PALS *Study Guide*

2016

Bulletin: **New resuscitation science and American Heart Association treatment guidelines were released October 28, 2015!**

The new AHA Handbook of Emergency Cardiac Care (ECC) contains these 2016 Guidelines and is required study for this course. This study guide will provide you with additional study information.

♥ Y o u **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

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

ECC Handbook p. 77

* **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 = <u>Decompensated shock</u>.

ECC Handbook p. 77

* **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** **O_2 is being inhaled:** expected.
    - **Color change** on exhalation = **CO_2!!** **Tube 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

PALS Drugs

In Arrest:

Epinephrine: catecholamine ECC Handbook p. 92
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 p. 89
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 p. 94
Decreases ventricular automaticity, conduction and repolarization.
VF/PVT: IV/IO: 1 mg/kg bolus repeat >15 min
ÆET: 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 p. 94
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 p. 80
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 p. 87
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

2010 (New): 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 p. 88 for injection technique

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.

2015 (Modification of Previous Recommendation):

For ease of placement and education, the anterior-lateral pad position is a reasonable default electrode placement. Anyof 3 alternative pad positions (anterior-posterior, anterior-left infrascapular, and anterior-right infrascapular) may beconsidered on the basis of individual patient characteristics. Placement of AED electrode pads on the victim' s bare chest inany of the 4 pad positions is reasonable for defibrillation.

2015 : **Continuous quantitative waveform capnography**

is now recommended for intubated patients throughout the periarrest period. When quantitative waveform capnography is used for adults, applications now include recommendations for confirming tracheal tube placement and for monitoring CPR quality and detecting ROSC based on end-tidal carbon dioxide

Capnography to monitor effectiveness of resuscitation efforts. PETCO2 should read 35 to 40mm Hh in individual of ROSC, High Quality CPR is confirmed by a Capnography read of >10mm Hg on the vertical axis over time. This patient is intubated and receiving CPR. Note that the ventilation rate is approximately 8 to 10 breaths per minute. Chest compressions are given continuously at a rate of slightly faster than 100/min but are not visible with this tracing.

Child *and* Infant CPR

Child CPR

- **1. Tap and ask: Are you OK?**
  - If inadequate:

• Send someone to call 911/call cod blue and bring an AED **(AEDs are approved for children** 0 – until puberty).

C. Check Brachial or femoral pulse for no more than 10 seconds.

- If pulse is felt, give **12-20** breaths per minute **(one every 3-5 seconds)**.
- If pulse **not definitely felt**, give 30 compressions in center of chest on low half of the Sternum.
- Compress 2" **depth** of chest wall with **one or two** hands. (at least 1/3 of the depth of the chest
- One cycle of CPR is **30** compressions and **2** breaths.
- **Give 5 cycles** of CPR; minimize interruptions **(about 2 minutes)**.

A. Open the airway with the head-tilt/chin lift.

- give 2 breaths over 1 second each.
- Each breath should make the chest rise.

4. When an AED arrives:

- **After 5 cycles** of CPR, turn it on and follow AED's voice prompts.
- **Use child pads or adult pads in** victim's age are 0 – until puberty.
- After the AED shocks or says "no shock advised", **resume CPR**.
- After 5 cycles of CPR, check rhythm/pulse.

Child Two-rescuer CPR

1. When using a basic airway:

- One rescuer gives **15 compressions and pauses**.
- Other rescuer gives **2 breaths during pause**.
- One cycle of CPR is **15** compressions and **2** breaths **(over 1 second each)**.
- Rescuers change "compressor" role after every 10 cycles of CPR.

2. When an advanced airway is in place:

- Give **100-120 continuous** compressions per minute.
- give **12-20** breaths per minute **(one every 3-5 seconds)**.

3. When an AED arrives:

- turn it on immediately and follow AED's voice prompts.
- **Use child pads or adult pads in** victim's age are 0 – until puberty.
- **Continue CPR** while attaching the AED until it says to not touch victim.

Infant CPR

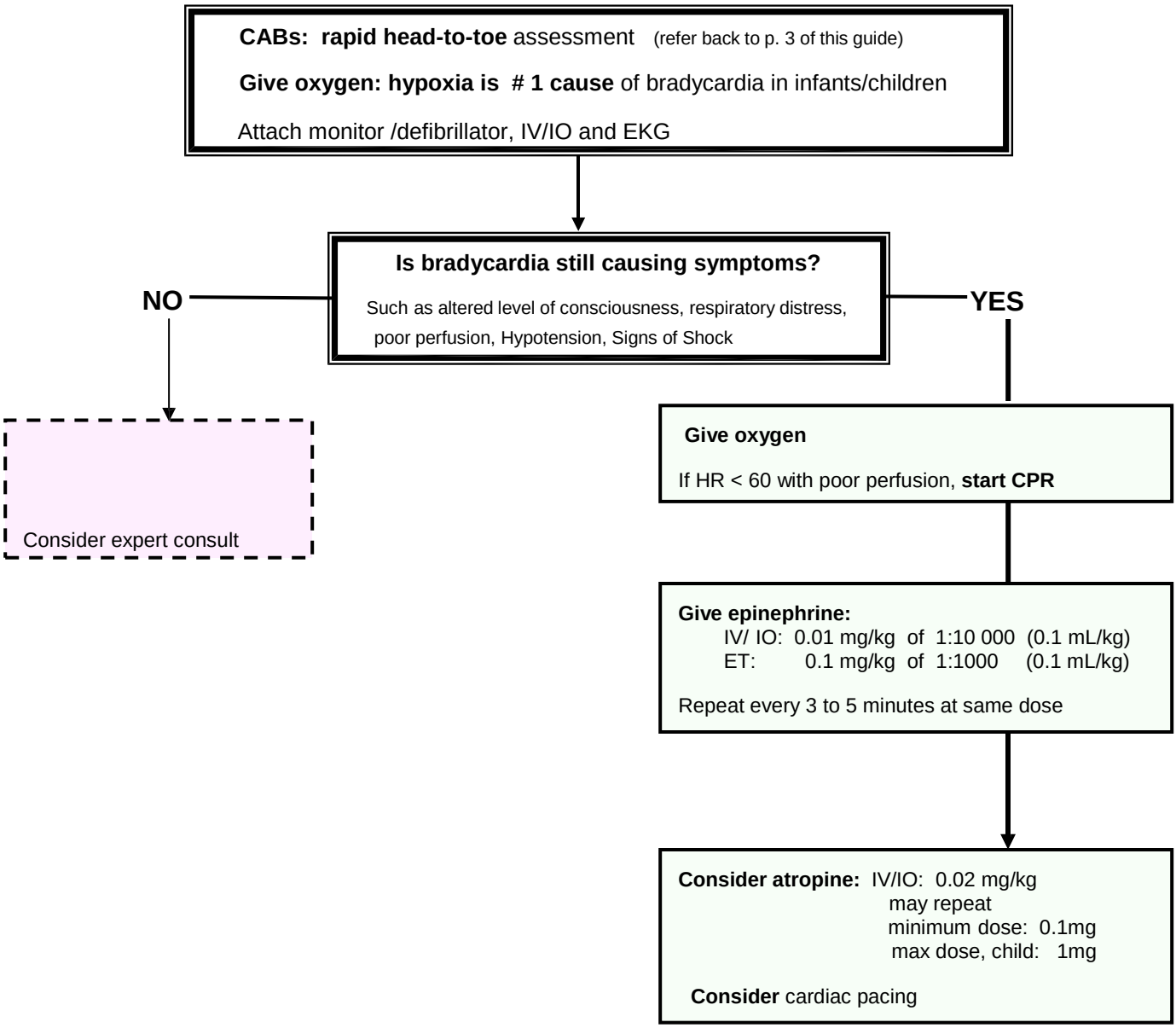
- Same as Child CPR except compress sternum with two fingers and depth 1/3 of the chest Depth or 1 ½ inches in depth or at least 1/3 of the depth of the chest
- AED is recommendation for use in infants under 1 year old.

Infant Two-rescuer CPR

- Same as Two-rescuer Child CPR except use the 2 thumb-encircling hands technique.

Bradycardia *with a Pulse*

ECC Handbook

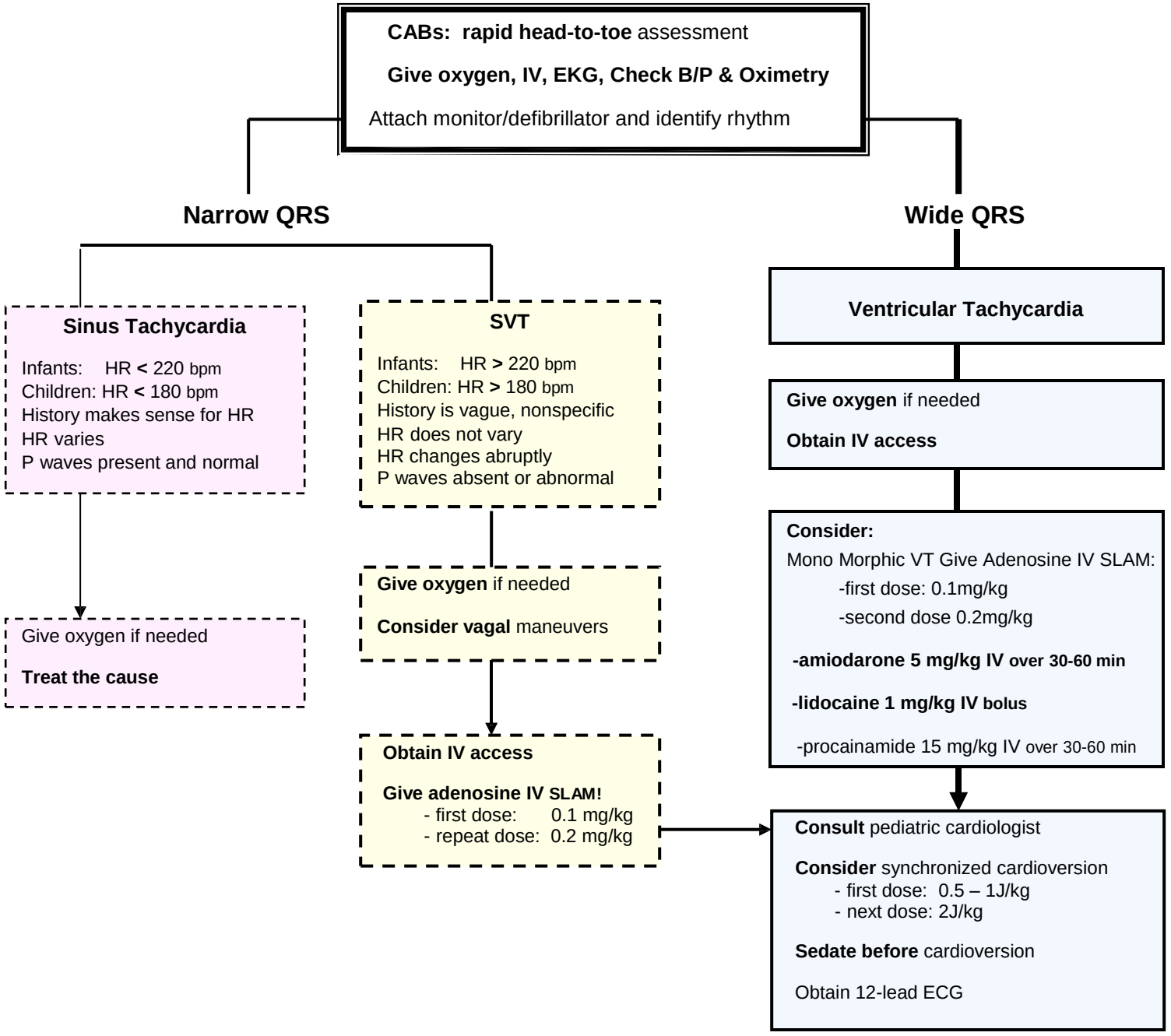


Consider and treat possible causes: 5Hs and 5Ts

Refer back to p. 2 of this study guide.

Tachycardia *with Adequate Perfusion*

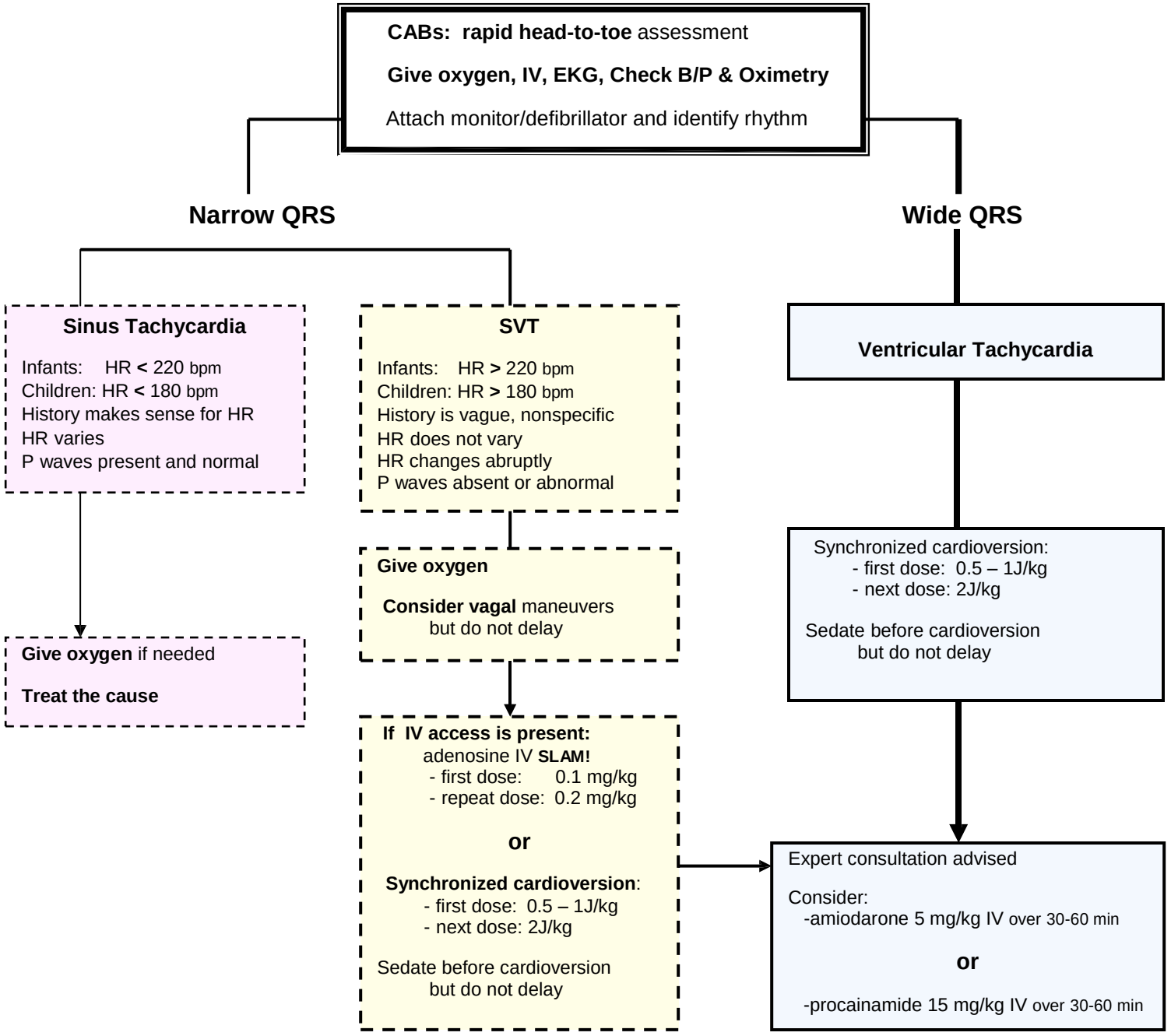
ECC Handbook



Consider and treat possible causes: 5Hs and 5Ts

Tachycardia *with Poor Perfusion*

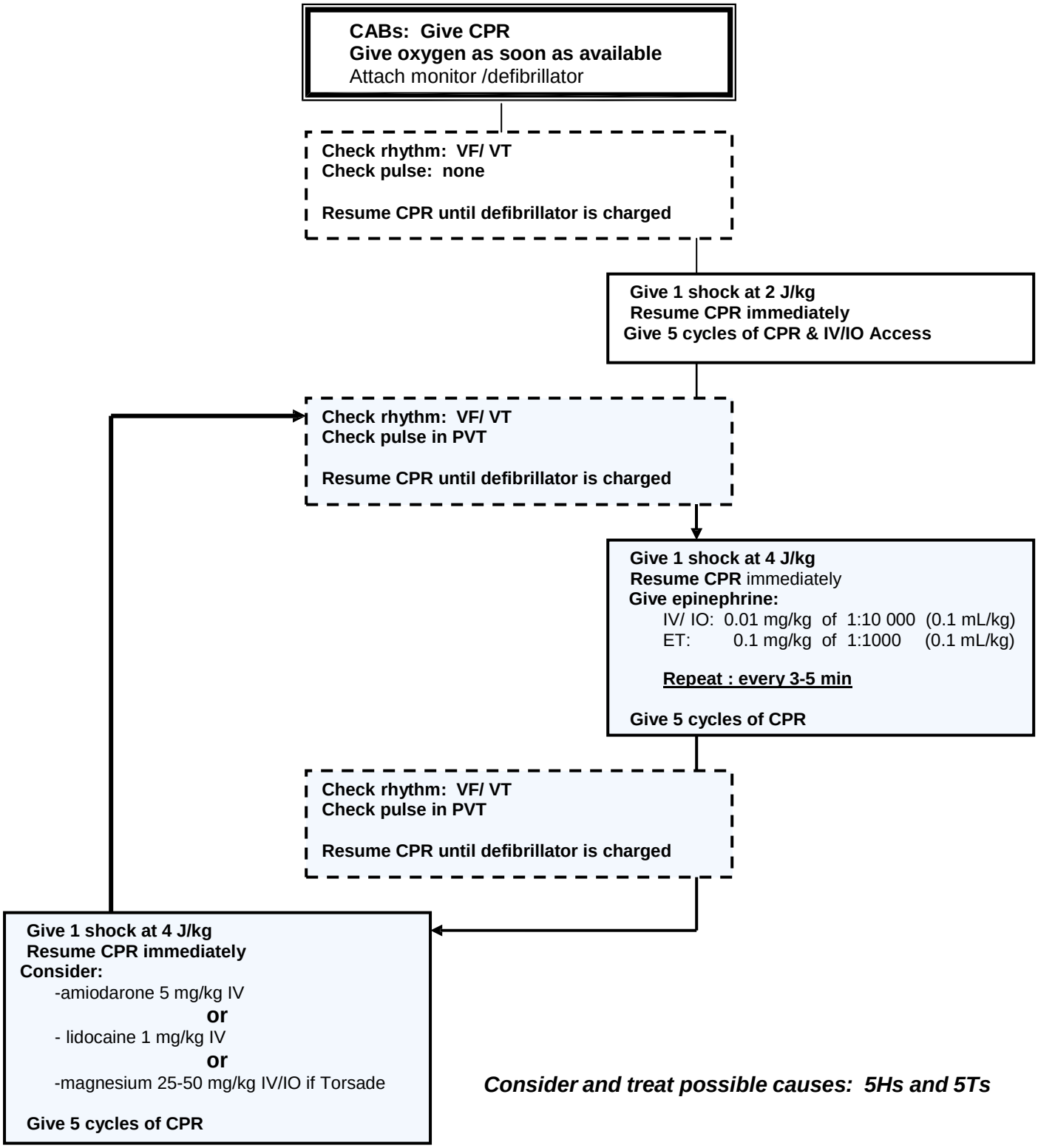
ECC Handbook



Consider and treat possible causes: 5Hs and 5Ts

Pulseless Arrest – VF *and Pulseless* VT

ECC Handbook



Consider and treat possible causes: 5Hs and 5Ts

Pulseless Arrest – Asystole *and* PEA

ECC Handbook