a rhythm check, lasting no more than 10 s, approximately every 2 min.
2a	C-EO	7. It is reasonable to ventilate with 100% oxygen during CPR.

Figure 10. AHA Chains of Survival for pediatric IHCA and OHCA.

IHCA



OHCA



Initiation of CPR

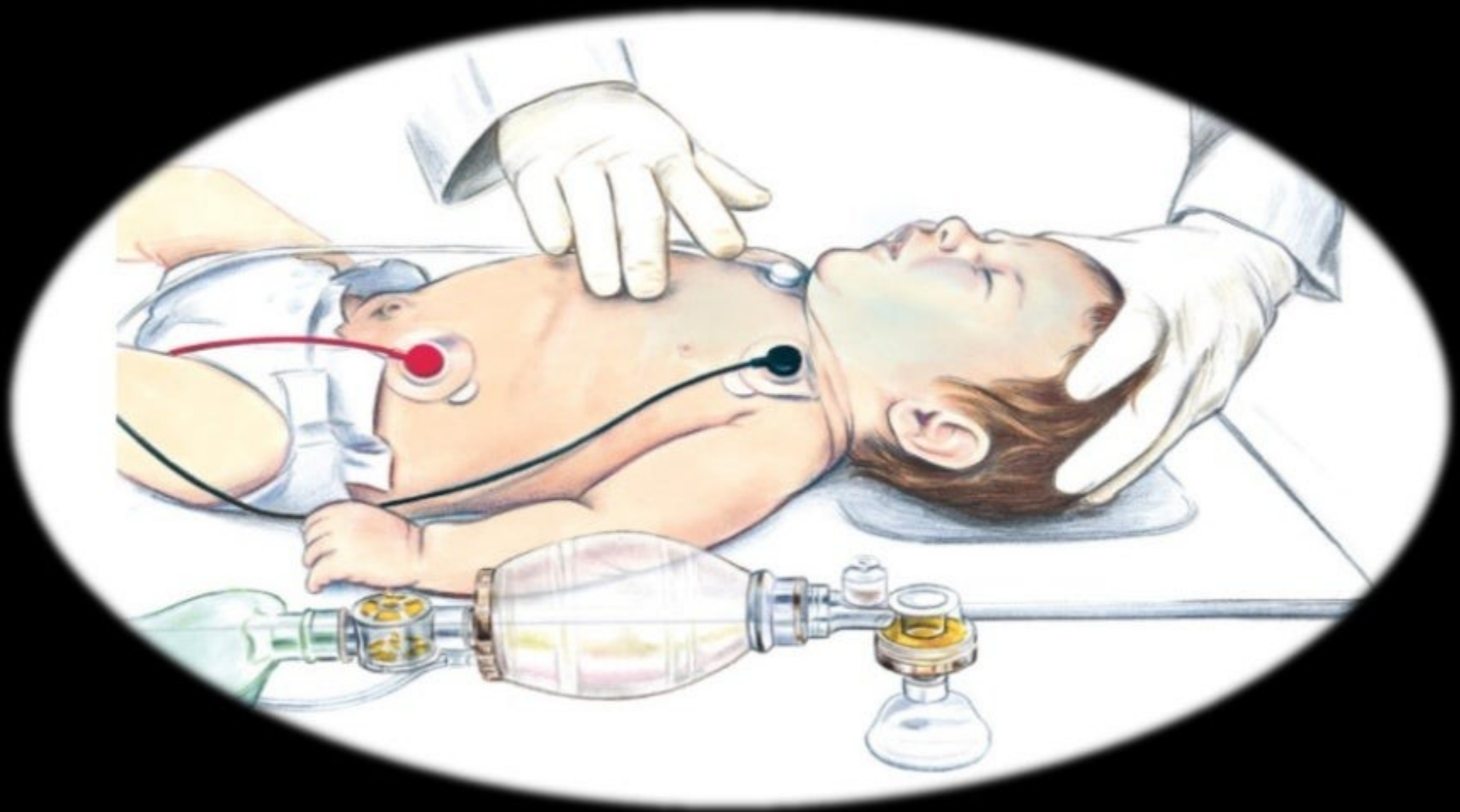
Recommendations for Initiation of CPR

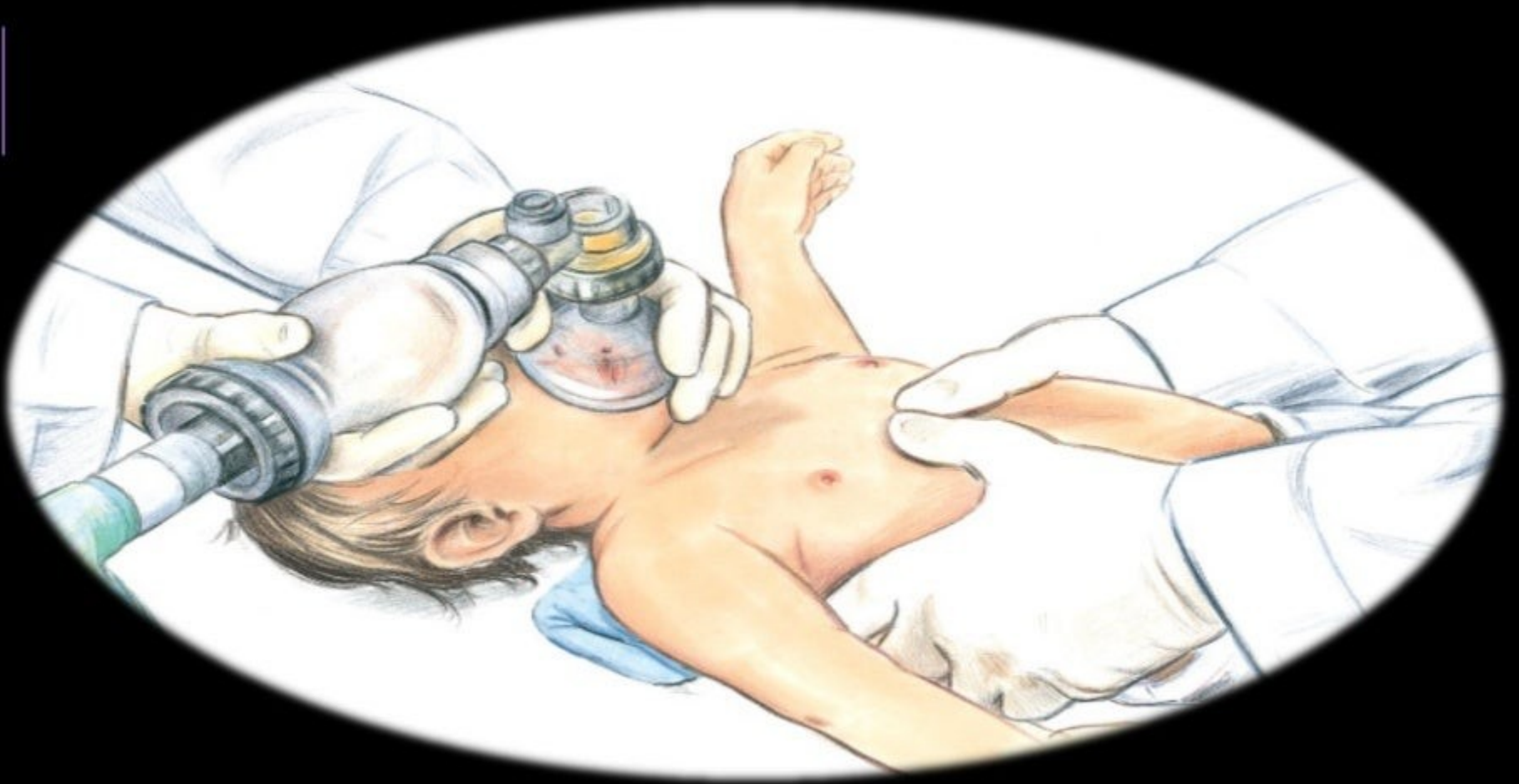
COR	LOE	Recommendations
1	C-LD	1. Lay rescuers should begin CPR for any victim who is unresponsive, not breathing normally, and does not have signs of life; do not check for a pulse. ⁶⁻²⁰
2a	C-LD	2. In infants and children with no signs of life, it is reasonable for healthcare providers to check for a pulse for up to 10 s and begin compressions unless a definite pulse is felt. ²¹⁻²³
2b	C-EO	3. It may be reasonable to initiate CPR with compressions-airway-breathing over airway-breathing-compressions. ²⁴

CPR technique

Recommendations for CPR Technique

COR	LOE	Recommendations
1	C-LD	1. For infants, single rescuers (whether lay rescuers or healthcare providers) should compress the sternum with 2 fingers (Figure 2) or 2 thumbs placed just below the intermammary line. ^{38–41}
1	C-LD	2. For infants, the 2-thumb–encircling hands technique (Figure 3) is recommended when CPR is provided by 2 rescuers. If the rescuer cannot physically encircle the victim's chest, compress the chest with 2 fingers. ^{42–46}
2b	C-LD	3. For children, it may be reasonable to use either a 1- or 2-hand technique to perform chest compressions. ^{47–49}
2b	C-EO	4. For infants, if the rescuer is unable to achieve guideline recommended depths (at least one third the anterior-posterior diameter of the chest), it may be reasonable to use the heel of 1 hand.





Pediatric BLS for Lay Rescuers

STEP 1

Make sure the scene is safe.

Check to see if the person is awake and breathing normally.



STEP 2

Shout for help.

If you're alone

- **With a cell phone,** phone 9-1-1, perform CPR (30 compressions and then 2 breaths) for 5 cycles, and then get an AED
- **Without a cell phone,** perform CPR (30 compressions and then 2 breaths) for 5 cycles, and then phone 9-1-1 and get an AED

If help is available, phone 9-1-1. Start CPR while you send someone to get an AED.



STEP 3

Repeat cycles of 30 compressions and then 2 breaths.

■ Child CPR

Push in the middle of the chest at least one third the chest depth or approximately 2 inches with 1 or 2 hands.



■ Infant CPR

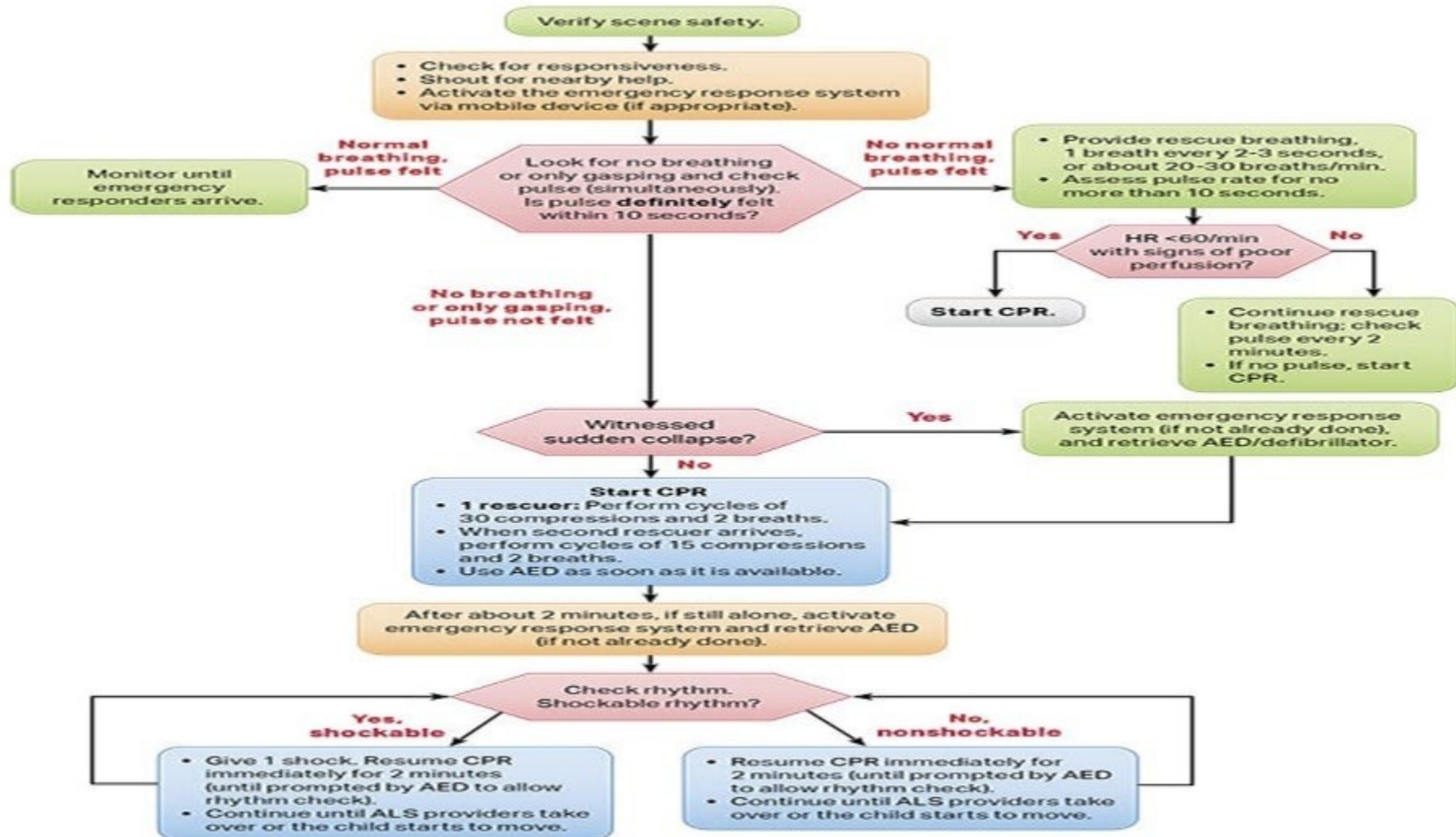
Push in the middle of the chest at least one third the chest depth or approximately 1½ inches with 2 fingers.



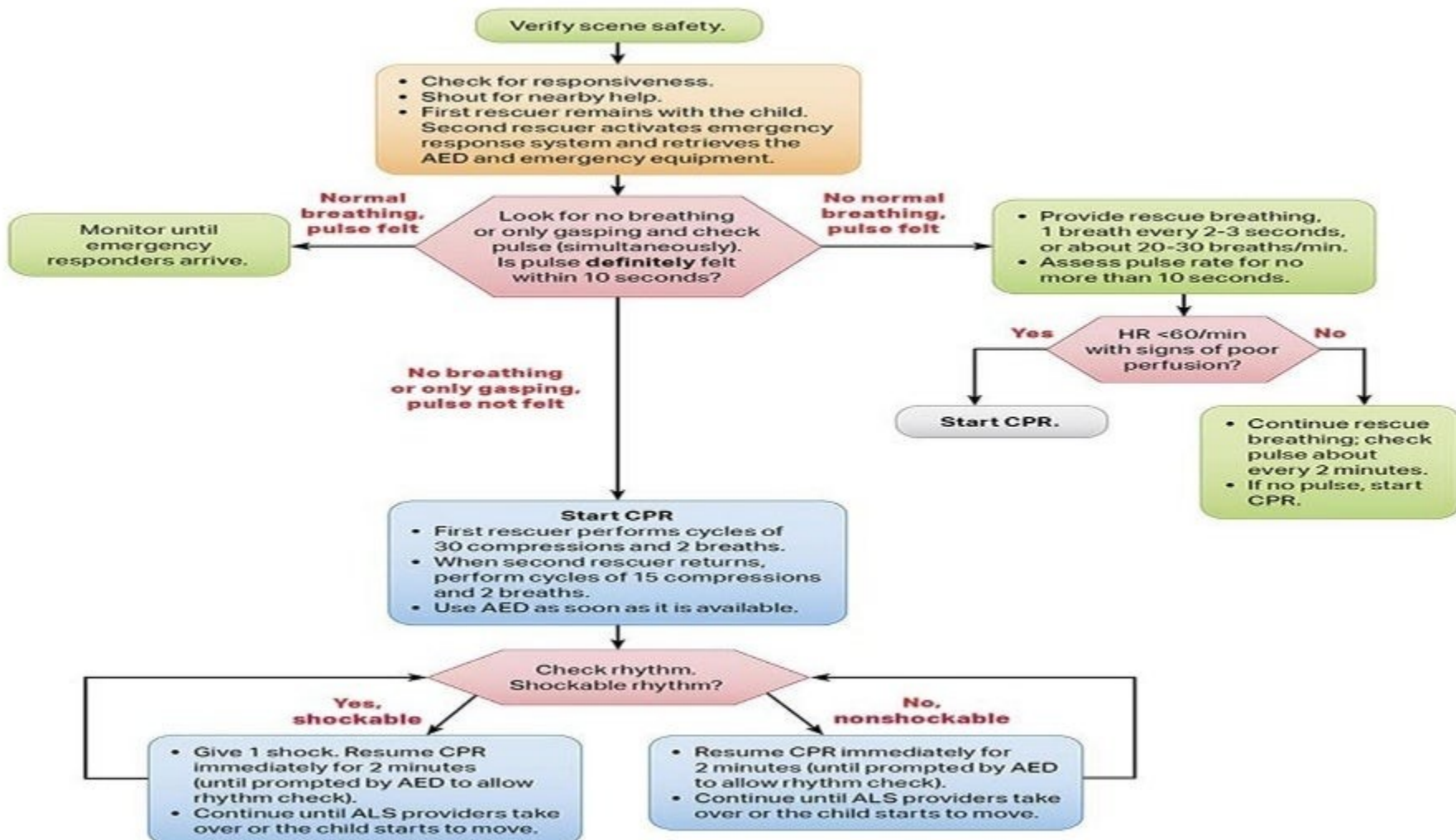
Use the AED as soon as it arrives.

Continue CPR until EMS arrives.

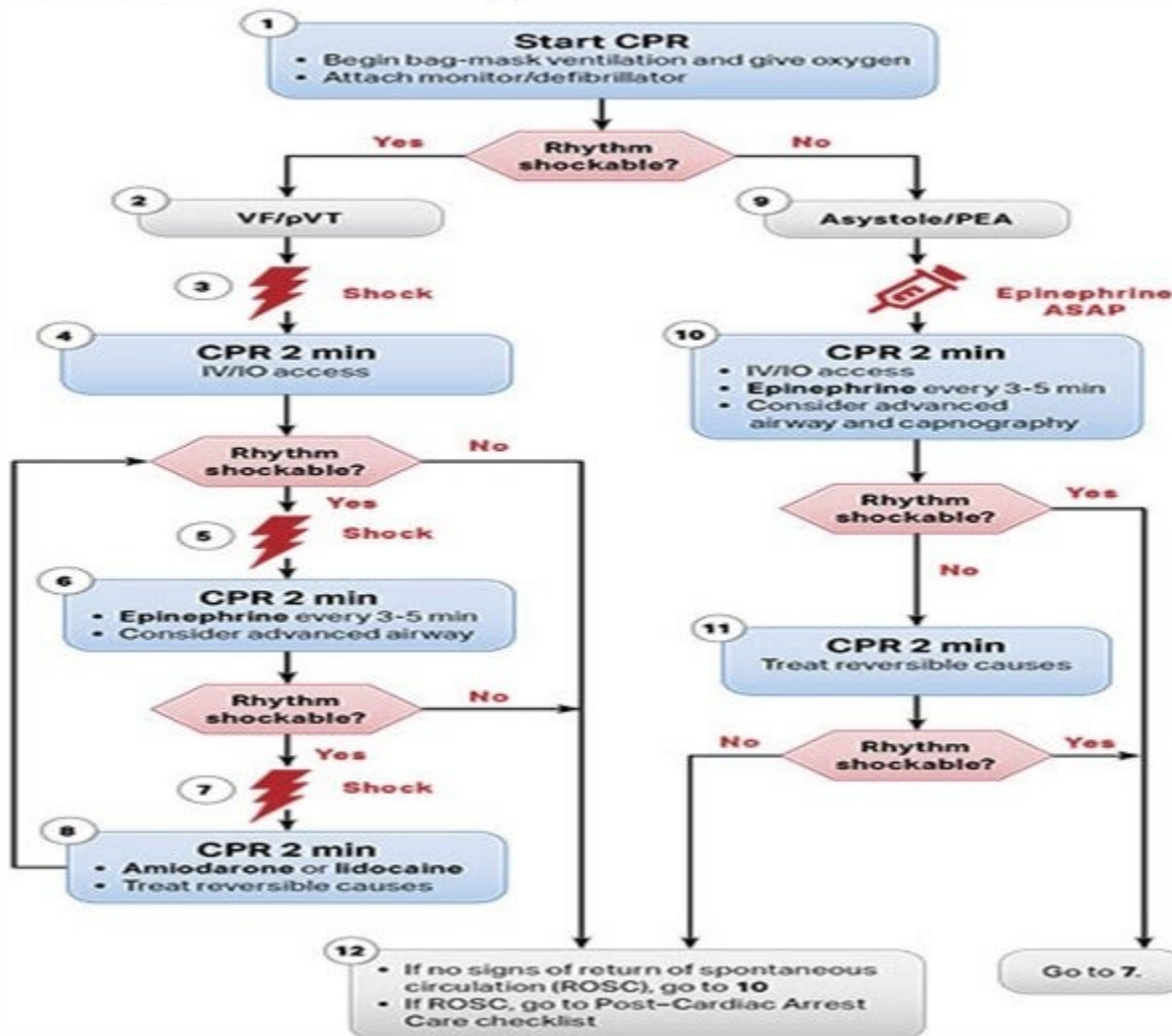
Pediatric Basic Life Support Algorithm for Healthcare Providers—Single Rescuer



Pediatric Basic Life Support Algorithm for Healthcare Providers—2 or More Rescuers



Pediatric Cardiac Arrest Algorithm



CPR Quality

- Push hard ($\geq 1/3$ of anteroposterior diameter of chest) and fast (100-120/min) and allow complete chest recoil
- Minimize interruptions in compressions
- Change compressor every 2 minutes, or sooner if fatigued
- If no advanced airway, 15:2 compression-ventilation ratio
- If advanced airway, provide continuous compressions and give a breath every 2-3 seconds

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 mL/kg of the 0.1 mg/mL concentration). Max dose 1 mg. Repeat every 3-5 minutes. If no IV/IO access, may give endotracheal dose: 0.1 mg/kg (0.1 mL/kg of the 1 mg/mL concentration).
- Amiodarone IV/IO dose:** 5 mg/kg bolus during cardiac arrest. May repeat up to 3 total doses for refractory VF/pulseless VT
- Lidocaine IV/IO dose:** Initial: 1 mg/kg loading dose

Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement

Reversible Causes

- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypoglycemia
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary



airway

Opening the Airway

Recommendations for Opening the Airway

COR	LOE	Recommendations
1	C-LD	1. Unless a cervical spine injury is suspected, use a head tilt–chin lift maneuver to open the airway. ⁶⁴
1	C-EO	2. For the trauma patient with suspected cervical spinal injury, use a jaw thrust without head tilt to open the airway.
1	C-EO	3. For the trauma patient with suspected cervical spinal injury, if the jaw thrust does not open the airway, use a head tilt–chin lift maneuver.

HEAD TILT CHIN LIFT

IF TRAUMA PATIENT JAW
THRUST

IF TRAUMA AND JAW
THRUST NOT OPEN THE
AIRWAY USE HEAD TILT CHIN
LIFT

Advanced airway

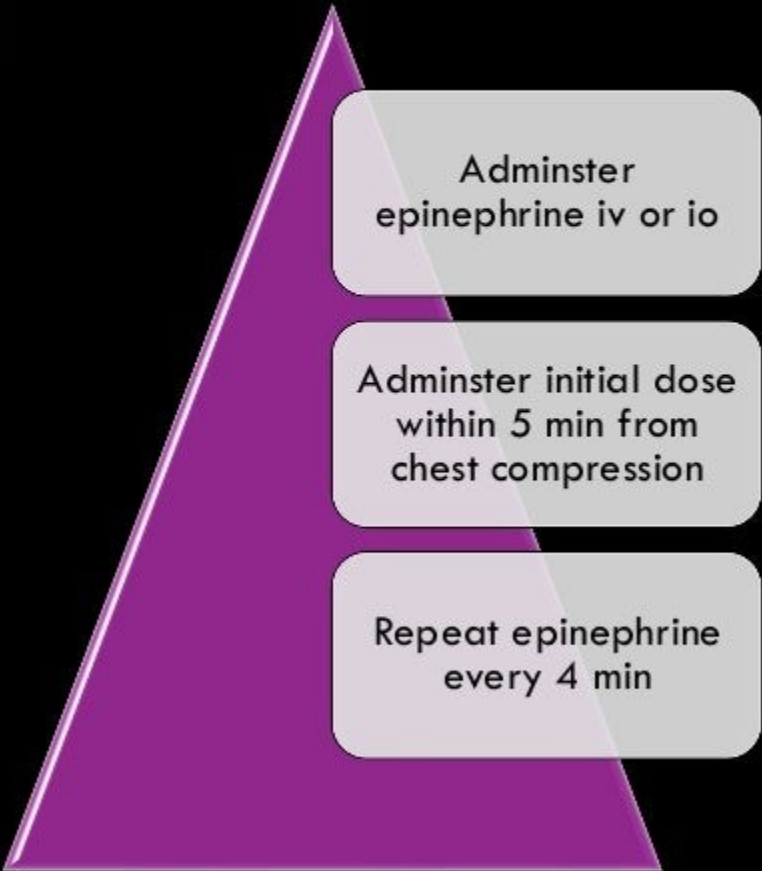
Most pediatric cardiac arrests are triggered by respiratory deterioration. Airway management and effective ventilation are fundamental to pediatric resuscitation. Although the majority of patients can be successfully ventilated with bag-mask ventilation

Advanced airway interventions, such as supraglottic airway (SGA) placement or endotracheal intubation (ETI), may improve ventilation, reduce the risk of aspiration, and enable uninterrupted compression delivery.

Recommendation for Advanced Airway Interventions During CPR

COR	LOE	Recommendation
2a	C-LD	1. Bag-mask ventilation is reasonable compared with advanced airway interventions (SGA and ETI) in the management of children during cardiac arrest in the out-of-hospital setting. ¹⁻⁴

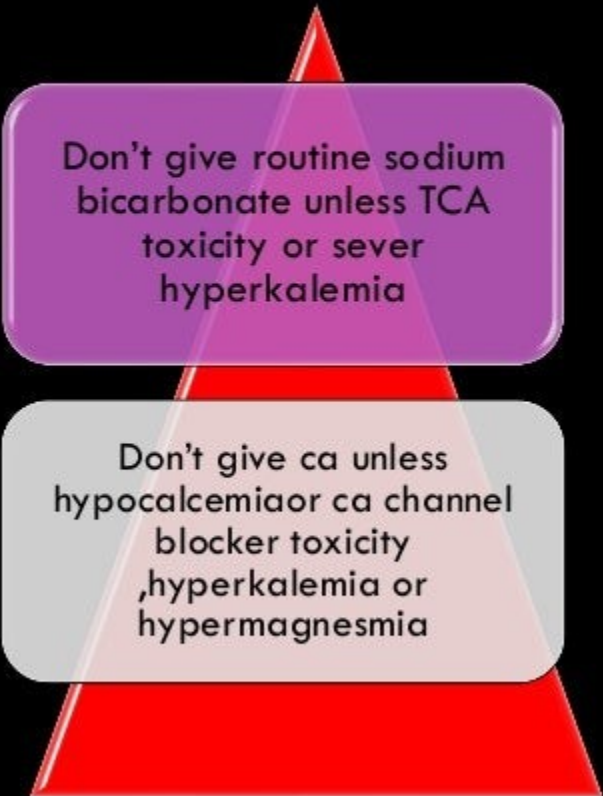
Drug administration



Administer
epinephrine iv or io

Administer initial dose
within 5 min from
chest compression

Repeat epinephrine
every 4 min



Don't give routine sodium
bicarbonate unless TCA
toxicity or severe
hyperkalemia

Don't give ca unless
hypocalcemia or ca channel
blocker toxicity
,hyperkalemia or
hypermagnesemia

Drug Administration During Cardiac Arrest

Recommendations for Drug Administration During Cardiac Arrest		
COR	LOE	Recommendations
2a	C-LD	1. For pediatric patients in any setting, it is reasonable to administer epinephrine. IV/ IO is preferable to endotracheal tube (ETT) administration. ^{2,9-11}
2a	C-LD	2. For pediatric patients in any setting, it is reasonable to administer the initial dose of epinephrine within 5 min from the start of chest compressions. ¹²⁻¹⁶
2a	C-LD	3. For pediatric patients in any setting, it is reasonable to administer epinephrine every 3-5 min until ROSC is achieved. ^{17,18}
2b	C-LD	4. For shock-refractory VF/pVT, either amiodarone or lidocaine may be used. ^{19,20}
3: Harm	B-NR	5. Routine administration of sodium bicarbonate is not recommended in pediatric cardiac arrest in the absence of hyperkalemia or sodium channel blocker (eg, tricyclic antidepressant) toxicity. ^{5-7,21-25}
3: Harm	B-NR	6. Routine calcium administration is not recommended for pediatric cardiac arrest in the absence of documented hypocalcemia, calcium channel blocker overdose, hypermagnesemia, or hyperkalemia. ^{3,4,23}

MANAGEMENT OF VF/p VT

Energy Dose

Recommendations for Energy Dose

COR	LOE	Recommendations
2a	C-LD	1. It is reasonable to use an initial dose of 2-4 J/kg of monophasic or biphasic energy for defibrillation, but, for ease of teaching, an initial dose of 2 J/kg may be considered. ¹⁻⁷
2b	C-LD	2. For refractory VF, it may be reasonable to increase the defibrillation dose to 4 J/kg. ¹⁻⁷
2b	C-LD	3. For subsequent energy levels, a dose of 4 J/kg may be reasonable, and higher energy levels may be considered, though not to exceed 10 J/kg or the adult maximum dose. ¹⁻⁷

Initial dose of energy 2-4j/kg

For refractory VF increase the dose of defibrillation to 4j/kg

Not exceed 10 j/kg
or adult dose

Chain of survival

Historically, cardiac arrest care has largely focused on the management of the cardiac arrest itself, highlighting high-quality CPR, early defibrillation, and effective teamwork. However, there are aspects of prearrest and postarrest care that are critical to improve outcomes

For both chains of survival, activating the emergency response is followed immediately by the initiation of high-quality CPR. If help is nearby or a cell phone is available, activating the emergency response and starting CPR can be nearly simultaneous. However, in the out-of-hospital setting, a single rescuer who does not have access to a cell phone should begin CPR (compressions-airway-breathing) for infants and children before calling for help because respiratory arrest is the most common cause of cardiac arrest and help may not be nearby

Coordination of Shock and CPR

Recommendations for Coordination of Shock and CPR

COR	LOE	Recommendations
1	C-EO	1. Perform CPR until the device is ready to deliver a shock. ⁸⁻¹²
1	C-EO	2. A single shock followed by immediate chest compressions is recommended for children with VF/pVT. ^{13,14}
1	C-EO	3. Minimize interruptions of chest compressions. ^{13,15}

Perform CPR until the device ready

Single shock followed by immediate chest compression

Minimize interruption

Type of Defibrillator

Recommendations for Type of Defibrillator

COR	LOE	Recommendations
1	C-LD	1. When using an AED on infants and children <8 y old, use of a pediatric attenuator is recommended. ²¹⁻³²
1	C-EO	2. For infants under the care of a trained healthcare provider, a manual defibrillator is recommended when a shockable rhythm is identified. ^{33,34}
2b	C-EO	3. If neither a manual defibrillator nor an AED equipped with a pediatric attenuator is available, an AED without a dose attenuator may be used. ^{26-28,30,35}

Use pediatric attenuator if infant or children less than 8 y

manual defibrillator is recommended

If manual defib or AED with pediatric attenuation not available use the usual AED

Defibrillator Paddle Size, Type, and Position

Recommendations for Defibrillator Paddle Size, Type, and Position		
COR	LOE	Recommendations
1	C-EO	1. Use the largest paddles or self-adhering electrodes that will fit on the child's chest while still maintaining good separation between the pads/paddles. ¹⁶⁻¹⁸
2b	C-LD	2. When affixing self-adhering pads, either anterior-lateral placement or anterior-posterior placement may be reasonable. ^{7,19}
2b	C-LD	3. Paddles and self-adhering pads may be considered equally effective in delivering electricity. ²⁰



**POST-CARDIAC
ARREST CARE
TREATMENT
AND
MONITORING**

Post-Cardiac Arrest Targeted Temperature Management

Recommendations for Post-Cardiac Arrest Targeted Temperature Management		
COR	LOE	Recommendations
1	A	1. Continuous measurement of core temperature during TTM is recommended. ^{3,4}
2a	B-R	2. For infants and children between 24 h and 18 yr of age who remain comatose after OHCA or IHCA, it is reasonable to use either TTM of 32°C–34°C followed by TTM of 36°C–37.5°C or only TTM of 36°C–37.5°C. ^{3,4}

Post-Cardiac Arrest Blood Pressure Management

Recommendations for Post-Cardiac Arrest Blood Pressure Management		
COR	LOE	Recommendations
1	C-LD	1. After ROSC, we recommend that parenteral fluids and/or vasoactive drugs be used to maintain a systolic blood pressure greater than the fifth percentile for age. ^{6–9}
1	C-EO	2. When appropriate resources are available, continuous arterial pressure monitoring is recommended to identify and treat hypotension. ^{6–9}

Post-Cardiac Arrest Oxygenation and Ventilation Management

Recommendations for Post-Cardiac Arrest Oxygenation and Ventilation Management

COR	LOE	Recommendations
2b	C-LD	1. It may be reasonable for rescuers to target normoxemia after ROSC that is appropriate to the specific patient's underlying condition. ¹⁰⁻¹³
2b	C-LD	2. It may be reasonable for rescuers to wean oxygen to target an oxyhemoglobin saturation between 94% and 99%. ^{10-12,14}
2b	C-LD	3. It may be reasonable for practitioners to target a partial pressure of carbon dioxide (Paco ₂) after ROSC that is appropriate to the specific patient's underlying condition, and limit exposure to severe hypercapnia or hypocapnia. ^{10,11,14}

Maintain normoxemia

Wean oxygen at target of
oxyhemoglobin
94-99%

Limit exposure to severe
hypercapnia or hypocapnia

Post-Cardiac Arrest EEG Monitoring and Seizure Treatment

Recommendations for Post-Cardiac Arrest EEG Monitoring and Seizure Treatment

COR	LOE	Recommendations
1	C-LD	1. When resources are available, continuous electroencephalography (EEG) monitoring is recommended for the detection of seizures following cardiac arrest in patients with persistent encephalopathy. ¹⁵⁻¹⁸
1	C-LD	2. It is recommended to treat clinical seizures following cardiac arrest. ^{19,20}
2a	C-EO	3. It is reasonable to treat nonconvulsive status epilepticus following cardiac arrest in consultation with experts. ^{19,20}

EEG monitoring is recommended for detection of seizures

Treat seizures following cardiac arrest

Treat nonconvulsive status epilepticus following arrest in consultation with experts

Recommendations for Prognostication Following Cardiac Arrest

COR	LOE	Recommendations
2a	B-NR	1. EEG in the first week post cardiac arrest can be useful as 1 factor for prognostication, augmented by other information. ¹⁻⁸
2a	B-NR	2. It is reasonable for providers to consider multiple factors when predicting outcomes in infants and children who survive cardiac arrests. ^{1,7,9-21}
2a	B-NR	3. It is reasonable for providers to consider multiple factors when predicting outcomes in infants and children who survive cardiac arrests after nonfatal drowning (ie, survival to hospital admission). ²²⁻³⁹

EVALUATION OF SUDDEN UNEXPLAINED CARDIAC ARREST

Hypertrophic cardiomyopathy, coronary artery anomalies, and arrhythmias are common causes of sudden unexplained cardiac arrest in infants and children

Recommendations for the Evaluation of Sudden Unexplained Cardiac Arrest

COR	LOE	Recommendations
1	C-EO	1. All infants, children, and adolescents with sudden unexpected cardiac arrest should, when resources allow, have an unrestricted, complete autopsy, preferably performed by a pathologist with training and experience in cardiovascular pathology. Consider appropriate preservation of biological material for genetic analysis to determine the presence of inherited cardiac disease. ⁶⁻²¹
1	C-EO	2. Refer families of patients who do not have a cause of death found on autopsy to a healthcare provider or center with expertise in inherited cardiac disease and cardiac genetic counseling. ^{6-12,17,18,20-25}
1	C-EO	3. For infants, children and adolescents who survive sudden unexplained cardiac arrest, obtain a complete past medical and family history (including a history of syncopal episodes, seizures, unexplained accidents or drowning, or sudden unexpected death before 50 yr of age), review previous electrocardiograms, and refer to a cardiologist. ^{16,17,19-21}



**RESUSCITATING THE
PATIENT IN
SHOCK**

Shock is the failure of oxygen delivery to meet tissue metabolic demands and can be life threatening.

The most common type of pediatric shock is hypovolemic, including shock due to hemorrhage. Distributive, cardiogenic, and obstructive shock occur less frequently.

Fluid Resuscitation in Shock

Recommendations for Fluid Resuscitation in Shock

COR	LOE	Recommendations
1	C-LD	1. Providers should reassess the patient after every fluid bolus to assess for fluid responsiveness and for signs of volume overload. ³⁻⁵
2a	B-R	2. Either isotonic crystalloids or colloids can be effective as the initial fluid choice for resuscitation. ⁶
2a	B-NR	3. Either balanced or unbalanced solutions can be effective as the fluid choice for resuscitation. ⁷⁻⁹
2a	C-LD	4. In patients with septic shock, it is reasonable to administer fluid in 10-mL/kg or 20-mL/kg aliquots with frequent reassessment. ⁴

Reassess the patient
after fluid bolus

Use isotonic or colloid for
resuscitation

In septic shock administer
10 ml/kg or 20 ml/kg
with assessment

Resuscitating a Patient in Septic Shock

Recommendations for Resuscitating a Patient in Septic Shock		
COR	LOE	Recommendations
2a	C-LD	1. In infants and children with fluid-refractory septic shock, it is reasonable to use either epinephrine or norepinephrine as an initial vasoactive infusion. ^{1,10-14}
2a	C-EO	2. For infants and children with cardiac arrest and sepsis, it is reasonable to apply the standard pediatric advanced life support algorithm compared with any unique approach for sepsis-associated cardiac arrest. ¹⁵
2b	B-NR	3. For infants and children with septic shock unresponsive to fluids and requiring vasoactive support, it may be reasonable to consider stress-dose corticosteroids. ^{12,16-19}
2b	C-LD	4. In infants and children with fluid-refractory septic shock, if epinephrine or norepinephrine are unavailable, dopamine may be considered. ¹⁰⁻¹²

Use epinephrine and norepinephrine in fluid refractory septic shock

Give stress dose of corticosteroid for infant and children unresponsive to fluid and requiring vasoactive support

If epinephrine and norepinephrine not available use dopamine

Resuscitating the Patient in Cardiogenic Shock

Recommendations for Resuscitating the Patient in Cardiogenic Shock

COR	LOE	Recommendations
1	C-EO	1. For infants and children with cardiogenic shock, early expert consultation is recommended.
2b	C-EO	2. For infants and children with cardiogenic shock, it may be reasonable to use epinephrine, dopamine, dobutamine, or milrinone as an inotropic infusion.

Early expert consultation

Use
epinephrine, dopamine, dobutamine
or milrinone as inotropic

Resuscitating the Patient in Traumatic Hemorrhagic Shock

Recommendation for Resuscitating the Patient in Traumatic Hemorrhagic Shock

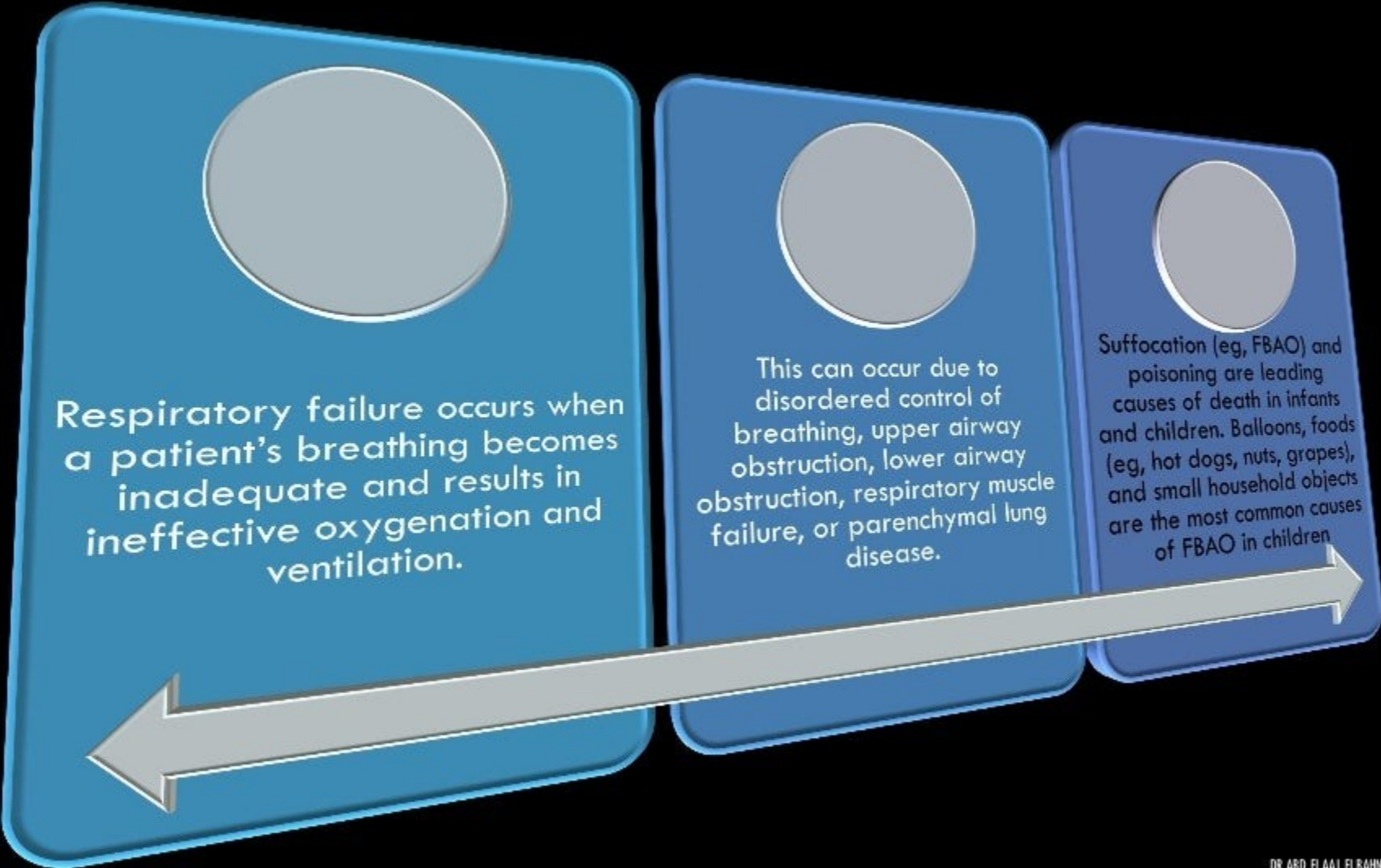
COR	LOE	Recommendation
2a	C-EO	1. Among infants and children with hypotensive hemorrhagic shock following trauma, it is reasonable to administer blood products, when available, instead of crystalloid for ongoing volume resuscitation. ²¹⁻²⁷

Give blood products instead of crystalloid in hypotensive hemorrhagic shock





TREATMENT OF RESPIRATORY FAILURE



The diagram consists of three blue rectangular boxes with rounded corners, arranged horizontally from left to right. Each box has a light grey circle at the top. A large, thick, grey arrow points from the rightmost box towards the leftmost box, passing behind the middle box. The text is written in white on the blue background of each box.

Respiratory failure occurs when a patient's breathing becomes inadequate and results in ineffective oxygenation and ventilation.

This can occur due to disordered control of breathing, upper airway obstruction, lower airway obstruction, respiratory muscle failure, or parenchymal lung disease.

Suffocation (eg, FBAO) and poisoning are leading causes of death in infants and children. Balloons, foods (eg, hot dogs, nuts, grapes), and small household objects are the most common causes of FBAO in children.

Treatment of Inadequate Breathing With a Pulse

Recommendations for Treatment of Inadequate Breathing With a Pulse

COR	LOE	Recommendations
1	C-EO	1. For infants and children with a pulse but absent or inadequate respiratory effort, provide rescue breathing. ⁷
2a	C-EO	2. For infants and children with a pulse but absent or inadequate respiratory effort, it is reasonable to give 1 breath every 2 to 3 s (20–30 breaths/min). ⁷

Rescue breathing if pulse present with absent respiration

Give 1 breath every 2 to 3 sec

20-30 breath/min

Foreign Body Airway Obstruction

Recommendations for Foreign Body Airway Obstruction

COR	LOE	Recommendations
1	C-LD	1. If the child has mild FBAO, allow the victim to clear the airway by coughing while observing for signs of severe FBAO. ^{4,8,9}
1	C-LD	2. For a child with severe FBAO, perform abdominal thrusts until the object is expelled or the victim becomes unresponsive. ^{4,8,9}
1	C-LD	3. For an infant with severe FBAO, deliver repeated cycles of 5 back blows (slaps) followed by 5 chest compressions until the object is expelled or the victim becomes unresponsive. ^{4,9-12}
1	C-LD	4. If the infant or child with severe FBAO becomes unresponsive, start CPR beginning with chest compressions (do not perform pulse check). After 2 min of CPR, activate the emergency response system if no one has done so. ¹¹
1	C-LD	5. For the infant or child with FBAO receiving CPR, remove any visible foreign body when opening the airway to provide breaths. ¹³⁻¹⁵
3: Harm	C-LD	6. Do not perform blind finger sweeps. ¹³⁻¹⁵

Mild FABO



ENCOURAGE
COUGH

Sever FABO
IN CHILD



ABDOMINAL
THRUST

Sever FABO
IN INFANT



5 BACK SLAPS
+5 CHEST
COMPRSSION

SEVER FABO
unresponsive

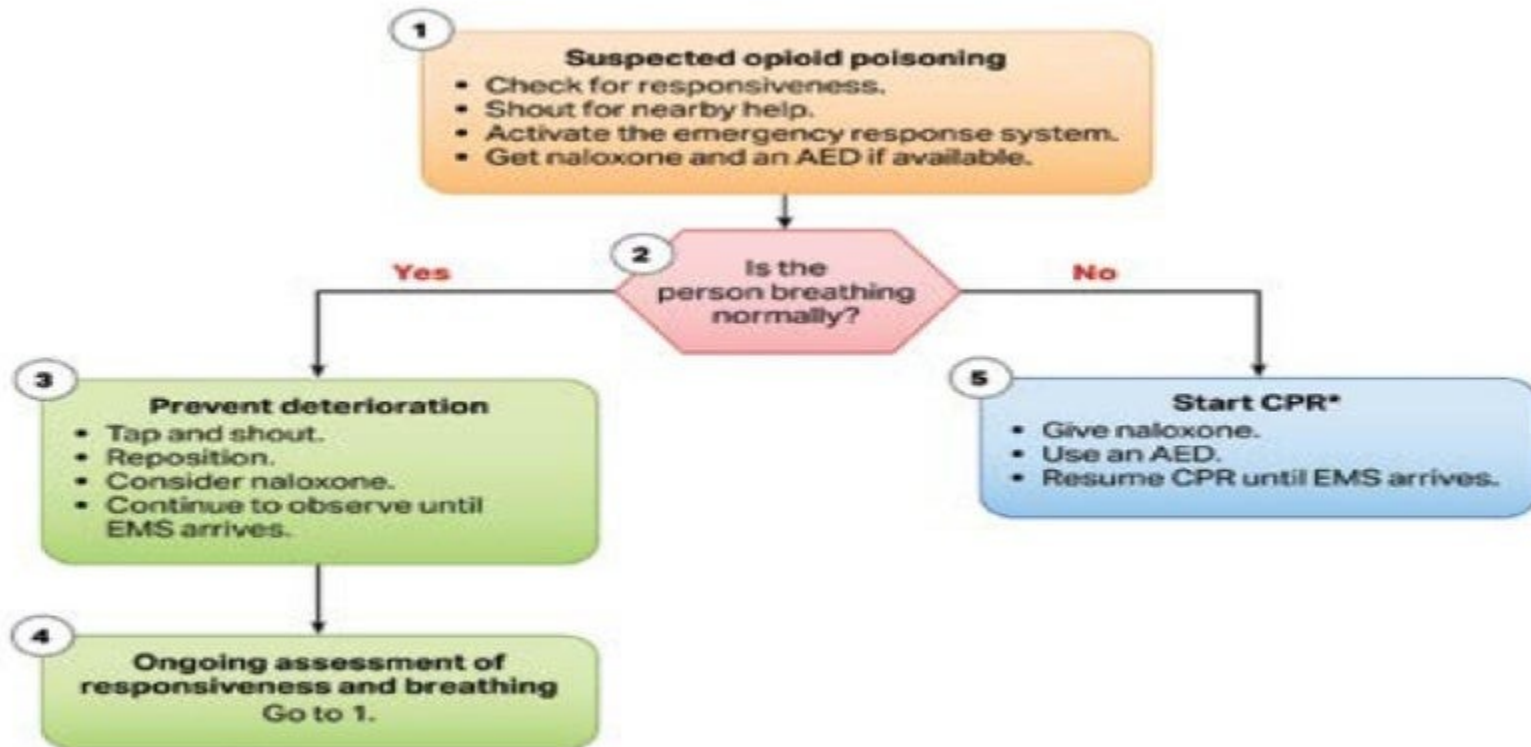


CPR with out pulse check
After 2 min CPR activate
emergency response system
Try remove F B

Opioid-Related Respiratory and Cardiac Arrest

Recommendations for Opioid-Related Respiratory and Cardiac Arrest		
COR	LOE	Recommendations
1	C-LD	1. For patients in respiratory arrest, rescue breathing or bag-mask ventilation should be maintained until spontaneous breathing returns, and standard pediatric basic or advanced life support measures should continue if return of spontaneous breathing does not occur. ^{17,18}
1	C-EO	2. For patients known or suspected to be in cardiac arrest, in the absence of a proven benefit from the use of naloxone, standard resuscitative measures should take priority over naloxone administration, with a focus on high-quality CPR (compressions plus ventilation). ^{19,20}
1	C-EO	3. Lay and trained responders should not delay activating emergency response systems while awaiting the patient's response to naloxone or other interventions. ^{21,22}
2a	B-NR	4. For a patient with suspected opioid overdose who has a definite pulse but no normal breathing or only gasping (ie, a respiratory arrest), in addition to providing standard pediatric basic life support or advanced life support, it is reasonable for responders to administer intramuscular or intranasal naloxone. ²³⁻³⁶

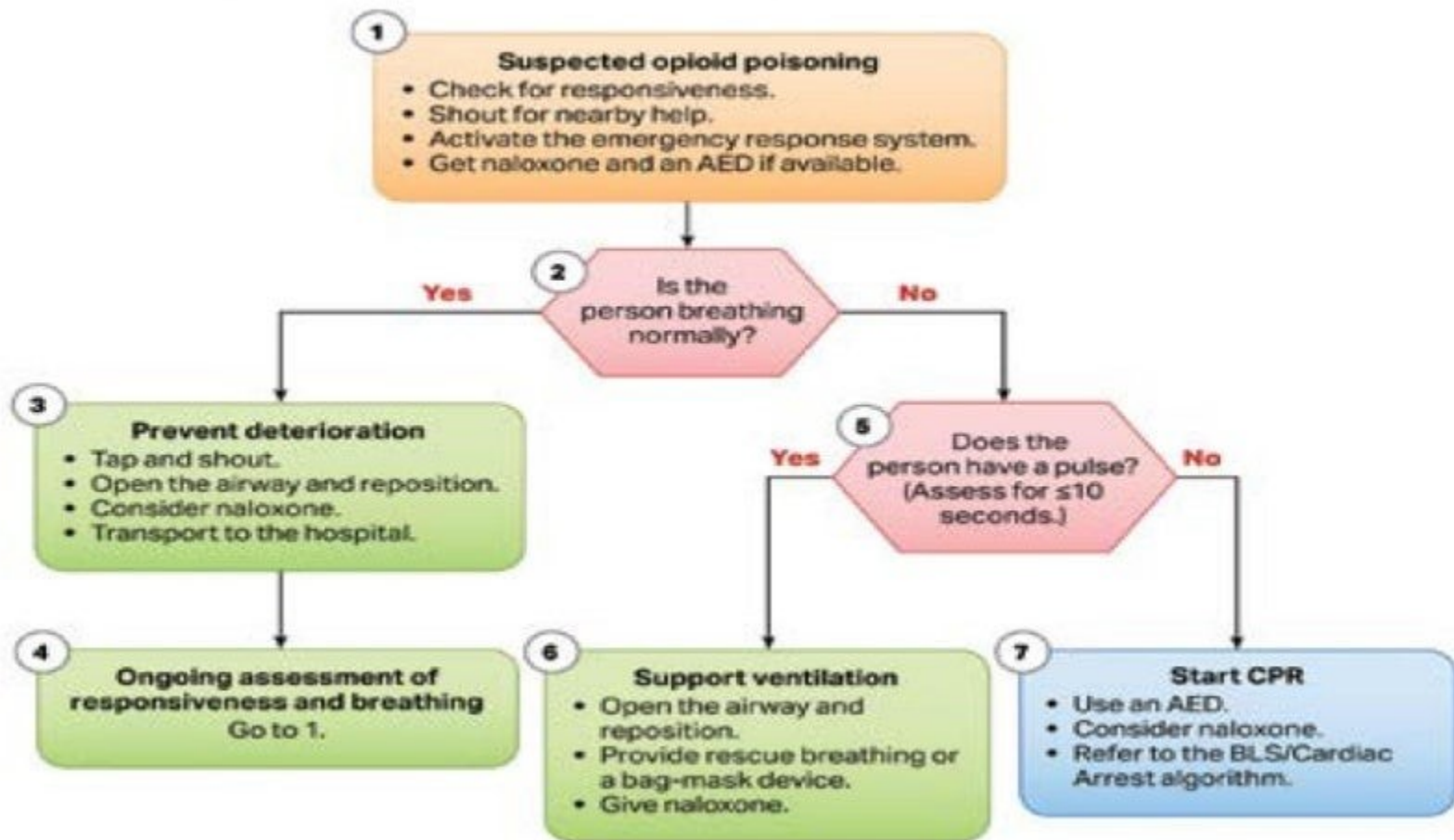
Opioid-Associated Emergency for Lay Responders Algorithm

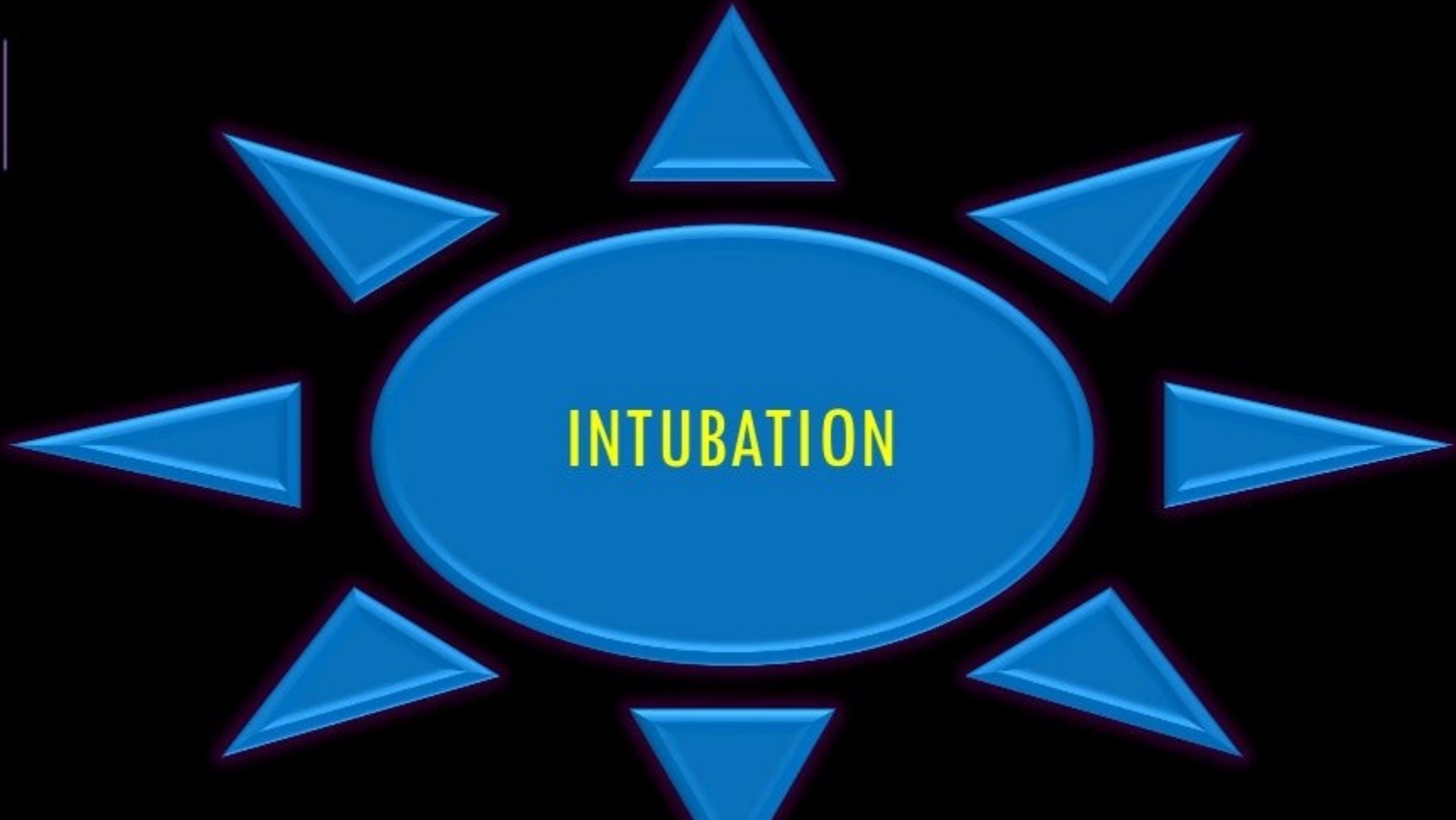


*For adult and adolescent victims, responders should perform compressions and rescue breaths for opioid-associated emergencies if they are trained and perform Hands-Only CPR if not trained to perform rescue breaths. For infants and children, CPR should include compressions with rescue breaths.

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Opioid-Associated Emergency for Healthcare Providers Algorithm





INTUBATION

Use of Cuffed Endotracheal Tubes for Intubation

Recommendations for the Use of Cuffed Endotracheal Tubes for Intubation

COR	LOE	Recommendations
1	C-EO	1. When a cuffed ETT is used, attention should be paid to ETT size, position, and cuff inflation pressure (usually <20–25 cm H ₂ O). ³
2a	C-LD	2. It is reasonable to choose cuffed ETTs over uncuffed ETTs for intubating infants and children. ^{4–15}

The Use of Cricoid Pressure During Intubation

Recommendations for the Use of Cricoid Pressure During Intubation

COR	LOE	Recommendations
2b	C-LD	1. Cricoid pressure during bag-mask ventilation may be considered to reduce gastric insufflation. ^{16,17}
3: No Benefit	C-LD	2. Routine use of cricoid pressure is not recommended during endotracheal intubation of pediatric patients. ^{16,17}
3: Harm	C-LD	3. If cricoid pressure is used, discontinue if it interferes with ventilation or the speed or ease of intubation. ^{16,17}

Use cuffed ETTs for intubating infant and children

Cricoid pressure during bag mask ventilation is considered to reduce gastric insufflation

Routine use of cricoid pressure not recommended during intubation

Atropine Use for Intubation

Recommendations for Atropine Use for Intubation

COR	LOE	Recommendations
2b	C-LD	1. It may be reasonable for practitioners to use atropine as a premedication to prevent bradycardia during emergency intubations when there is higher risk of bradycardia (eg, when giving succinylcholine). ^{18,19}
2b	C-LD	2. When atropine is used as a premedication for emergency intubation, a dose of 0.02 mg/kg of atropine, with no minimum dose, may be considered. ²⁰

Use atropine as premedication to prevent bradycardia 0.02mg/kg

Monitoring Exhaled CO₂ in Patients With Advanced Airways

Recommendations for Monitoring Exhaled CO₂ in Patients With Advanced Airways

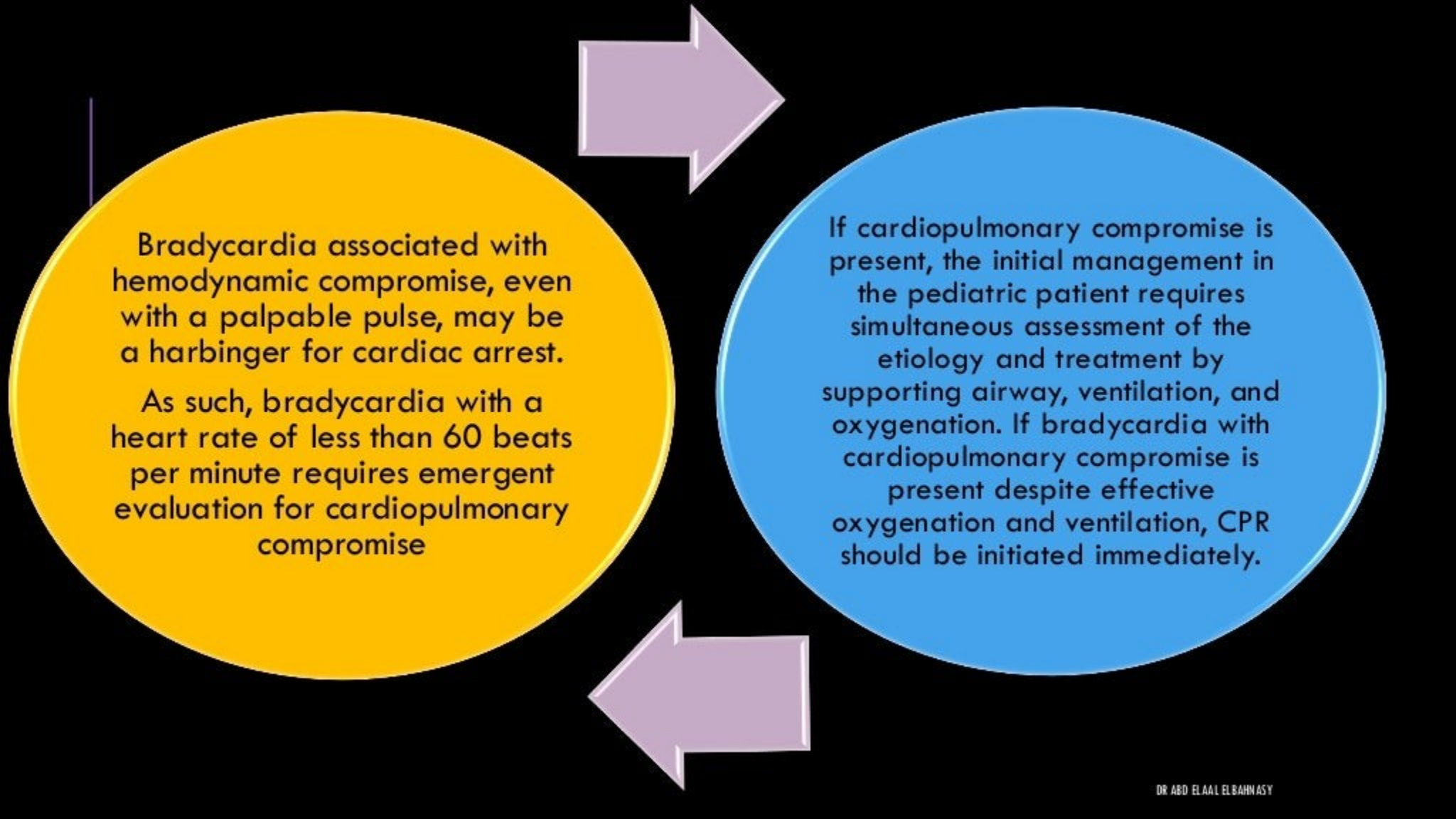
COR	LOE	Recommendations
1	C-LD	1. In all settings, for infants and children with a perfusing rhythm, use exhaled CO ₂ detection (colorimetric detector or capnography) for confirmation of ETT placement. ²¹⁻²⁷
2a	C-LD	2. In infants and children with a perfusing rhythm, it is beneficial to monitor exhaled CO ₂ (colorimetric detector or capnography) during out-of-hospital and intra/interhospital transport. ^{21,22,28-30}

Use capnography for detection exhaled co2 and confirmation of ETT placement





MANAGEMENT OF BRADYCARDIA



Bradycardia associated with hemodynamic compromise, even with a palpable pulse, may be a harbinger for cardiac arrest.

As such, bradycardia with a heart rate of less than 60 beats per minute requires emergent evaluation for cardiopulmonary compromise

If cardiopulmonary compromise is present, the initial management in the pediatric patient requires simultaneous assessment of the etiology and treatment by supporting airway, ventilation, and oxygenation. If bradycardia with cardiopulmonary compromise is present despite effective oxygenation and ventilation, CPR should be initiated immediately.

Recommendations for the Management of Bradycardia

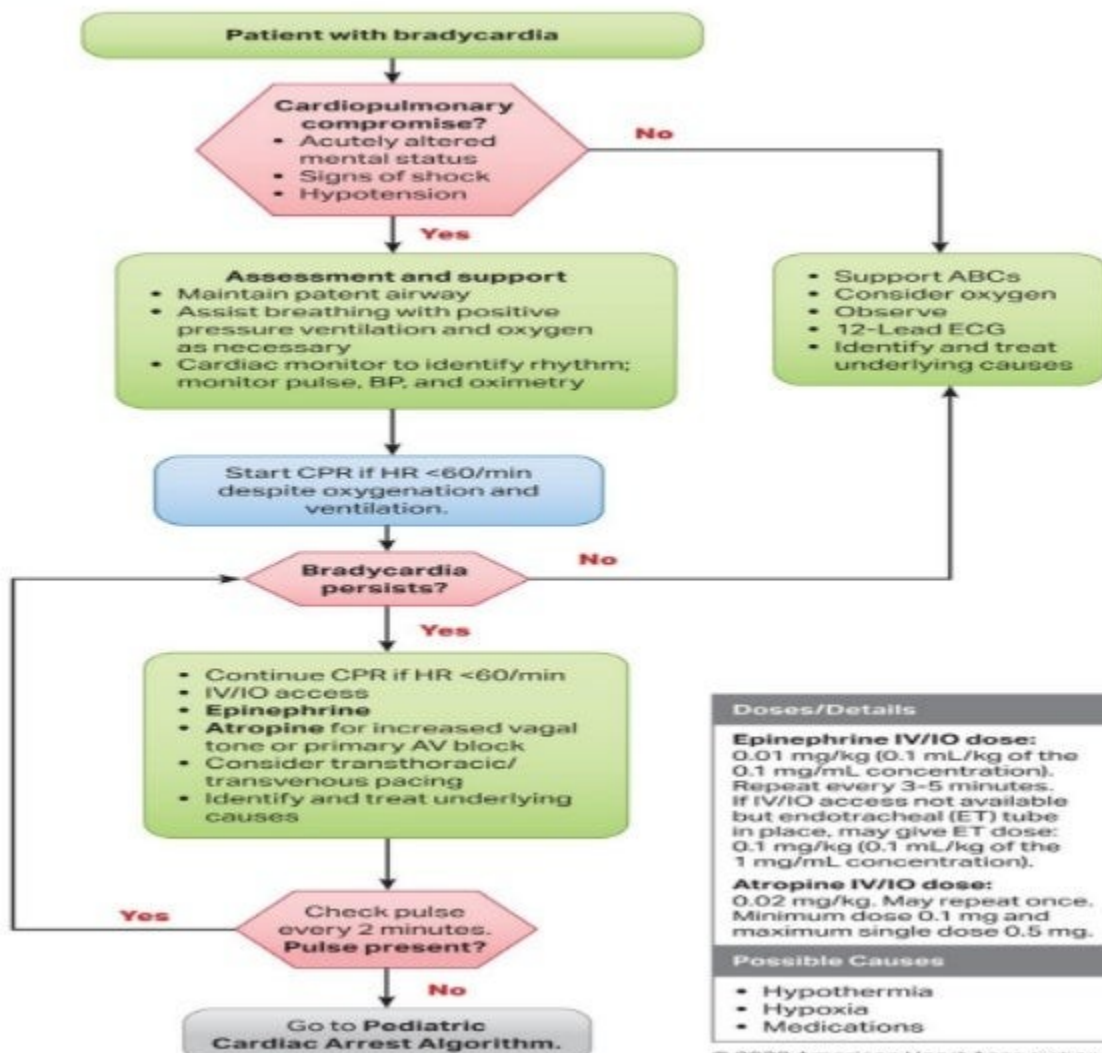
COR	LOE	Recommendations
1	C-LD	1. If bradycardia is due to increased vagal tone or primary atrioventricular conduction block (ie, not secondary to factors such as hypoxia), give atropine. ^{2,4,6,7}
1	C-LD	2. If the heart rate is <60 beats/min with cardiopulmonary compromise despite effective ventilation with oxygen, start CPR. ^{1,10}
1	C-EO	3. If bradycardia persists after correction of other factors (eg, hypoxia) or responds only transiently, give epinephrine IV/IO. If IV/IO access is not available, give endotracheally if present. ^{1,11}
2b	C-LD	4. Emergency transcutaneous pacing may be considered if bradycardia is due to complete heart block or sinus node dysfunction unresponsive to ventilation, oxygenation, chest compressions, and medications, especially in children with congenital or acquired heart disease. ¹²⁻¹⁶

Give atropine if the cause increase vagal tone or primary AV block

If HR less than 60 despite effective ventilation with oxygen atart CPR

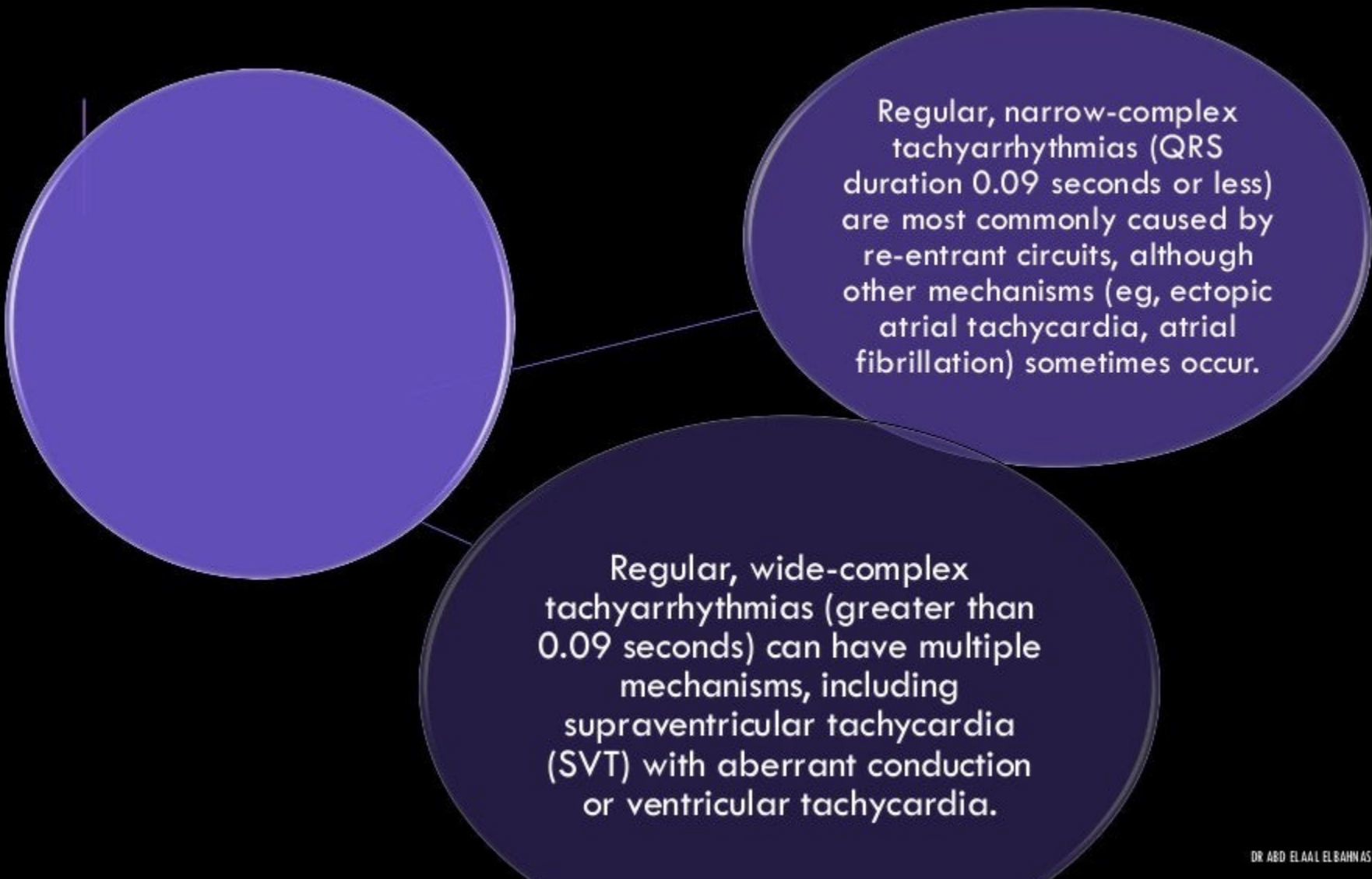
If brady cardia persist give epinephrineif no response consider transcutaneous pacing

Pediatric Bradycardia With a Pulse Algorithm





TACHYARRHYTHMIAS



Regular, narrow-complex tachyarrhythmias (QRS duration 0.09 seconds or less) are most commonly caused by re-entrant circuits, although other mechanisms (eg, ectopic atrial tachycardia, atrial fibrillation) sometimes occur.

Regular, wide-complex tachyarrhythmias (greater than 0.09 seconds) can have multiple mechanisms, including supraventricular tachycardia (SVT) with aberrant conduction or ventricular tachycardia.

Treatment of Supraventricular Tachycardia With A Pulse

Recommendations for Treatment of Supraventricular Tachycardia With A Pulse

COR	LOE	Recommendations
1	C-LD	1. If IV/IO access is readily available, adenosine is recommended for the treatment of SVT. ³⁻⁹
1	C-EO	2. For hemodynamically stable patients whose SVT is unresponsive to vagal maneuvers and/or IV adenosine, expert consultation is recommended. ^{5-15,17}
2a	C-LD	3. It is reasonable to attempt vagal stimulation first, unless the patient is hemodynamically unstable or it will delay chemical or electric synchronized cardioversion. ^{1,2,4}
2a	C-LD	4. If the patient with SVT is hemodynamically unstable with evidence of cardiovascular compromise (ie. altered mental status, signs of shock, hypotension) it is reasonable to perform electric synchronized cardioversion starting with a dose of 0.5 to 1 J/kg. If unsuccessful, increase the dose to 2 J/kg. ^{5,8,15}
2b	C-LD	5. For a patient with unstable SVT unresponsive to vagal maneuvers, IV adenosine, electric synchronized cardioversion and for whom expert consultation is not available, it may be reasonable to consider either procainamide or amiodarone. ^{12,15}

If iv/io available give adenosine

Hemodynamic stable svt not responding to vagal maneuver or adenosine ,expert consultation recommended

If hemodynamic unstable SVT perform cardioversion 0.5/1j/kg if unsuccessful increase the dose to 2 j/kg

If no response and no expert consultation available try procainamide or amiodarone

Treatment of Wide-Complex Tachycardia With a Pulse

Recommendations for Treatment of Wide-Complex Tachycardia With a Pulse

COR	LOE	Recommendations
1	C-LD	1. If the patient with a wide-complex tachycardia is hemodynamically stable, expert consultation is recommended prior to administration of antiarrhythmic agents. ¹⁸
2a	C-EO	2. If the patient with a wide-complex tachycardia is hemodynamically unstable with evidence of cardiovascular compromise (ie, altered mental status, signs of shock, hypotension), it is reasonable to perform electric synchronized cardioversion starting with a dose of 0.5–1 J/kg. If unsuccessful, increase the dose to 2 J/kg.

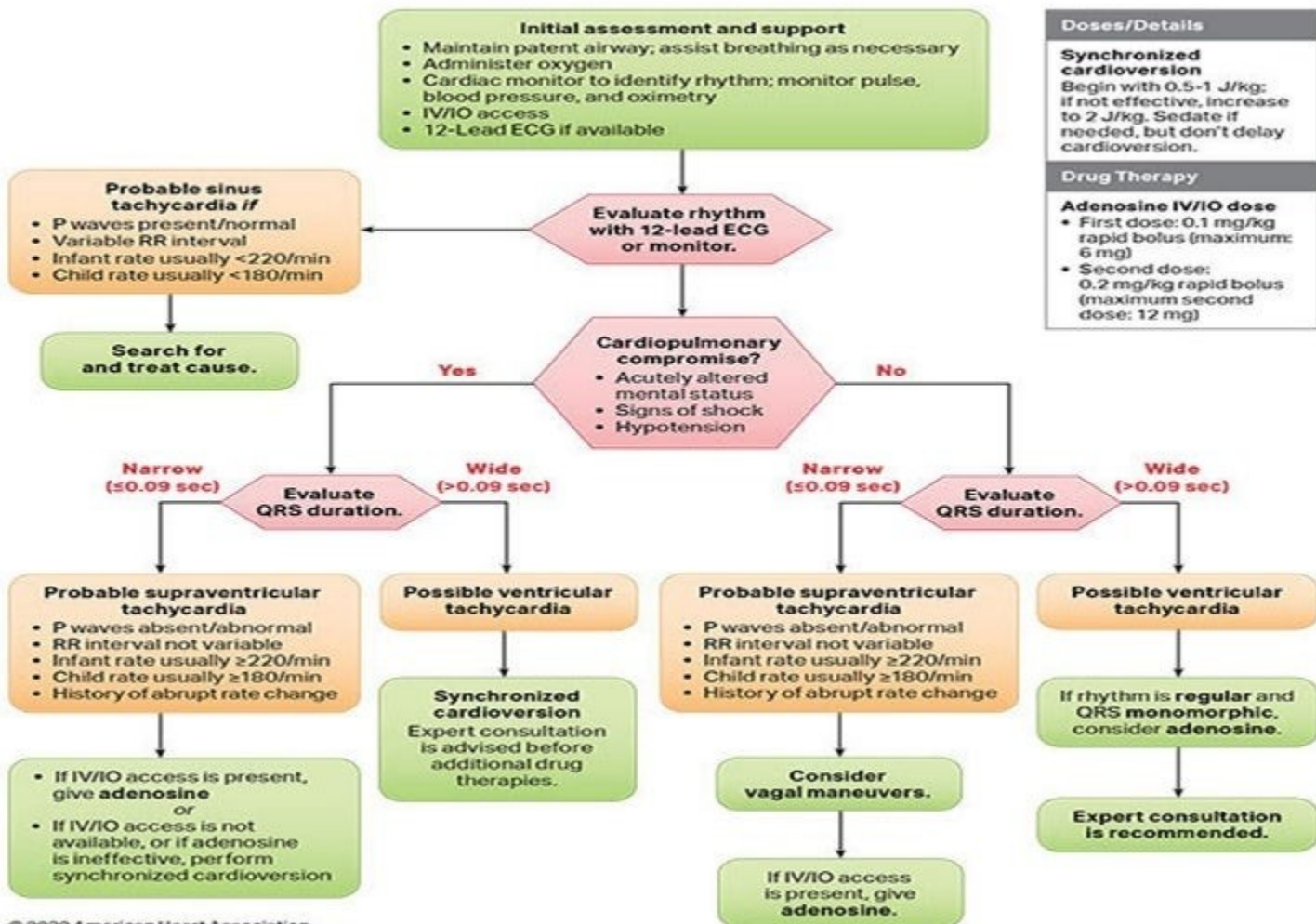
Hemodynamic
stable

expert

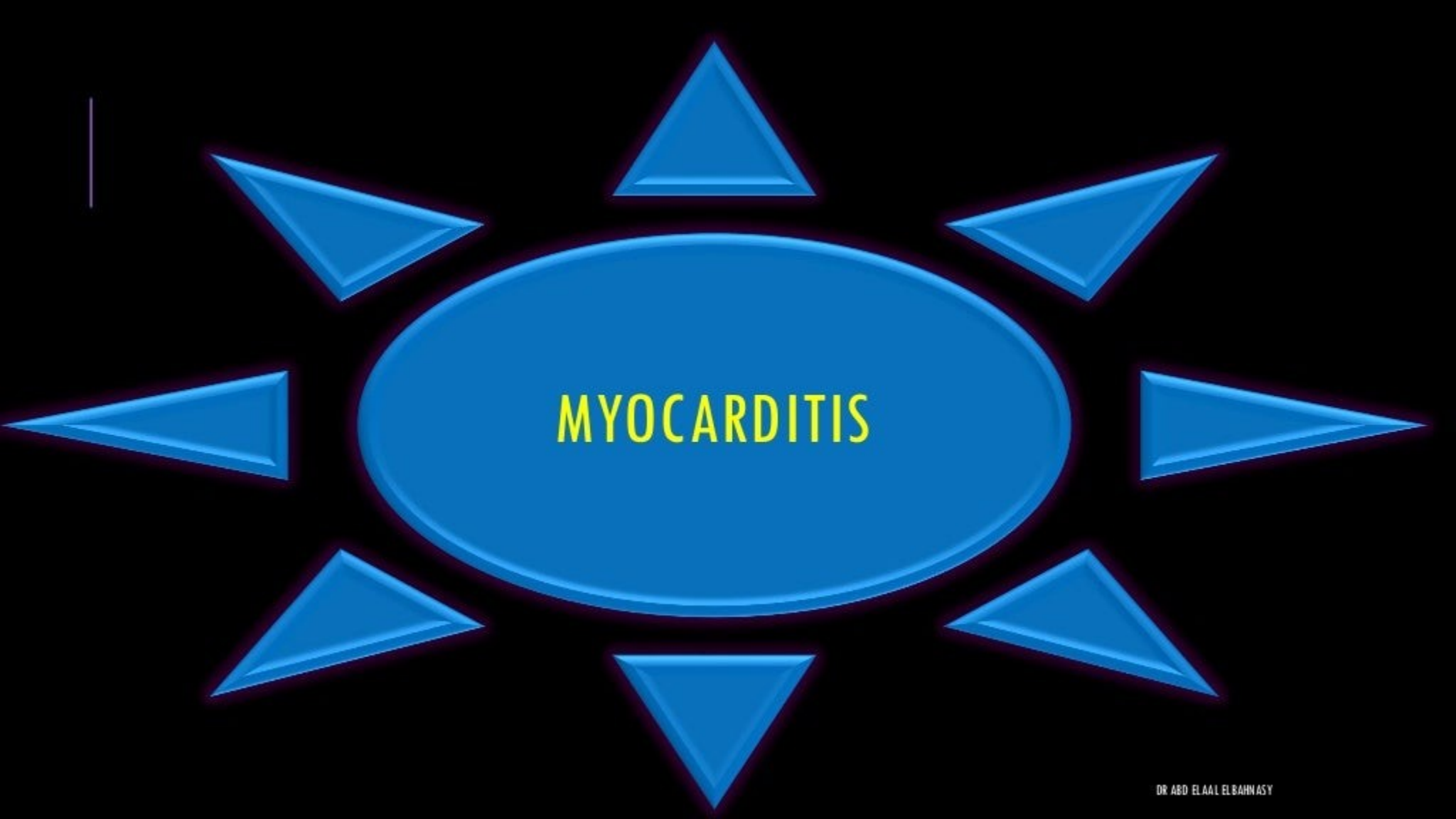
Hemodynamic
unstable

DC

Pediatric Tachycardia With a Pulse Algorithm







MYOCARDITIS

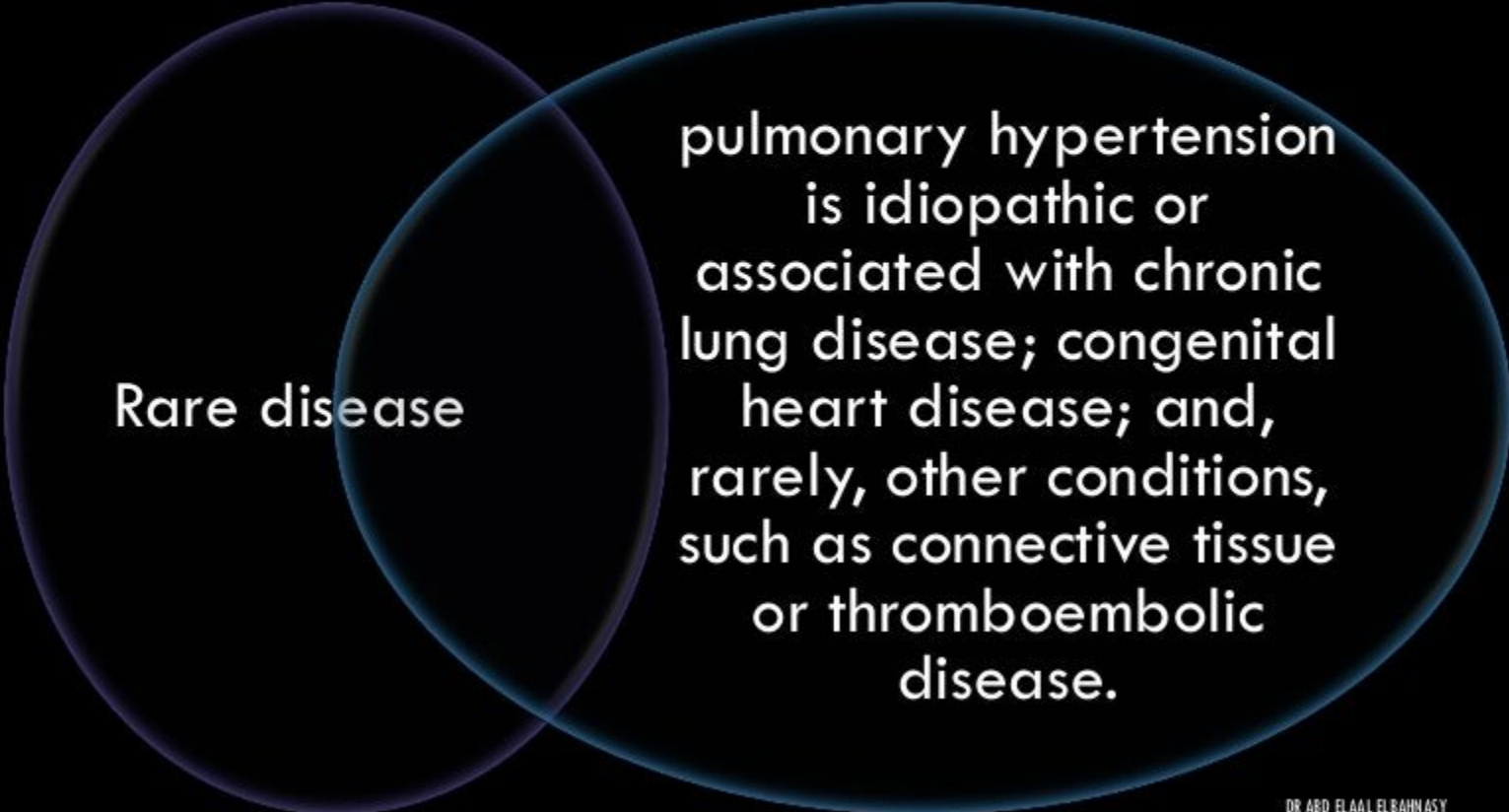
Fulminant myocarditis can result in decreased cardiac output with end-organ compromise; conduction system disease, including complete heart block; and persistent supraventricular or ventricular arrhythmias, which can ultimately result in cardiac arrest.¹

Sudden onset of heart block and multifocal ventricular ectopy in the patient with fulminant myocarditis should be considered a prearrest state

Recommendations for Treatment of Myocarditis and Cardiomyopathy

COR	LOE	Recommendations
1	C-LD	1. Given the high risk of cardiac arrest in children with acute myocarditis who demonstrate arrhythmias, heart block, ST-segment changes, and/or low cardiac output, early consideration of transfer to ICU monitoring and therapy is recommended. ^{1,7,8}
2a	B-NR	2. For children with myocarditis or cardiomyopathy and refractory low cardiac output, prearrest use of ECLS or MCS can be beneficial to provide end-organ support and prevent cardiac arrest. ^{9,10}
2a	B-NR	3. Given the challenges to successful resuscitation of children with myocarditis and cardiomyopathy, once cardiac arrest occurs, early consideration of ECPR can be beneficial. ⁹

Pulmonary hypertension



Rare disease

pulmonary hypertension
is idiopathic or
associated with chronic
lung disease; congenital
heart disease; and,
rarely, other conditions,
such as connective tissue
or thromboembolic
disease.

Recommendations for Treatment of the Child With Pulmonary Hypertension

COR	LOE	Recommendations
1	B-R	1. Inhaled nitric oxide or prostacyclin should be used as the initial therapy to treat pulmonary hypertensive crises or acute right-sided heart failure secondary to increased pulmonary vascular resistance. ^{7,9-12}
1	B-NR	2. Provide careful respiratory management and monitoring to avoid hypoxia and acidosis in the postoperative care of the child with pulmonary hypertension. ¹³⁻¹⁵
1	C-EO	3. For pediatric patients who are at high risk for pulmonary hypertensive crises, provide adequate analgesics, sedatives, and neuromuscular blocking agents. ^{2,11,16,17}
2a	C-LD	4. For the initial treatment of pulmonary hypertensive crises, oxygen administration and induction of alkalosis through hyperventilation or alkali administration can be useful while pulmonary-specific vasodilators are administered. ¹³⁻¹⁵
2b	C-LD	5. For children who develop refractory pulmonary hypertension, including signs of low cardiac output or profound respiratory failure despite optimal medical therapy, ECLS may be considered. ^{11,18-23}

MANAGEMENT OF TRAUMATIC CARDIAC ARREST

Thoracic injury should be suspected in all thoracoabdominal trauma because tension pneumothorax, hemothorax, pulmonary contusion, or pericardial tamponade may impair hemodynamics, oxygenation, and ventilation.

Recommendations for the Management of Traumatic Cardiac Arrest

COR	LOE	Recommendations
1	C-EO	1. In pediatric traumatic cardiac arrest, evaluate for and treat potential reversible causes, such as hemorrhage, tension pneumothorax, and pericardial tamponade. ^{9,10}
2b	C-LD	2. In pediatric cardiac arrest secondary to penetrating injury with a short transport time, it may be reasonable to perform resuscitative thoracotomy. ¹¹⁻¹⁸

Figure 14. Pediatric Post-Cardiac Arrest Care Checklist.

Components of Post-Cardiac Arrest Care		Check
Oxygenation and ventilation		
Measure oxygenation and target normoxemia 94%–99% (or child's normal/appropriate oxygen saturation).		☐
Measure and target $Paco_2$ appropriate to the patient's underlying condition and limit exposure to severe hypercapnia or hypocapnia.		☐
Hemodynamic monitoring		
Set specific hemodynamic goals during post-cardiac arrest care and review daily.		☐
Monitor with cardiac telemetry.		☐
Monitor arterial blood pressure.		☐
Monitor serum lactate, urine output, and central venous oxygen saturation to help guide therapies.		☐
Use parenteral fluid bolus with or without inotropes or vasopressors to maintain a systolic blood pressure greater than the fifth percentile for age and sex.		☐
Targeted temperature management (TTM)		
Measure and continuously monitor core temperature.		☐
Prevent and treat fever immediately after arrest and during rewarming.		☐
If patient is comatose apply TTM (32°C–34°C) followed by (36°C–37.5°C) or only TTM (36°C–37.5°C).		☐
Prevent shivering.		☐
Monitor blood pressure and treat hypotension during rewarming.		☐
Neuromonitoring		
If patient has encephalopathy and resources are available, monitor with continuous electroencephalogram.		☐
Treat seizures.		☐
Consider early brain imaging to diagnose treatable causes of cardiac arrest.		☐
Electrolytes and glucose		
Measure blood glucose and avoid hypoglycemia.		☐
Maintain electrolytes within normal ranges to avoid possible life-threatening arrhythmias.		☐
Sedation		
Treat with sedatives and anxiolytics.		☐
Prognosis		
Always consider multiple modalities (clinical and other) over any single predictive factor.		☐
Remember that assessments may be modified by TTM or induced hypothermia.		☐
Consider electroencephalogram in conjunction with other factors within the first 7 days after cardiac arrest.		☐
Consider neuroimaging such as magnetic resonance imaging during the first 7 days.		☐



TOP 10 TAKE-HOME MESSAGES

1. High-quality cardiopulmonary resuscitation (CPR) is the foundation of resuscitation. New data reaffirm the key components of high-quality CPR: providing adequate chest compression rate and depth, minimizing interruptions in CPR, allowing full chest recoil between compressions, and avoiding excessive ventilation.
2. A respiratory rate of 20 to 30 breaths per minute is new for infants and children who are (a) receiving CPR with an advanced airway in place or (b) receiving rescue breathing and have a pulse.
3. For patients with nonshockable rhythms, the earlier epinephrine is administered after CPR initiation, the more likely the patient is to survive.
4. Using a cuffed endotracheal tube decreases the need for endotracheal tube changes.
5. The routine use of cricoid pressure does not reduce the risk of regurgitation during bag-mask ventilation and may impede intubation success.
6. For out-of-hospital cardiac arrest, bag-mask ventilation results in the same resuscitation outcomes as advanced airway interventions such as endotracheal intubation.

7. Resuscitation does not end with return of spontaneous circulation (ROSC). Excellent post-cardiac arrest care is critically important to achieving the best patient outcomes. For children who do not regain consciousness after ROSC, this care includes targeted temperature management and continuous electroencephalography monitoring. The prevention and/or treatment of hypotension, hyperoxia or hypoxia, and hypercapnia or hypocapnia is important.

8. After discharge from the hospital, cardiac arrest survivors can have physical, cognitive, and emotional challenges and may need ongoing therapies and interventions.

9. Naloxone can reverse respiratory arrest due to opioid overdose, but there is no evidence that it benefits patients in cardiac arrest.

10. Fluid resuscitation in sepsis is based on patient response and requires frequent reassessment. Balanced crystalloid, unbalanced crystalloid, and colloid fluids are all acceptable for sepsis resuscitation. Epinephrine or norepinephrine infusions are used for fluid-refractory septic shock.

